APPENDIX D

PRELIMINARY WATER QUALITY MANAGEMENT PLAN

County of Orange/Santa Ana Region Priority Project Preliminary Water Quality Management Plan (pWQMP)

Project Name:

Residences at 4400 Von Karman

4400 Von Karman

Newport Beach, CA 92660

Prepared for:

KCN MANAGEMENT, LLC

5000 Birch St. East Tower, Suite 600

Newport Beach, CA 92660

(949)267-1507

Prepared by:

Tait & Associates, INC

801 N. Parkcenter Drive

Santa Ana, CA 92705

(714)560-8643

Prepared June 1, 2020

Revised October 16, 2020

Project Owner's Certification			
Planning Application No. (If applicable)	PA2020-061	Grading Permit No.	
Tract/Parcel Map and Lot(s) No.		Building Permit No.	
Address of Project Site and APN (If no address, specify Tract/Parcel Map and Lot Numbers)			

This Water Quality Management Plan (WQMP) has been prepared for Picerne Group by Tait & Associates, Inc. The WQMP is intended to comply with the requirements of the County of Orange 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 , including the ongoing operation and maintenance of all best management practices (BMPs), 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:			
Title	Derek Picerne/ Executive Vice President		
Company	Picerne Group, LLC		
Address	5000 Birch, Suite 600, Newport Beach, CA 92660		
Email	dpicerne@picernegroup.com		
Telephone #	(949) 267-1511		
I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein.			
Owner Signature		Date	

Preparer (Engineer):			
Title	David Sloan, PE / Director of Engineering	PE Registration #	C82595
Company	Tait & Associates, Inc.		
Address	801 N. Parkcenter Dr., Santa Ana, CA 92705		
Email	dsloan@tait.com		
Telephone #	(714) 560-8643		

I hereby certify that this Water Quality Management Plan is in compliance with, and meets the requirements set forth in, Order No. R8-2009-0030/NPDES No. CAS618030, of the Santa Ana Regional Water Quality Control Board.

Preparer Signature		Date	
Place Stamp Here			

Contents

Page No.

Attachments

Section I Permit(s) and Water Quality Conditions of Approval or Issuance

Provide discretionary or grading/building permit information and water quality conditions of approval, or permit issuance, applied to the project. If conditions are unknown, please request applicable conditions from staff. *Refer to Section 2.1 in the Technical Guidance Document (TGD) available on the OC Planning website (ocplanning.net).*

Project Infomation			
Permit/Application No. (If applicable)	N/A	Grading or Building Permit No. (If applicable)	N/A
Address of Project Site (or Tract Map and Lot Number if no address) and APN	17852		
Water Quality Conditions of Approval or Issuance			
Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.)	N/A for Preliminary WQMP.		
Conceptual WQMP			
Was a Conceptual Water Quality Management Plan previously approved for this project?	N/A		

Watershed-Based Plan Conditions	
Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS.	WIHMP: Not Applicable 303(d) Listed Impairments for San Diego Creek and Newport Bay: Selenium, Toxaphene, Fecal Coliform, Metals, Copper, Sediment Toxicity, Chlordane, DDT, PCB's (Polychlorinated Biphenyls), Indicator Bacteria, Nutrients, Pesticides, Sedimentation/Siltation TMDL's for San Diego Creek and Newport Bay: Bacteria Indicators/Pathogens, Nutrients, Pesticides, Sedimentation/Siltation

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 Technical Guidance Document (TGD) for information that must be included in the project description.*

Description of Proposed Project				
Development Category (From Model WQMP, Table 7.11-2; or -3):	Category 8: Significant Redevelopment Project			
Project Area (ft^2): 308,359 (7.08 AC)	Number of Dwelling Units: 312		SIC Code: 59 (Residential)	
Project Area	Pervious		Impervious	
	Area (acres or sq ft)	Percentage	Area (acres or sq ft)	Percentage
Pre-Project Conditions	1.26	18%	5.82	82%
Post-Project Conditions	1.48	21%	5.60	79%
Drainage Patterns/Connections				

Narrative Project Description: (Use as much space as necessary.)	The proposed development is located within the Koll Center in the City of Newport Beach, Orange County, California. In general, the property is situated within the northerly portion of the Koll Center, and is bordered by Birch Street to the North, Von Karman to the south and existing office buildings and paved parking and drive areas to the East and West. The project is comprised of 4 parts, an apartment project, a park, a replacement parking structure, and the remaining office and parking area. The 5-story podium 312 unit apartment building consisting of one-level of on grade parking garage, two levels of subterranean parking (Type -I), the majority of the residential units are located above the podium on levels 2 thru 5 (Type-V). A portion of the residential units at the northeast corner of the site are 4-story (Type-V) slab on grade construction. The building is accessed from the south via a vehicular access providing links to the adjoining properties and proposed 1/2 acre park area. Project leasing offices are accessed directly from the park with a direct connection to the amenity spaces and courtyards on the second level. The project proposes to provide 276 office stalls on site at the grade & first levels of subterranean garage along with residential guest and residential parking provided at the subterranean levels. The park is approximately 1/2 acres and features a pavilion with signature tree and a multi-purpose lawn. The replacement garage is located on approximately 1.1 acres. **Existing (Pre-Developed) Hydrologic Conditions:** The property is currently an office park consisting of buildings, parking lots and landscaping in the parking lot planter islands. Soil classification is largely comprised of 'B' type soils, The reader is instructed to refer to the 'NRCS Hydrologic Soils Groups' Map (Figure XVI-2a from the Orange County Technical Guidance Document, Exhibit 7.III) included in the appendix of this report. The site currently drains in 2 directions, with approximetly 70% of the drainage running towards Von Karmen Avenue and 30% towards Birch Street. The site is considered relatively flat at 1% to 2% to provide sheet flow within the existing parking lots. The parking lot drainage is collected by a series of concrete swales which are collected by storm drain lines. From the southerly side of the existing ridge line the flows collected by the onsite SD system connect to the existing storm drain line in Von Karmen Avenue. The drainage area northerly of the existing ridge line is tributary to an existing 60" storm drain line located on the east side of the 5000 Birch Street building which ultimately drains to the collection ponds within Koll Center. **Developed (Post-Developed) Hydrologic Conditions:** The project will maintain the existing drainage pattern of the site, drainage areas south of the high point will drain to Von Karman and drainage areas northerly of the high point will drain to an existing 60" storm drain line located on the east side of the 5000 Birch Street building. Approximately 1.48 ac of the 7.08 ac site

	will be landscaped or have a pervious surface, which includes 0.40 ac of pervious area from the park site. The impervious surface includes walkway areas in the podium area, roads and parking areas that allow for vehicular traffic, which are anticipated to be paved with asphalt. Because the percentage of impervious surface will be decreased, runoff volumes will be reduced from the pre-developed condition and therefore, no hydrologic conditions of concern (HCOC) are anticipated as a result of developing the project.

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 Technical Guidance Document (TGD) for guidance.*

Pollutants of Concern			
Pollutant	Check One for each: E=Expected to be of concern N=Not Expected to be of concern		Additional Information and Comments
Suspended-Solid/ Sediment	E ☒	N ☐	Attached Residential, Retail, Parking, and Street project components
Nutrients	E ☒	N ☐	Attached Residential, Retail, Parking, and Street project components
Heavy Metals	E ☒	N ☐	Attached Residential, Retail, Parking, and Street project components
Pathogens (Bacteria/Virus)	E ☒	N ☐	Attached Residential, Retail, Parking, and Street project components
Pesticides	E ☒	N ☐	Attached Residential, Retail, Parking, and Street project components
Oil and Grease	E ☒	N ☐	Attached Residential, Retail, Parking, and Street project components
Toxic Organic Compounds	E ☒	N ☐	Attached Residential, Retail, Parking, and Street project components
Trash and Debris	E ☒	N ☐	Attached Residential, Retail, Parking, and Street project components

II.3 Hydrologic Conditions of Concern

Determine if streams located downstream from the project area are potentially susceptible to hydromodification impacts. *Refer to Section 2.2.3.1 in the Technical Guidance Document (TGD) for North Orange County or Section 2.2.3.2 for South Orange County.*

☒ No – Show map

☐ Yes – Describe applicable hydrologic conditions of concern below. *Refer to Section 2.2.3 in the Technical Guidance Document (TGD).*

While streams located downstream of the project site are potentially susceptible to hydromodification impacts, there are no 'Hydrologic Conditions of Concern' (HCOC). Because of the increased pervious surface resulting from development of the project, the runoff volume produced by the site is reduced from the existing condition.

Approximately 3,488 cu-ft of runoff volume is produced by a 2-year, 24-hour storm event under the post developed condition. The same frequency and duration storm produces approximately 3,594 cu-ft in the pre-developed condition. This represents a decrease in runoff volume. A summary of runoff volumes is provided in the following table. Hydrology calculations for the 2-year, 24-hour storm event are included in the Appendix of this report. Hydrology maps can be found in the Appendix of this report.

Due to roof runoff starting at the building roof 14 stories above ground, the time of concentration will be reduced as a result of the project.

HCOC CALCULATIONS

Proposed

Drainage Area	*Area*	*Area*	*Rainfall Depth*	*Pervious Area*	*Impervious Area*	*Impervious Area*	*Impervious Ratio*	*C*	*V*
	(square feet)	(acres)	(ft)	(sf)	(sf)	(acres)		(0.75*imp+0.15)	(cf)
A1	60893	1.40	0.18	18990	41903	0.96	0.69	0.67	608
A2	46765	1.07	0.18	6990	39775	0.91	0.85	0.79	553
A3	13123	0.30	0.18	3746	9377	0.22	0.71	0.69	135
A4	18165	0.42	0.18	3344	14821	0.34	0.82	0.76	208
A5	34200	0.79	0.18	8100	26100	0.60	0.76	0.72	371
A6	9828	0.23	0.18	8100	1728	0.04	0.18	0.28	42
A7	4170	0.10	0.18	2963	1207	0.03	0.29	0.37	23
B1	72614	1.67	0.18	12070	60544	1.39	0.83	0.78	845
B2	7063	0.16	0.18	0	7063	0.16	1.00	0.90	95
B3	2477	0.06	0.18	2360	117	0.00	0.05	0.19	7
D	51366	1.18	0.18	8100	43266	0.99	0.84	0.78	602
Total	320664	7.36		74763	245901	5.65			**3,488**

Existing

Drainage Area	*Area*	*Area*	*Rainfall Depth*	*Pervious Area*	*Impervious Area*	*Impervious Area*	*Impervious Ratio*	*C*	*V*
	(square feet)	(acres)	(ft)	(sf)	(sf)	(acres)		(0.75*imp+0.15)	(cf)
A1	62793	1.44	0.18	13418	49375	1.13	0.79	0.74	697
A2	60905	1.40	0.18	11150	49755	1.14	0.82	0.76	697
A3	18260	0.42	0.18	600	17660	0.41	0.97	0.88	240
A4	34200	0.79	0.18	8430	25770	0.59	0.75	0.72	367
A5	9828	0.23	0.18	8100	1728	0.04	0.18	0.28	42
A6	4170	0.10	0.18	1734	2436	0.06	0.58	0.59	37
B1	69582	1.60	0.18	14000	55582	1.28	0.80	0.75	782
B2	7063	0.16	0.18	0	7063	0.16	1.00	0.90	95
B3	2477	0.06	0.18	2360	117	0.00	0.05	0.19	7
D	51366	1.18	0.18	5500	45866	1.05	0.89	0.82	632
Total	320644	7.36		65292	255352	5.86	0.80	**Total**	**3,594**

II.4 Post Development Drainage Characteristics

Describe post development drainage characteristics. *Refer to Section 2.2.4 in the Technical Guidance Document (TGD).*

The proposed storm drain system will largely maintain the same drainage pattern(s), and connectivity that exists today. Currently there are three (3) storm drain discharge locations. Refer to the Existing & Proposed Hydrology Exhibit attached with this report.

1. Drainage Area "A" collects the parking lot, landscape, and building roof runoff which is conveyed through an onsite storm drain system which conveys the drainage to an underground detention system. After the drainage enters the detention system, it is treated with a proprietary biofiltration system which eventually connects to the public storm drain located in Von Karman.

2. Drainage Area "B" collects the parking lot, landscape, and building roof runoff which is conveyed through an onsite storm drain system which conveys the drainage to an underground detention system. After the drainage enters the detention system, it is treated with a proprietary biofiltration system which eventually connects to the public storm drain located on the east side of 5000 Birch Street.

3. Drainage Area "C" collects the parking lot and landscape runoff which flows to a bioretention planter. Low flows will be treated and conveyed through an onsite storm drain system. Storm flows exceeding low flows will be diverted to an existing catch basin located in Von Karman.

4. Drainage Area "D" is a separate area, but still part of the Koll Center development. The area will be redeveloped into a multistory parking structure that services the Koll Center. The area includes parking lot, landscape and building roof which is conveyed by an onsite storm drain system which conveys the drainage to an underground detention system. After the drainage enters the detention system, it is treated with a proprietary biofiltration system which eventually connects to the existing 66" public storm drain.

The storm drain systems that receive the project storm flows discharge into existing drainage ponds to the southerly of the project site. This pond appears to operate as a detention facility before again entering an existing 54-inch RCP within MacArthur Boulevard. These flows discharge to San Diego Creek before ultimately reaching Newport Bay and the Pacific Ocean.

The construction of the proposed towers will not increase the overall drainage areas from existing to the proposed condition for the three drainage areas noted above. However these individual drainage areas will be slightly altered for the new development. The intent is to remodel the storm drain system which currently exists on site and modify the system to pick up drainage from the proposed development. The connections to the existing public storm drain systems will remain intact.

II.5 Property Ownership/Management

Describe property ownership/management. *Refer to Section 2.2.5 in the Technical Guidance Document (TGD).*

The property will be privately owned and maintained. This includes all street and storm drain improvements as well as all applicable site design, source control, and treatment control BMP's.

Section III Site Description

III.1 Physical Setting

Fill out table with relevant information. *Refer to Section 2.3.1 in the Technical Guidance Document (TGD).*

Name of Planned Community/Planning Area (if applicable)	Koll Center Newport
Location/Address	Von Karmen Ave. & Birch St.
	Newport Beach, CA 92660
General Plan Land Use Designation	Mixed Use: Residential/Commerical
Zoning	PC: Planned Community
Acreage of Project Site	7.08 AC
Predominant 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 Technical Guidance Document (TGD).*

Site Characteristics	
Precipitation Zone	Between 0.7-inches and 0.75-inches (24-hour, 85th percentile rainfall) from Figure XVI-1 (Rainfall Zones) from the Orange County Technical Guidance Document.
Topography	The site is relatively flat.

Drainage Patterns/Connections	The existing condition contains 3 points of connection. The proposed condition will follow the same drainage pattern and maintain the same points of connection.
Soil Type, Geology, and Infiltration Properties	According to the soils report provided by EEI Geotechnical, the Soil classification varies from sand with silt to silty clay.
Hydrogeologic (Groundwater) Conditions	Per page 7, Section 4.2 states, at the time of our subsurface exploration, a zone of heavy seepage was encountered at depths ranging from 20 to 25 feet below the ground surface. Additionally, pore pressure dissipation testing performed in CPT sounding CPT-1 indicates that groundwater was present at a depth of approximately 23 feet below the ground surface at the time of testing. In general, groundwater is expected to follow the direction of surface topography; therefore, local groundwater flow is expected to be in a general westerly direction. It should be noted that variations in groundwater may result from fluctuations in the ground surface topography, subsurface stratification, rainfall, irrigation, and other factors that may not have been evident at the time of our subsurface exploration.
Geotechnical Conditions (relevant to infiltration)	Although the infiltration rates for the site are acceptable, infiltration is not recommended because the sand layers are sandwiched between impervious clay layers. If water was allowed to infiltrate into the sand layers, the water would likely building up and flow laterally until it encountered the basement drains. Thus, surface water would be cycled from the surface to the basement sump drain and back up to the surface again.
Off-Site Drainage	N/A
Utility and Infrastructure Information	Existing utilities are not anticipated to constrain site design in regards to implementing BMP strategies.

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 Technical Guidance Document (TGD).*

Receiving Waters	San Diego Creek (Reach 1) Newport Bay (Lower) Newport Bay (Upper) Pacific Ocean

303(d) Listed Impairments	**San Diego Creek (Reach 1)** - Selenium, Toxaphene, Fecal Coliform, Sedimentation/Siltation, Nutrients, Pesticides, Metal/Metalloids, Pathogens, Sediment **Newport Bay (Upper)** - Metals, Copper, Sediment Toxicity, Chlordane, DDT (Dichlorodiphenyl Trichloroethane), PCB's (Polychlorinated Biphenyls), Indicator Bacteria, Nutrients, Pesticides, Sedimentation/Siltation, Other Organics **Newport Bay (Lower)** - Copper, Sediment Toxicity, Chlordane, DDT, PCB's, Indicator Bacteria, Nutrients, Pesticides, Other Organics
Applicable TMDLs	**San Diego Creek (Reach 1)** - Indicator Bacteria, Nutrients, Pesticides, Sedimentation/Siltation **Newport Bay (Upper)** - Indicator Bacteria, Nutrients, Pesticides, Sedimentation/Siltation **Newport Bay (Lower)** - Nutrients, Pesticides
Pollutants of Concern for the Project	Primary Pollutants of Concern: Suspended-Solid / Sediment, Nutrients, Heavy Metals, Pathogens (Bacteria/Virus), Pesticides, and Toxic Organic Compounds Other Pollutants of Concern: Oil and Grease, Trash and Debris
Environmentally Sensitive and Special Biological Significant Areas	San Diego Creek (Reach 1) Newport Bay (Upper) Newport Bay (Lower)

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. (Please ask your assigned planner or plan checker regarding whether your project is part 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	
If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	This project does not have HCOCs due to the fact that the existing site has already been fully developed, the proposed condition does not modify the proposed drainage patterns and the proposed redevelopment will not significantly exceed the volumes and time of concentration of the storm water runoff for the pre-development condition for a two-year frequency storm event (a difference of five percent or less is considered insignificant). Reference Attachment B for calculations.
List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP)	Per Section 7.II-2.4.3 of the WQMP, "Priority Projects must infiltrate, harvest and use, evapotranspire, or biotreat/biofilter, the 85th percentile, 24-hour storm 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 required DCV will be detained and stored in various underground basins which will convey the required treatment volume to proposed Modular Wetland units and planters where bio-filtration will occur. The MWS and planters will remove stormwater pollutants through physical and biological processes. Pollutants removed from stormwater include particulate organic matter, phosphorus, suspended solids, nitrogen, metals, TKN, and bacteria. Refer to the info sheet in Attachment D.
List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP)	Per Section 7.II-2.4.3 of the WQMP, "If it is not feasible to meet LID performance criteria through retention and/or biotreatment provided on-site or at a sub-regional/regional scale, then treatment control BMPs shall be provided on-site or offsite prior to discharge to waters of the US. Sizing of treatment control BMP(s) shall be based on either the unmet volume after claiming applicable water quality credits, if appropriate (See Section 7.II-3.1 Water Quality Credits) and as calculated in TGD Appendix VI. If treatment control BMPs can treat all of the remaining unmet volume and have a medium to high effectiveness for reducing the primary POCs, the project is considered to be in compliance; a waiver application and participation in an alternative program is not required. If the cost of providing treatment control BMPs greatly outweighs the pollution control benefits they would provide, a waiver of treatment control and LID requirements can be requested and alternative compliance approaches must be used to fulfill the remaining unmet volume (See Section 7.II-3.3)." Treatment control BMP's will not be utilized for this project.

Calculate LID design storm capture volume for Project.

Drainage Area	Area (sf)	Area (AC)	Rainfall Depth (in)	Pervious Area (sf)	Pervious Area (ac)	Impervious Area (ac)	Impervious ratio	C (0.75ximp+0.15)	DCV(cf) (CxdxA)	BMP USED
A1	60893	1.40	0.75	18990	0.44	0.96	0.69	0.67	2,535	MWS #1 (4'X8')
A2	46765	1.07	0.75	6990	0.16	0.91	0.85	0.79	2,303	MWS #1 (4'X8')
A3	13123	0.30	0.75	3746	0.09	0.22	0.71	0.69	563	MWS #2 (4'X6')
A4	18165	0.42	0.75	3344	0.08	0.34	0.82	0.76	865	MWS #2 (4'X6')
A5	34200	0.79	0.75	8100	0.19	0.60	0.76	0.72	1,544	MWS #2 (4'X6')
B1	50917	1.17	0.75	4500	0.10	1.07	0.91	0.83	2,653	MWS #3 (4'X8')
B2	7063	0.16	0.75	0	0.00	0.16	1.00	0.90	397	MWS #3 (4'X8')
B3	21697	0.50	0.75	8500	0.20	0.30	0.61	0.61	822	MWS #3 (4'X8')
C	4170	0.10	0.75	2963	0.07	0.03	0.29	0.37	96	MWS #1 (4'X8')
D	51366	1.18	0.75	8100	0.19	0.99	0.84	0.78	2,510	MWS #4 (4'X6')
Total	308,359	7.08		65,233	1.50	5.58			11,778	

IV.2. Site Design and Drainage

Describe site design and drainage 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 "BMP Exhibit."
- Calculation of Design Capture Volume (DCV) for each drainage area.
- A listing of GIS coordinates for LID and Treatment Control BMPs.

Refer to Section 2.4.2 in the Technical Guidance Document (TGD).

BMP utilization in Site Design to Maximum Extent Practicable (MEP):

Since infiltration and harvest and reuse are no feasible, the next hierarchy will utilize the biotreatment or bioretention strategy for treating the design capture volume. Due to geotechnical concerns related to clayey layers of soil, infiltration strategies were not proposed. For this reason, a proprietary biotreatment system will be incorporated for all drainage areas with the exception of Area C. Area C shall incorporate a bioretention planter. The bioretention with underdrain BMP will be lined with an impermeable membrane to ensure infiltration does not occur in these areas.

Streets, Landscape, Sidewalks, & Building Roof

Per the reasons stated above, infiltration and/ or Harvest and use methods are not considered for these areas of the project site. The streets area lack either adequate space or are infeasible to implement these LID BMP strategies. The proposed bio treatment strategy consists of using proprietary biotreatment devices such as a Modular Wetlands System, or approved equal in streets and parking. Tributary drainage areas and resulting design capture volumes shall be held within the treatment capacities of each bio treatment device. Catch basin (inlet) Modular Wetlands system are proposed and location of the biotreatment devices can be seen on the BMP Site Plan included in this report.

South Parking Structure

Drainage from the parking structure will outlet to an underground detention system which will drain towards a Modular Wetlands System to treat the DCV. The details of the MWS will be completed during the final engineering phase of the project as the landscape plans become finalized.

Drainage Area	Area (sf)	Area (AC)	Rainfall Depth (in)	Pervious Area (sf)	Pervious Area (ac)	Impervious Area (ac)	Impervious ratio	C (0.75ximp+0.15)	DCV(cf) (CxdxA)	BMP USED
A1	60893	1.40	0.75	18990	0.44	0.96	0.69	0.67	2,535	MWS #1 (4'X8')
A2	46765	1.07	0.75	6990	0.16	0.91	0.85	0.79	2,303	MWS #1 (4'X8')
A3	13123	0.30	0.75	3746	0.09	0.22	0.71	0.69	563	MWS #2 (4'X6')
A4	18165	0.42	0.75	3344	0.08	0.34	0.82	0.76	865	MWS #2 (4'X6')
A5	34200	0.79	0.75	8100	0.19	0.60	0.76	0.72	1,544	MWS #2 (4'X6')
B1	50917	1.17	0.75	4500	0.10	1.07	0.91	0.83	2,653	MWS #3 (4'X8')
B2	7063	0.16	0.75	0	0.00	0.16	1.00	0.90	397	MWS #3 (4'X8')
B3	21697	0.50	0.75	8500	0.20	0.30	0.61	0.61	822	MWS #3 (4'X8')
C	4170	0.10	0.75	2963	0.07	0.03	0.29	0.37	96	MWS #1 (4'X8')
D	51366	1.18	0.75	8100	0.19	0.99	0.84	0.78	2,510	MWS #4 (4'X6')
Total	308,359	7.08		65,233	1.50	5.58			11,778	

GIS Coordinates for the project BMP area:
GPS coordinates shall be provided upon final WQMP.

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 Technical Guidance Document (TGD) for selecting LID BMPs and Section 2.4.3 in the Technical Guidance Document (TGD) for conducting conformance analysis with project performance criteria.*

IV.3.1 Hydrologic Source Controls (HSCs)

If required HSCs are included, fill out applicable check box forms. If the retention criteria are otherwise met with other LID BMPs, include a statement indicating HSCs not required.

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:	☐

IV.3.2 Infiltration BMPs

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

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:	☐

Show calculations below to demonstrate if the LID Design Strom Capture Volume can be met with infiltration BMPs. If not, document how much can be met with infiltration and document why it is not feasible to meet the full volume with infiltration BMPs.

Infiltration is not recommended because the sand layers are sandwiched between impervious clay layers. If water was allowed to infiltrate into the sand layers, the water would likely building up and flow laterally until it encountered the basement drains. Thus, surface water would be cycled from the surface to the basement sump drain and back up to the surface again.

IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

If the full Design Storm Capture Volume cannot be met with infiltration BMPs, describe any evapotranspiration and/or rainwater harvesting BMPs included.

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:	☐

Show calculations below to demonstrate if the LID Design Storm Capture Volume can be met with evapotranspiration and/or rainwater harvesting BMPs in combination with infiltration BMPs. If not, document below how much can be met with either infiltration BMPs, evapotranspiration, rainwater harvesting BMPs, or a combination, and document why it is not feasible to meet the full volume with these BMP categories.

N/A

IV.3.4 Biotreatment BMPs

If the full Design Storm Capture Volume cannot be met with infiltration BMPs, and/or evapotranspiration and rainwater harvesting BMPs, describe biotreatment BMPs included. Include sections for selection, suitability, sizing, and infeasibility, as applicable.

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:	☐

Show calculations below to demonstrate if the LID Design Storm Capture Volume can be met with infiltration, evapotranspiration, rainwater harvesting and/or biotreatment BMPs. If not, document how much can be met with either infiltration BMPs, evapotranspiration, rainwater harvesting BMPs, or a combination, and document why it is not feasible to meet the full volume with these BMP categories.

Please Refer to Appendix 'B' of this report for Bio retention BMP calculations.

IV.3.5 Hydromodification Control BMPs

Describe hydromodification control BMPs. *See Section 5 of the Technical Guidance Document (TGD).* Include sections for selection, suitability, sizing, and infeasibility, as applicable. Detail compliance with Prior Conditions of Approval (if applicable).

Hydromodification Control BMPs	
BMP Name	**BMP Description**
N/A	

IV.3.6 Regional/Sub-Regional LID BMPs

Describe regional/sub-regional LID BMPs in which the project will participate. *Refer to Section 7.II-2.4.3.2 of the Model WQMP.*

Regional/Sub-Regional LID BMPs
N/A

IV.3.7 Treatment Control BMPs

Treatment control BMPs can only be considered if the project conformance analysis indicates that it is not feasible to retain the full design capture volume with LID BMPs. Describe treatment control BMPs including sections for selection, sizing, and infeasibility, as applicable.

Treatment Control BMPs	
BMP Name	**BMP Description**
N/A	

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)	☒	☐	
N6	Local Industrial Permit Compliance	☐	☒	No industrial waste discharges are anticipated
N7	Spill Contingency Plan	☐	☒	No storage of hazardous waste
N8	Underground Storage Tank Compliance	☒	☐	
N9	Hazardous Materials Disclosure Compliance	☒	☐	
N10	Uniform Fire Code Implementation	☒	☐	
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	No loading docks on property
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	No retail gasoline on property

N1-Education for property Owners, Tenants and occupants & N-12 Employee Training
The property owner shall prepare a training manual for all existing and future employees. The manual shall include information regarding proper practices that contribute to the protection of the stormwater quality. Training shall be provided upon hire of new associates. A copy of the training manual shall remain in the building at all times for employees to use as needed. The manual shall include all Educational Material included on Attachment A of this report. Additional education material may be found in the following website: http://www.ocwatershed.com/PublicEd/resources/business-brochures.html

N2-Activity Restrictions
The property owner shall ensure that the rules and guidelines as determined on the project conditions, covenants and restrictions (CC&R's) and lease terms or other policies are followed at all times once the project is operations. Prohibited activities for the project that promoted water quality includes:
· 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 dumpster lids closed at all times.
· Prohibit vehicle washing, maintenance, or repair on the premised or restrict those activities to designated areas.

N3-Common Area Landscape Management
Specific practices are followed for landscape maintenance. Ongoing maintenance is conducted to minimize erosion and over-irrigation, conserve water and reduce pesticide and fertilizer applications.
All maintenance must be consistent with the City of Tustin requirements. Proper maintenance practices should help reduce and/or eliminate pollution from pesticides, nutrients, trash/debris and sediments. The project common area landscape maintenance should be consistent with the following documents included in Attachment A:
· Building and Ground Maintenance Guidelines
· Housekeeping practices
· Plaza and sidewalk cleaning
· Landscape maintenance

N4-BMP Maintenance
BMP maintenance, implementation schedules and responsible parties are included with each specific BMP narrative in section V.

N5-Title 22 CCR compliance
Hazardous waste shall be managed properly trough compliance with applicable title 22 regulations. Storage and transportation of hazardous materials shall be per the title 22 of the California Code of Regulations and the Health and Safety Code.

N9-Hazardous Material Disclosure Compliance
The Owner is responsible for obtaining the required permits for the use and transportation of hazardous materials. Permits may be required from the County of Orange Health Department, City of Tustin, and other local authorities.

N10-Uniform Fire Code Implementation
The Owner is responsible for complying with the Los Angeles Fire Department requirements regarding proper management of hazardous materials and emergency response plans. An inventory of hazardous materials should be maintained on-site and an emergency response plans should be established.

N11-Common area litter control
The Owner will be required to implement trash management and litter control procedures in the common areas aimed at reducing pollution of drainage water. The Owner may contract with their landscape maintenance firm to provide this service with regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposal violations and reporting the violations to the Owner for investigation.

N12-Employee Training
The Owner will be required to implement an education program as it would apply to future employees.

N14-Common area catch basin inspection
The Owner must ensure that the on-site drain inlets, grates, and drain pipes will be periodically inspected visually. Cleaning should take place in the late summer/early fall prior to the start of the rainy season. If necessary, clean, repair, or replace any drainage facility prior to the start of each rainy season (no later than October 15 of each year). Also refer to "Drainage System Maintenance" in Attachment A.

N15-Street Sweeping Private Streets and Parking Lots
The Owner must sweep outdoor lots regularly (minimum monthly), and prior to the storm season (no later than October 15 each year). Sweeping shall be done with a vacuum-type sweeper. Under no circumstances are outdoor areas/lots to be rinsed or washed with water unless said rinse/wash water is collected and disposed of properly (i.e. into the sewer).

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	☐	☒	
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	☒	☐	
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☐	☒	
S6	Dock areas	☐	☒	
S7	Maintenance bays	☐	☒	
S8	Vehicle wash areas	☐	☒	
S9	Outdoor processing areas	☐	☒	
S10	Equipment wash areas	☐	☒	
S11	Fueling areas	☐	☒	
S12	Hillside landscaping	☐	☒	
S13	Wash water control for food preparation areas	☒	☐	
S14	Community car wash racks	☐	☒	

S1-Provide storm drain system stenciling and signage
All catch basins/inlets/outlets on site must be marked using the City's "No Dumping – Drains to Ocean" curb marker or stenciled. An approved stencil shall be used to paint this message on the top of curb directly above the inlet, and on one side of the curb face. Labeling for catch basins is to be inspected regularly and maintained so as to be reasonably legible at all times. The inspection and maintenance is to be performed by the Owner. This stencil is to alert the public/employees to the destination of pollutants discharged into the storm water.

S3-Design and construct trash and waste storage areas to reduce pollution introduction
The owner shall post signs on trash enclosure gates that state "Keep Dumpster Lids Closed." The Owner will monitor dumpster usage such that dumpsters are not overfilled and the dumpster lids can close completely. The Owner shall increase the trash pickup schedule as necessary to prevent dumpsters from overfilling. The Owner will observe and damage to the trash enclosure wall and any discharge from the trash storage area.

S4-Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control
All irrigation systems will be inspected to ensure that the systems are functioning properly and that the programmable timers are set correctly.

IV.4 Alternative Compliance Plan (If Applicable)

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.*

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 Technical Guidance Document (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 colspan="2">☐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>☐ 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>
</table>

Calculation of Water Quality Credits (if applicable)	N/A

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 Model WQMP.*

N/A

Section V Inspection/Maintenance Responsibility for BMPs

Fill out information in table below. Prepare and attach an Operation and Maintenance Plan. Identify the funding 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.*

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
Modular Wetland System (MWS) Linear Unit	Owner	-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).	Prior and following the rainy season After each rain event
Underground Detention Basin	Owner	Regular inspections of system to observe sediment build up and detention capacity. Cleaning of accumulated trash, debris, and sediment as determined by inspections. Cleaning is recommended during dry weather. Per manufacturer recommendations.	At a minimum, quarterly inspections and within 48-hours following a significant storm even to verify there is no standing water in the chambers. Per manufacturer recommendations.
N1 - Education for Property Owners, Tenants and Occupants	Property Management Association	Provide environmental awareness educational materials made available by the City of Anaheim and/or the County of Orange. These materials will describe the use of chemicals that should be limited to the property, with no discharges of wastes via hosing or other direct discharge to gutters, catch basins and storm drains.	Upon initial tenancy and ongoing thereafter.

N2 - Activity Restrictions	Property Management Association	Use restrictions that may include car washing, rinsing, waste disposal, or other activity potentially detrimental to downstream receiving waters. Restricted activities to be developed by the PMA and implemented through lease terms.	Upon initial tenancy and ongoing thereafter.
N3 - Common Area Landscape Management	Property Management Association	Utilize landscape maintenance practices aimed at minimizing use of irrigation, fertilizers and pesticides. Usage shall be consistent with Management Guidelines for Use of Fertilizers (DAMP Section 5.5). Landscaping shall correlate to the climate, soil, and related natural resources of the area. Plantings shall be grouped with plants of similar water requirements.	Ongoing. Review and revise annually, and as needed.
N4 - BMP Maintenance	Property Management Association	Inspection of all structural and non- structural BMP's. Scheduling of required cleaning and maintenance activities. BMP inspection and any resulting maintenance activity shall be performed at regular intervals as part of the overall Landscape Management program, and prior to the start of the rainy season.	Varies by BMP. Annually at a minimum (prior to the rainy season).
N5 - Title 22 CCR Compliance	Property Management Association	Comply with all applicable local water quality ordinances. The local jurisdiction (City), under local water quality ordinances, have authority to ensure clean stormwater discharges from areas of concern to public properties.	Ongoing. Review and revise annually, and as needed.
N9 - Hazardous Materials Disclosure Compliance	Property Management Association	Comply with State regulations dealing with hazardous materials, enforced by the City on behalf of the State. Hazardous materials shall either be placed in an enclosure that prevents contact	Ongoing. Review and revise annually, and as needed.

		with runoff or is protected by a secondary containment structure such as a berm, dyke, or curb. Any storage area containing hazardous materials shall be paved and sufficiently impervious to contain any leaks and/or spills. Storage areas containing hazardous materials shall have a roof or awning to minimize direct precipitation and collection of stormwater within the secondary containment area. Any stormwater retained within the containment area shall be disposed of in accordance with the applicable hazardous material disposal ordinances. Hazardous materials shall be disposed of at the nearest Hazard Materials Disposal Center. CASQA BMP Handbook SC-34 and SC-60 shall be used as a resource when developing applicable hazardous material cleanup and prevention strategies.	
N10 - Uniform Fire Code Implementation	Property Management Association	Comply with Article 80 of the Uniform Fire Code enforced by the fire protection agency.	Ongoing. Review and revise annually, and as needed.
N11 - Common Area Litter Control	Property Management Association	Good housekeeping practices shall be adhered to that aim to minimize litter and trash production on the site. Good housekeeping practices include but are not limited to: covering storage areas, using drip pans or absorbent materials when working with oils/greases, checking storage containers regularly for leaks or damage, regular sweeping and clean-up of trash storage and recycling areas, and regular clean-up of loose trash and debris around site.	Ongoing. Review and revise annually, and as needed.
N12 - Employee Training	Property Management Association	Provide employee training / education information to janitorial, maintenance, landscaping, and other staff for activities that may impact water quality. Educational materials will utilize brochures obtained	Employee training shall take place at a minimum at the time of hiring, and annually thereafter.

		from the City, County and State resources Public Education Materials is available in Attachment A of this WQMP.	
N14 - Common Area Catch Basin Inspection	Property Management Association	Conduct regular inspection, cleaning, and maintenance of common area catch basins. Cleaning and maintenance activities may include removal of trash, sediment, debris, or other deleterious material from the catch basin. Catch basins shall be visually inspected for illegal dumping. If illegal dumping has occurred the proper authorities shall be notified as soon as practicable.	At minimum 2-times per year, both before the rainy season and after at least one major storm to check for standing water. Adjust inspection schedule as needed.
N15 - Street Sweeping Private Streets and Parking Lots	Property Management Association	Provide vacuum sweeping for paved areas. Sweeping operations shall be performed during dry weather. CASQA BMP Handbook SC- 43 and SC-70 shall be used as a resource for determining the frequency and procedures for providing vacuum sweeping of the paved areas. Sweeping and/or spraying of permeable paver areas is not recommended as it tends to move the sediment rather than remove it. Also, sweeping and spraying may move the sediment deeper into the surface openings, making them more difficult to remove.	At minimum 2-times per year, both before the rainy season and after at least one major storm to check for standing water. Adjust inspection schedule as needed.
S1 - Provide storm drain system stencilling and signage	Property Management Association	Provide stencilling that is easily visible on or near each catch basin. Stencilling shall provide a brief statement, which prohibits the dumping of improper materials into thestorm drain.	Stencilling shall be inspected annually, and maintained or repainted as needed.

S3 - Design and construct trash and waste storage areas to reduce pollution introduction	Owner then Property Management Association	All trash enclosure areas shall be paved with an impervious surface, designed not to allow run-on from adjoining areas, designed to divert drainage from adjoining roofs and pavements around the area, screened or walled to prevent off- site transport of trash, and shall include solid roofing or an awning to prevent direct precipitation. Trash area drains to the storm drain system is prohibited.	During design/construction activities. Ongoing inspection and maintenance thereafter.
S4 - Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	Owner then Property Management Association	Implement irrigation methods to minimize runoff of excess irrigation water across impervious surfaces and into the stormwater conveyance system. Such measures include employing rain-triggered shutoff devices to eliminate or reduce irrigation during and immediately after precipitation, using mulches (such as wood chips) to minimize sediment in runoff and to maintain soil infiltration capacity, and coordinating design of the irrigation system and landscape to minimize overspray and runoff. Irrigation systems should consider the use of flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or water supply lines. Water conservation devices such as programmable irrigation timers, drip irrigation, and soil moisture sensors should also be considered.	During design/constructio n activities. Ongoing inspection and maintenance thereafter.
S5 - Protect		Protect slopes, channels, and energy dissipation devices so function is maintained. The potential for erosion of slopes and/or channels shall be minimized by incorporating the following BMP's, as	Regular inspection and any resulting maintenance of slopes, channels,

slopes and channels and provide energy dissipation	Property Management Association	applicable: immediate stabilization of disturbed slopes; vegetate slopes with native or drought tolerant vegetation; control and treat flows in landscaping prior to reaching existing natural drainage system.	and energy dissipation devices shall be on- going and part of the overall Landscape/Site Management program.

Section VI BMP Exhibit (Site Plan)

VI.1 BMP Exhibit (Site Plan)

Include a BMP Exhibit (Site Plan), at a size no less than 24" by 36," which includes the following minimum information:

- Insert in the title block (lower right hand corner) of BMP Exhibit: the WQMP Number (assigned by staff) and the grading/building or Planning Application permit numbers
- Project location (address, tract/lot number(s), etc.)
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural BMP locations
- Drainage delineations and flow information
- Delineate the area being treated by each structural BMP
- GIS coordinates for LID and Treatment Control BMPs
- Drainage connections
- BMP details
- Preparer name and stamp

Please do not include any areas outside of the project area or any information not related to drainage or water quality. The approved BMP Exhibit (Site Plan) shall be submitted as a plan sheet on all grading and building plan sets submitted for plan check review and approval. The BMP Exhibit shall be at the same size as the rest of the plan sheets in the submittal and shall have an approval stamp and signature prior to plan check submittal.

VI.2 Submittal and Recordation of Water Quality Management Plan

Following approval of the Final Project-Specific WQMP, three copies of the approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be submitted. In addition, these documents shall be submitted in a PDF format.

Each approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be recorded in the Orange County Clerk-Recorder's Office, prior to close-out of grading and/or building permit. Educational Materials are not required to be included.

Section VII Educational Materials

Refer to the Orange County Stormwater Program (ocwatersheds.com) for a library of materials available. Please only attach the educational materials specifically applicable to this 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)	☒		☐
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

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

Even if you live miles from the Pacific Ocean, you may be unknowingly polluting it.

Dumping one quart of motor oil into a storm drain can contaminate 250,000 gallons of water.

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.

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

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

The Ocean Begins at Your Front Door

The Pollution Solution

Several residential activities can result in water pollution. Among these activities are car washing and hosing off driveways and sidewalks. Both activities can waste water and result in excess runoff. Water conservation methods described in this pamphlet can prevent considerable amounts of runoff and conserve water. By taking your car to a commercial car wash and by sweeping driveways and sidewalks, you can further prevent the transport of pollutants to Orange County waterways. Here are some of the common pollutants for which you can be part of the solution:

1 Pesticides and Fertilizer

- **Pollution:** The same pesticides that are designed to be toxic to pests can have an equally lethal impact on our marine life. The same fertilizer that promotes plant growth in lawns and gardens can also create nuisance algae blooms, which remove oxygen from the water and clog waterways when it decomposes.

- **Solution:** Never use pesticides or fertilizer within 48 hours of an anticipated rainstorm. Use only as much as is directed on the label and keep it off driveways and sidewalks.

2 Dirt and Sediment

- **Pollution:** Dirt or sediment can impede the flow of the stormwater and negatively impact stream habitat as it travels through waterways and deposits downstream. Pollutants can attach to sediment, which can then be transported through our waterways.

- **Solution:** Protect dirt stockpiles by covering them with tarps or secure plastic sheets to prevent wind or rain from allowing dirt or sediment to enter the storm drain system.

3 Metals

- **Pollution:** Metals and other toxins present in car wash water can harm important plankton, which forms the base of the aquatic food chain.

- **Solution:** Take your car to a commercial car wash where the wash water is captured and treated at a local wastewater treatment plant.

DID YOU KNOW?

Did you know that most of the pollution found in our waterways is not from a single source, but from a "non-point" source meaning the accumulation of pollution from residents and businesses throughout the community

4 Pet Waste

- **Pollution:** Pet waste carries bacteria through our watersheds and eventually will be washed out to the ocean. This can pose a health risk to swimmers and surfers.

- **Solution:** Pick up after your pets!

5 Trash and Debris

- **Pollution:** Trash and debris can enter waterways by wind, littering and careless maintenance of trash receptacles. Street sweeping collects some of this trash; however, much of what isn't captured ends up in our storm drain system where it flows untreated out to the ocean.

- **Solution:** Don't litter and make sure trash containers are properly covered. It is far more expensive to clean up the litter and trash that ends up in our waterways than it is to prevent it in the first place. Come out to one of Orange County's many locations for Coastal and Inner-Coastal Cleanup Day, which is held in September.

6 Motor Oil / Vehicle Fluids

- **Pollution:** Oil and petroleum products from our vehicles are toxic to people, wildlife and plants.

- **Solution:** Fix any leaks from your vehicle and keep the maintenance up on your car. Use absorbent material such as cat litter on oil spills, then sweep it up and dispose of it in the trash. Recycle used motor oil at a local Household Hazardous Waste Collection Center.

A TEAM EFFORT

The Orange County Stormwater Program has teamed with the Municipal Water District of Orange County (MWDOC) and the University of California Cooperative Extension Program (UCCE) to develop this pamphlet.

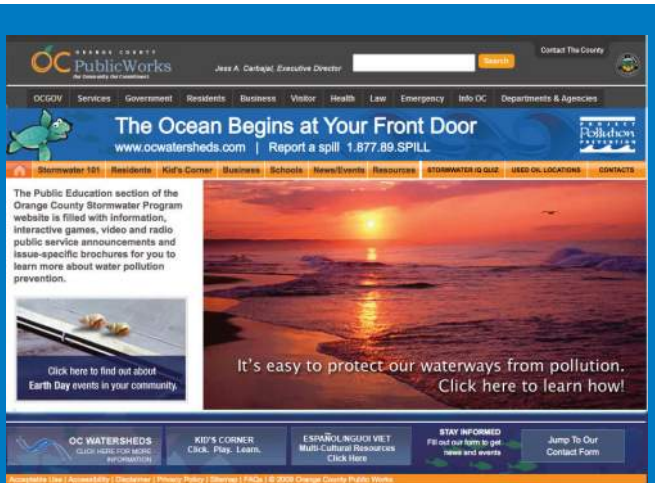
Low Impact Development (LID) and sustainable water use prevents water pollution and conserves water for drinking and reuse. Reducing your water use and the amount of water flowing from your home protects the environment and saves you money.

Thank you for making water protection a priority!

For more information, please visit www.ocwatersheds.com/publiced/

www.mwdoc.com

www.uccemg.com



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

Special Thanks to
The City of Los Angeles Stormwater Program for the use of its artwork

The Metropolitan Water District of Southern California for the use of the California-Friendly Plant and Native Habitat photos

PROJECT Pollution PREVENTION

UCCE University of California Cooperative Extension

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

RUNOFF, RAINWATER AND REUSE

Where Does Water Runoff Go?

Stormwater, or water from rainfall events, and runoff from outdoor water use such as sprinklers and hoses flows from homes directly into catch basins and the storm drain system. After entering the storm drain, the water flows untreated into streams, rivers, bays and ultimately the Pacific Ocean. Runoff can come from lawns, gardens, driveways, sidewalks and roofs. As it flows over hard, impervious surfaces, it picks up pollutants. Some pollutants carried by the water runoff include trash, pet waste, pesticides, fertilizer, motor oil and more.

Water Conservation

Pollution not only impairs the water quality for habitat and recreation, it can also reduce the water available for reuse. Runoff allowed to soak into the ground is cleaned as it percolates through the soil, replenishing depleted groundwater supplies. Groundwater provides at least 50% of the total water for drinking and other indoor household activities in north and central Orange County. When land is covered with roads, parking lots, homes, etc., there is less land to take in the water and more hard surfaces over which the water can flow.

In Orange County, 60-70% of water used by residents and businesses goes to irrigation and other outdoor uses. Reusing rainwater to irrigate our lawn not only reduces the impact of water pollution from runoff, but it also is a great way to conserve our precious water resources and replenish our groundwater basin.

What is Low Impact Development (LID)?

Low Impact Development (LID) is a method of development that seeks to maintain the natural hydrologic character of an area. LID provides a more sustainable and pollution-preventative approach to water management.

New water quality regulations require implementation of LID in larger new developments and encourage implementation of LID and other sustainable practices in existing residential areas. Implementing modifications to your lawn or garden can reduce pollution in our environment, conserve water and reduce your water bill.

Permeable pavement allows water runoff to infiltrate through the soil and prevents most pollutants from reaching the storm drain system.

OPTIONS FOR RAINWATER HARVESTING AND REUSE

Rainwater harvesting is a great way to save money, prevent pollution and reduce potable water use. To harvest your rainwater, simply redirect the runoff from roofs and downspouts to rain barrels. Rain gardens are another option; these reduce runoff as well as encourage infiltration.

Downspout Disconnection/Redirection

Disconnecting downspouts from pipes running to the gutter prevents runoff from transporting pollutants to the storm drain. Once disconnected, downspouts can be redirected to rain gardens or other vegetated areas, or be connected to a rain barrel.

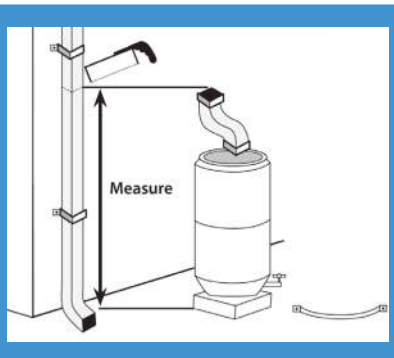
Rain Barrels

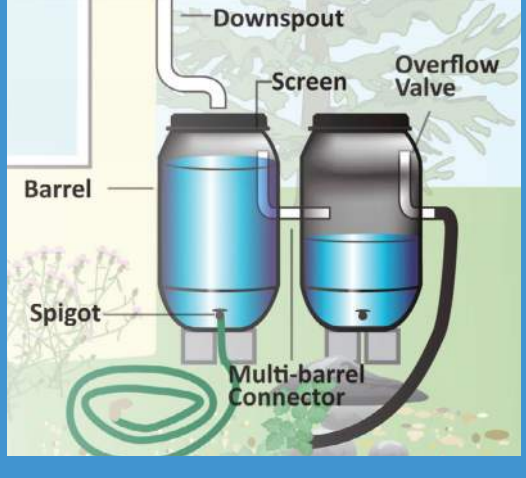
Rain barrels capture rainwater flow from roofs for reuse in landscape irrigation. Capacity of rain barrels needed for your home will depend on the amount of roof area and rainfall received. When purchasing your rain barrel, make sure it includes a screen, a spigot to siphon water for use, an overflow tube to allow for excess water to run out and a connector if you wish to connect multiple barrels to add capacity of water storage.

Mosquito growth prevention is very important when installing a rain barrel. The best way to prevent mosquito breeding is to eliminate entry points by ensuring all openings are sealed tightly. If these methods are unsuccessful, products are available to kill mosquito larvae, but that are harmless to animals and humans. Regular application of these products is essential. Please visit the Orange County Vector Control website for more information at www.ocvcd.org/mosquitoes3.php.

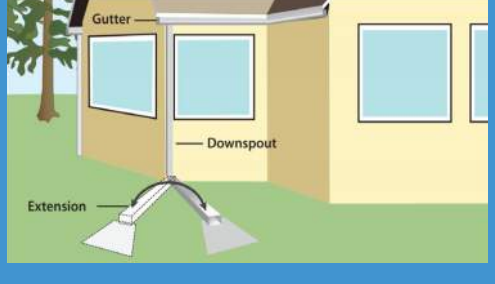
Rain Gardens

Rain gardens allow runoff to be directed from your roof downspout into a landscaped area. Vegetation and rocks in the garden will slow the flow of water to allow for infiltration into the soil. Plants and soil particles will absorb pollutants from the roof runoff. By utilizing a native plant palate, rain gardens can be maintained all year with minimal additional irrigation. These plants are adapted to the semi-arid climate of Southern California, require less water and can reduce your water bill.





Before modifying your yard to install a rain garden, please consult your local building and/or planning departments to ensure your garden plan follows pertinent building codes and ordinances. Besides codes and ordinances, some home owner associations also have guidelines for yard modifications. If your property is in hill areas or includes engineered slopes, please seek professional advice before proceeding with changes.



For information on how to disconnect a downspout or to install and maintain a rain barrel or rain garden at your home, please see the Los Angeles Rainwater Harvesting Program, A Homeowner's "How-To" Guide, November 2009 at www.larainwaterharvesting.org/

OTHER WATER CONSERVATION AND POLLUTION PREVENTION TECHNIQUES

Native Vegetation and Maintenance

"California Friendly" plants or native vegetation can significantly reduce water use. These plants often require far less fertilizers and pesticides, which are two significant pollutants found in Orange County waterways. Replacing water "thirsty" plants and grass types with water efficient natives is a great way to save water and reduce the need for potentially harmful pesticides and fertilizer.

Please see the California Friendly Garden Guide produced by the Metropolitan Water District of Southern California and associated Southern California Water Agencies for a catalog of California friendly plants and other garden resources at www.bewaterwise.com/Gardensoft.

Weed Free Yards

Weeds are water thieves. They often reproduce quickly and rob your yard of both water and nutrients. Weed your yard by hand if possible. If you use herbicides to control the weeds, use only the amount recommended on the label and never use it if rain is forecast within the next 48 hours.

Soil Amendments

Soil amendments such as green waste (e.g. grass clippings, compost, etc.) can be a significant source of nutrients and can help keep the soil near the roots of plants moist. However, they can cause algal booms if they get into our waterways, which reduces the amount of oxygen in the water and impacts most aquatic organisms. It is important to apply soil amendments more than 48 hours prior to predicted rainfall.

IRRIGATE EFFICIENTLY

Water runoff from sprinklers left on too long will carry pollutants into our waterways.

Smart Irrigation Controllers

Smart Irrigation Controllers have internal clocks as well as sensors that will turn off the sprinklers in response to environmental changes. If it is raining, too windy or too cold, the smart irrigation control sprinklers will automatically shut off.

Check with your local water agency for available rebates on irrigation controllers and smart timers.

- Aim your sprinklers at your lawn, not the sidewalk – By simply adjusting the direction of your sprinklers you can save water, prevent water pollution from runoff, keep your lawn healthy and save money.
- **Set a timer for your sprinklers** – lawns absorb the water they need to stay healthy within a few minutes of turning on the sprinklers. Time your sprinklers; when water begins running off your lawn, you can turn them off. Your timer can be set to water your lawn for this duration every time.
- **Water at Sunrise** – Watering early in the morning will reduce water loss due to evaporation. Additionally, winds tend to die down in the early morning so the water will get to the lawn as intended.
- **Water by hand** – Instead of using sprinklers, consider watering your yard by hand. Hand-watering ensures that all plants get the proper amount of water and you will prevent any water runoff, which wastes water and carries pollutants into our waterways.
- **Fix leaks** - Nationwide, households waste one trillion gallons of water a year to leaks – that is enough water to serve the entire state of Texas for a year. If your garden hose is leaking, replace the nylon or rubber hose washer and ensure a tight connection. Fix broken sprinklers immediately.

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

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

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

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

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

For emergencies, dial 911.

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

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

Printed on Recycled Paper

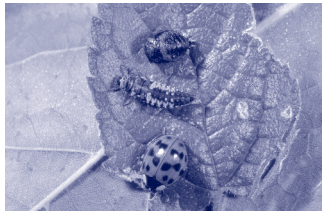
Help Prevent Ocean Pollution:

Responsible Pest Control

Tips for Pest Control

Key Steps to Follow:

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



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

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

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

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

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

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

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

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

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.

Printed on Recycled Paper

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 such as painting can lead to water pollution if you're not careful. Paint must be used, stored and disposed of properly to ensure that it does 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 paint into the ocean, so don't let it 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 Problem Reporting Hotline
at **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 using, storing and disposing of paint. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

Printed on Recycled Paper

Help Prevent Ocean Pollution:

Tips for Projects Using Paint

Tips for Projects Using Paint

Paint can cause significant damage to our environment. Whether you hire a contractor or do it yourself, it is important to follow these simple tips when purchasing, using, cleaning, storing and disposing of paint.

Purchasing Paint

- Measure the room or object to be painted, then buy only the amount needed.
- Whenever possible, use water-based paint since it usually does not require hazardous solvents such as paint thinner for cleanup.

Painting

- Use only one brush or roller per color of paint to reduce the amount of water needed for cleaning.
- Place open paint containers or trays on a stable surface and in a position that is unlikely to spill.
- Always use a tarp under the area or object being painted to collect paint drips and contain spills.

Cleaning

- Never clean brushes or rinse paint containers in the street, gutter or storm drain.
- For oil-based products, use as much of the paint on the brushes as possible. Clean brushes with thinner. To reuse thinner, pour it through a fine filter (e.g. nylon, metal gauze or filter paper) to remove solids such as leftover traces of paint.
- For water-based products, use as much of the paint on the brushes as possible, then rinse in the sink.
- Collect all paint chips and dust. Chips and dust from marine paints or paints containing lead, mercury or tributyl tin are hazardous waste. Sweep up and dispose of at a Household Hazardous Waste Collection Center (HHWCC).

Storing Paint

- Store paint in a dry location away from the elements.
- Store leftover water-based paint, oil-based paint and solvents separately in original or clearly marked containers.
- Avoid storing paint cans directly on cement floors. The bottom of the can will rust much faster on cement.
- Place the lid on firmly and store the paint can upside-down to prevent air from entering. This will keep the paint usable longer. Oil-based paint is usable for up to 15 years. Water-based paint remains usable for up to 10 years.

Alternatives to Disposal

- Use excess paint to apply another coat, for touch-ups, or to paint a closet, garage, basement or attic.
- Give extra paint to friends or family. Extra paint can also be donated to a local theatre group, low-income housing program or school.
- Take extra paint to an exchange program such as the **"Stop & Swap"** that allows you to drop off or pick up partially used home care products free of charge. **"Stop & Swap"** programs are available at most HHWCCs.
- For HHWCC locations and hours, call **(714) 834-6752** or visit **www.oclandfills.com**.

Disposing of Paint

- Never put wet paint in the trash.

For water-based paint:

- If possible, brush the leftover paint on cardboard or newspaper. Otherwise, allow the paint to dry in the can with the lid off in a well-ventilated area protected from the elements, children and pets. Stirring the paint every few days will speed up the drying.
- Large quantities of extra paint should be taken to a HHWCC.
- Once dried, paint and painted surfaces may be disposed of in the trash. When setting a dried paint can out for trash collection, leave the lid off so the collector will see that the paint has dried.

For oil-based paint:

- Oil-based paint is a household hazardous waste. All leftover paint should be taken to a HHWCC.

Aerosol paint:

- Dispose of aerosol paint cans at a HHWCC.

Spills

- Never hose down pavement or other impermeable surfaces where paint has spilled.
- Clean up spills immediately by using an absorbent material such as cat litter. Cat litter used to clean water-based paint spills can be disposed of in the trash. When cleaning oil-based paint spills with cat litter, it must be taken to a HHWCC.
- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at **(714) 567-6363** or visit **www.ocwatersheds.com** to fill out an incident reporting form.

PROJECT Pollution PREVENTION

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.

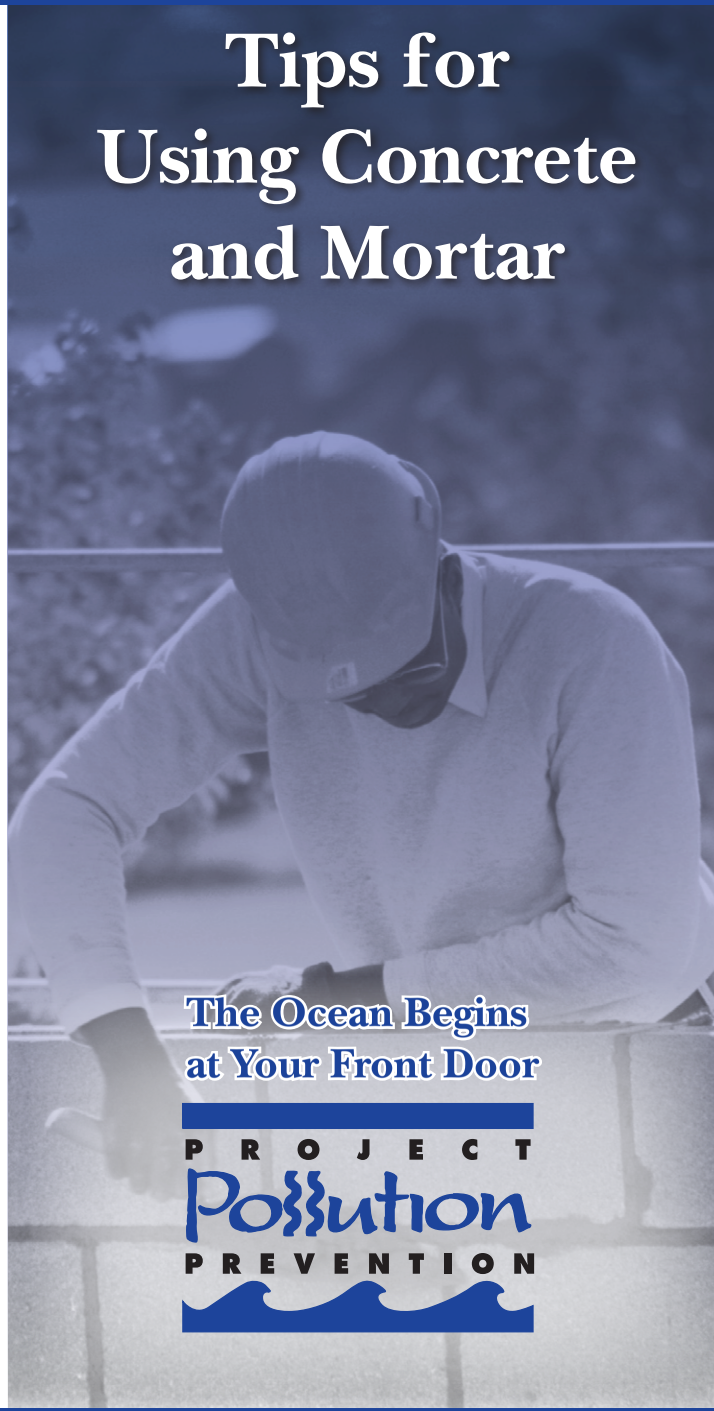
For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com.**

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.

Building & Grounds Maintenance SC-41

Objectives

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

Targeted Constituents

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

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.

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

CASQA California Stormwater Quality Association

- 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.

Suggested Protocols

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.

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

- 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.
- 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.
- 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.

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.

Training

- 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 nature of the staff.

Spill Response and Prevention

- 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.

Other Considerations

Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs

- Cost will vary depending on the type and size of facility.
- Overall costs should be low in comparison to other BMPs.

Maintenance

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building 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

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

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

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

Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

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

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

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

Parking/Storage Area Maintenance SC-43

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)
- Keep accurate maintenance logs to evaluate BMP implementation.

CASQA California Stormwater Quality Association

SC-43 Parking/Storage Area Maintenance

Suggested Protocols

General

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

Controlling Litter

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

Surface Cleaning

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

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

Surface Repair

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

Inspection

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

Training

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

Spill Response and Prevention

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

Other Considerations

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

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Surface Repair

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

References and Resources

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

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

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

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

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

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

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

Drainage System Maintenance SC-44

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

Targeted Constituents

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

Approach

Pollution Prevention

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.

Suggested Protocols

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.
  - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

CASQA California Stormwater Quality Association

- 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. 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 (emphasis added) state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS.

Illicit Connections and Discharges

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:
  - Is there evidence of spills such as paints, discoloring, etc?

- Are there any odors associated with the drainage system?
- Record locations of apparent illegal discharges/illicit connections?
- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of 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" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- 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)
  - 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.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Allow only properly trained individuals to handle hazardous materials/wastes.
- 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).

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- 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.
- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

- 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.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and prohibition against disposal of flushed effluent to sanitary sewer in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.
- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:
  - Purchase and installation of signs.
  - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.
  - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.
  - Purchase of landfill space to dispose of illegally-dumped items and material.

- 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.

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.

Supplemental Information

Further Detail of the BMP

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 resuspension 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 or that fire hydrant line flushing coincide with storm sewer flushing.

References and Resources

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

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

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

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

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

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

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

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line:
http://www.epa.gov/npdes/menuofbmps/poll_16.htm

Housekeeping Practices SC-60

Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

Objectives

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

Approach

Pollution Prevention

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.
- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

Suggested Protocols

General

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Dispose of wash water, sweepings, and sediments, properly.
- Recycle or dispose of fluids properly.
- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.
- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).
- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

Training

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) plant up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

Requirements

Costs

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

Maintenance

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

Supplemental Information

Further Detail of the BMP

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

Examples

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000.
http://www.nalms.org/bclss/bmphome.html#bmp

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

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities, Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, Revised by California Coastal Commission, February 2002.

Orange County Stormwater Program
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Mateo STOPPP - (http://stoppp.tripod.com/bmp.html)

Plaza and Sidewalk Cleaning SC-71

Objectives

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

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Description

Pollutants on sidewalks and other pedestrian traffic areas and plazas are typically due to littering and vehicle use. This fact sheet describes good housekeeping practices that can be incorporated into the municipality's existing cleaning and maintenance program.

Approach

Pollution Prevention

- Use dry cleaning methods whenever practical for surface cleaning activities.
- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal).

Suggested Protocols

Surface Cleaning

- Regularly broom (dry) sweep sidewalk, plaza and parking lot areas to minimize cleaning with water.
- Dry cleanup first (sweep, collect, and dispose of debris and trash) when cleaning sidewalks or plazas, then wash with or without soap.
- Block the storm drain or contain runoff when cleaning with water. Discharge wash water to landscaping or collect water and pump to a tank or discharge to sanitary sewer if allowed. (Permission may be required from local sanitation district.)

- Block the storm drain or contain runoff when washing parking areas, driveways or drive-throughs. Use absorbents to pick up oil; then dry sweep. Clean with or without soap. Collect water and pump to a tank or discharge to sanitary sewer if allowed. Street Repair and Maintenance.

Graffiti Removal

- Avoid graffiti abatement activities during rain events.
- Implement the procedures under Painting and Paint Removal in SC-70 Roads, Streets, and Highway Operation and Maintenance fact sheet when graffiti is removed by painting over.
- Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a dirt or landscaped area after treating with an appropriate filtering device.
- Plug nearby storm drain inlets and vacuum/pump wash water to the sanitary sewer if authorized to do so if a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound). Ensure that a non-hazardous cleaning compound is used or dispose as hazardous waste, as appropriate.

Surface Removal and Repair

- Schedule surface removal activities for dry weather if possible.
- Avoid creating excess dust when breaking asphalt or concrete.
- Take measures to protect nearby storm drain inlets prior to breaking up asphalt or concrete (e.g. place hay bales or sand bags around inlets). Clean afterwards by sweeping up as much material as possible.
- Designate an area for clean up and proper disposal of excess materials.
- Remove and recycle as much of the broken pavement as possible to avoid contact with rainfall and stormwater runoff.
- When making saw cuts in pavement, use as little water as possible. Cover each storm drain inlet completely with filter fabric during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site.
- Always dry sweep first to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains. Once dry sweeping is complete, the area may be hosed down if needed. Wash water should be directed to landscaping or collected and pumped to the sanitary sewer if allowed.

Concrete Installation and Repair

- Schedule asphalt and concrete activities for dry weather.

- Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place san bags around inlets or work areas).
- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
- Protect applications of fresh concrete from rainfall and runoff until the material has dried.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.
- Cover litter receptacles and clean out frequently to prevent leaking/spillage or overflow.
- Clean parking lots on a regular basis with a street sweeper.

Training

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

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Limitations related to sweeping activities at large parking facilities may include current sweeper technology to remove oil and grease.
- Surface cleaning activities that require discharges to the local sewering agency will require coordination with the agency.
- Arrangements for disposal of the swept material collected must be made, as well as accurate tracking of the areas swept and the frequency of sweeping.

Requirements

Costs

- The largest expenditures for sweeping and cleaning of sidewalks, plazas, and parking lots are in staffing and equipment. Sweeping of these areas should be incorporated into street sweeping programs to reduce costs.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Community education, such as informing residents about their options for recycling and waste disposal, as well as the consequences of littering, can instill a sense of citizen responsibility and potentially reduce the amount of maintenance required by the municipality.

Additional BMPs that should be considered for parking lot areas include:

- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low concentrations.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Structural BMPs such as storm drain inlet filters can be very effective in reducing the amount of pollutants discharged from parking facilities during periods of rain.

References and Resources

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

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

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

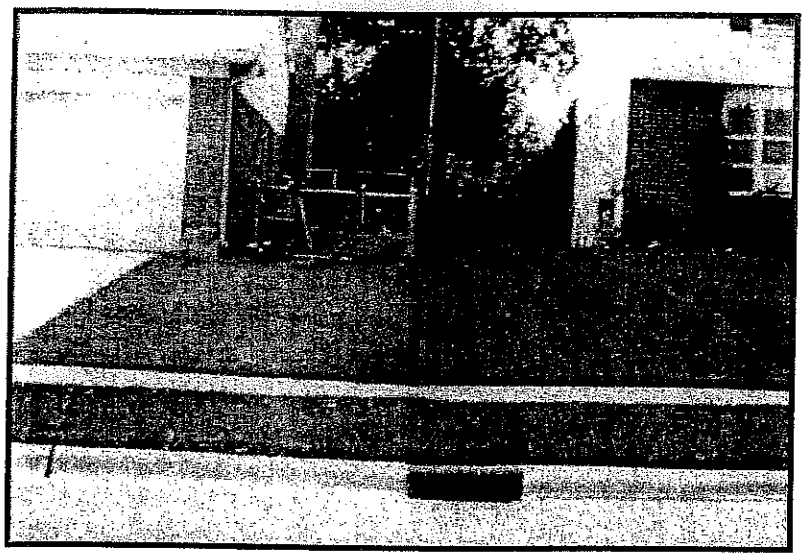
Orange County Stormwater Program
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

Santa Clara Valley Urban Runoff Pollution Prevention Program. Maintenance Best Management Practices for the Construction Industry. Brochures: Landscaping, Gardening, and Pool; Roadwork and Paving; and Fresh Concrete and Mortar Application. June 2001.

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Plan. 2001. Municipal Activities Model Program Guidance. November.

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.

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Description

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

Approach

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

Design Objectives

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

- 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

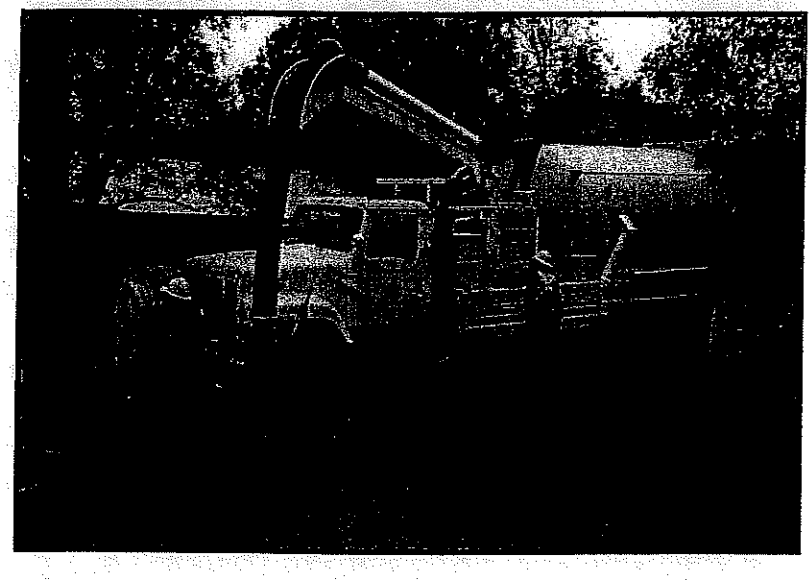
A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

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.

Drainage System Maintenance SC-44



Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

Targeted Constituents

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

Approach

Pollution Prevention

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.

Suggested Protocols

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.
  - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

CASQA California Stormwater Quality Association

- 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. 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 (emphasis added) state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS.

Illicit Connections and Discharges

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:
  - Is there evidence of spills such as paints, discoloring, etc?

- Are there any odors associated with the drainage system?
- Record locations of apparent illegal discharges/illicit connections?
- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of 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" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- 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)
  - 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.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Allow only properly trained individuals to handle hazardous materials/wastes.
- 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).

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- 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.
- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

- 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.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and prohibition against disposal of flushed effluent to sanitary sewer in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.
- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:
  - Purchase and installation of signs.
  - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.
  - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.
  - Purchase of landfill space to dispose of illegally-dumped items and material.

- 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.

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.

Supplemental Information

Further Detail of the BMP

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 resuspension 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 or that fire hydrant line flushing coincide with storm sewer flushing.

References and Resources

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

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

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

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

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

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

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

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line:
http://www.epa.gov/npdes/menuofbmps/poll_16.htm

Attachment B

Calculations

DCV CALCULATIONS PARCEL 1 ONLY

Project: **Koll Project**
Total Area(AC) **7.08**
Total DCV (required) cf **11,778**

Drainage Area	Area (sf)	Area (AC)	Rainfall Depth (in)	Pervious Area (sf)	Pervious Area (ac)	Impervious Area (ac)	Impervious ratio	C (0.75ximp+0.15)	DCV(cf) (CxdxA)	BMP USED
A1	60893	1.40	0.75	18990	0.44	0.96	0.69	0.67	2,535	MWS #1 (4'X8')
A2	46765	1.07	0.75	6990	0.16	0.91	0.85	0.79	2,303	MWS #1 (4'X8')
A3	13123	0.30	0.75	3746	0.09	0.22	0.71	0.69	563	MWS #2 (4'X6')
A4	18165	0.42	0.75	3344	0.08	0.34	0.82	0.76	865	MWS #2 (4'X6')
A5	34200	0.79	0.75	8100	0.19	0.60	0.76	0.72	1,544	MWS #2 (4'X6')
B1	50917	1.17	0.75	4500	0.10	1.07	0.91	0.83	2,653	MWS #3 (4'X8')
B2	7063	0.16	0.75	0	0.00	0.16	1.00	0.90	397	MWS #3 (4'X8')
B3	21697	0.50	0.75	8500	0.20	0.30	0.61	0.61	822	MWS #3 (4'X8')
C	4170	0.10	0.75	2963	0.07	0.03	0.29	0.37	96	MWS #1 (4'X8')
D	51366	1.18	0.75	8100	0.19	0.99	0.84	0.78	2,510	MWS #4 (4'X6')
Total	308,359	7.08		65,233	1.50	5.58			11,778	

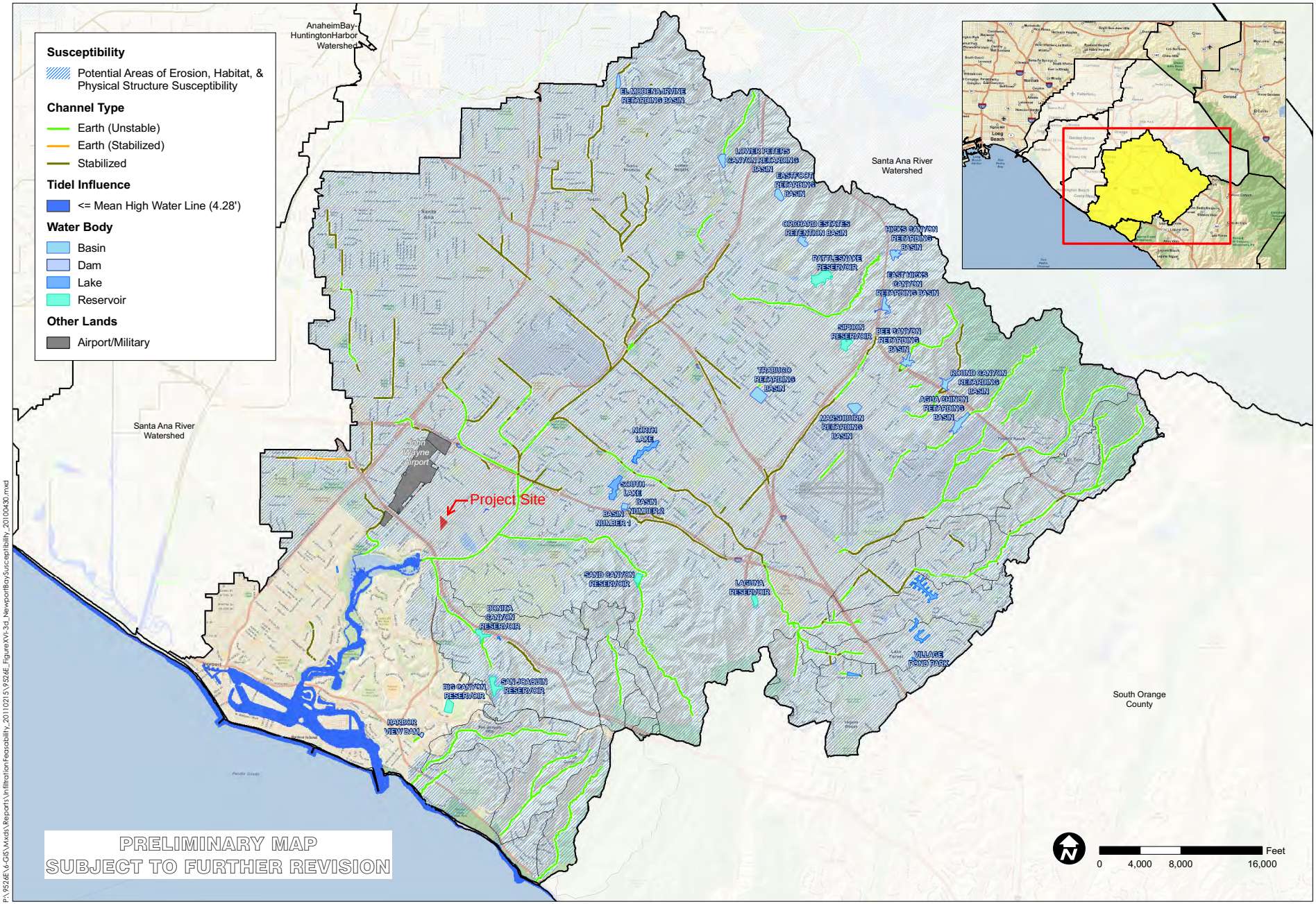
HCOC CALCULATIONS

Proposed									
Drainage Area	*Area*	*Area*	*Rainfall Depth*	*Pervious Area*	*Impervious Area*	*Impervious Area*	*Impervious Ratio*	*C*	*V*
	(square feet)	(acres)	(ft)	(sf)	(sf)	(acres)		(0.75*imp+0.15)	(cf)
A1	60893	1.40	0.18	18990	41903	0.96	0.69	0.67	608
A2	46765	1.07	0.18	6990	39775	0.91	0.85	0.79	553
A3	13123	0.30	0.18	3746	9377	0.22	0.71	0.69	135
A4	18165	0.42	0.18	3344	14821	0.34	0.82	0.76	208
A5	34200	0.79	0.18	8100	26100	0.60	0.76	0.72	371
A6	9828	0.23	0.18	8100	1728	0.04	0.18	0.28	42
A7	4170	0.10	0.18	2963	1207	0.03	0.29	0.37	23
B1	72614	1.67	0.18	12070	60544	1.39	0.83	0.78	845
B2	7063	0.16	0.18	0	7063	0.16	1.00	0.90	95
B3	2477	0.06	0.18	2360	117	0.00	0.05	0.19	7
D	51366	1.18	0.18	8100	43266	0.99	0.84	0.78	602
Total	320664	7.36		74763	245901	5.65			**3,488**

Existing									
Drainage Area	*Area*	*Area*	*Rainfall Depth*	*Pervious Area*	*Impervious Area*	*Impervious Area*	*Impervious Ratio*	*C*	*V*
	(square feet)	(acres)	(ft)	(sf)	(sf)	(acres)		(0.75*imp+0.15)	(cf)
A1	62793	1.44	0.18	13418	49375	1.13	0.79	0.74	697
A2	60905	1.40	0.18	11150	49755	1.14	0.82	0.76	697
A3	18260	0.42	0.18	600	17660	0.41	0.97	0.88	240
A4	34200	0.79	0.18	8430	25770	0.59	0.75	0.72	367
A5	9828	0.23	0.18	8100	1728	0.04	0.18	0.28	42
A6	4170	0.10	0.18	1734	2436	0.06	0.58	0.59	37
B1	69582	1.60	0.18	14000	55582	1.28	0.80	0.75	782
B2	7063	0.16	0.18	0	7063	0.16	1.00	0.90	95
B3	2477	0.06	0.18	2360	117	0.00	0.05	0.19	7
D	51366	1.18	0.18	5500	45866	1.05	0.89	0.82	632
Total	320644	7.36		65292	255352	5.86	0.80	**Total**	**3,594**

Attachment C

Orange County Technical Guidance Maps



P:\9526E\6-GIS\Mxds\Reports\Infiltration Feasibility_20110215\9526E_FigureXVI-3d_NewportBaySusceptibility_20100430.mxd

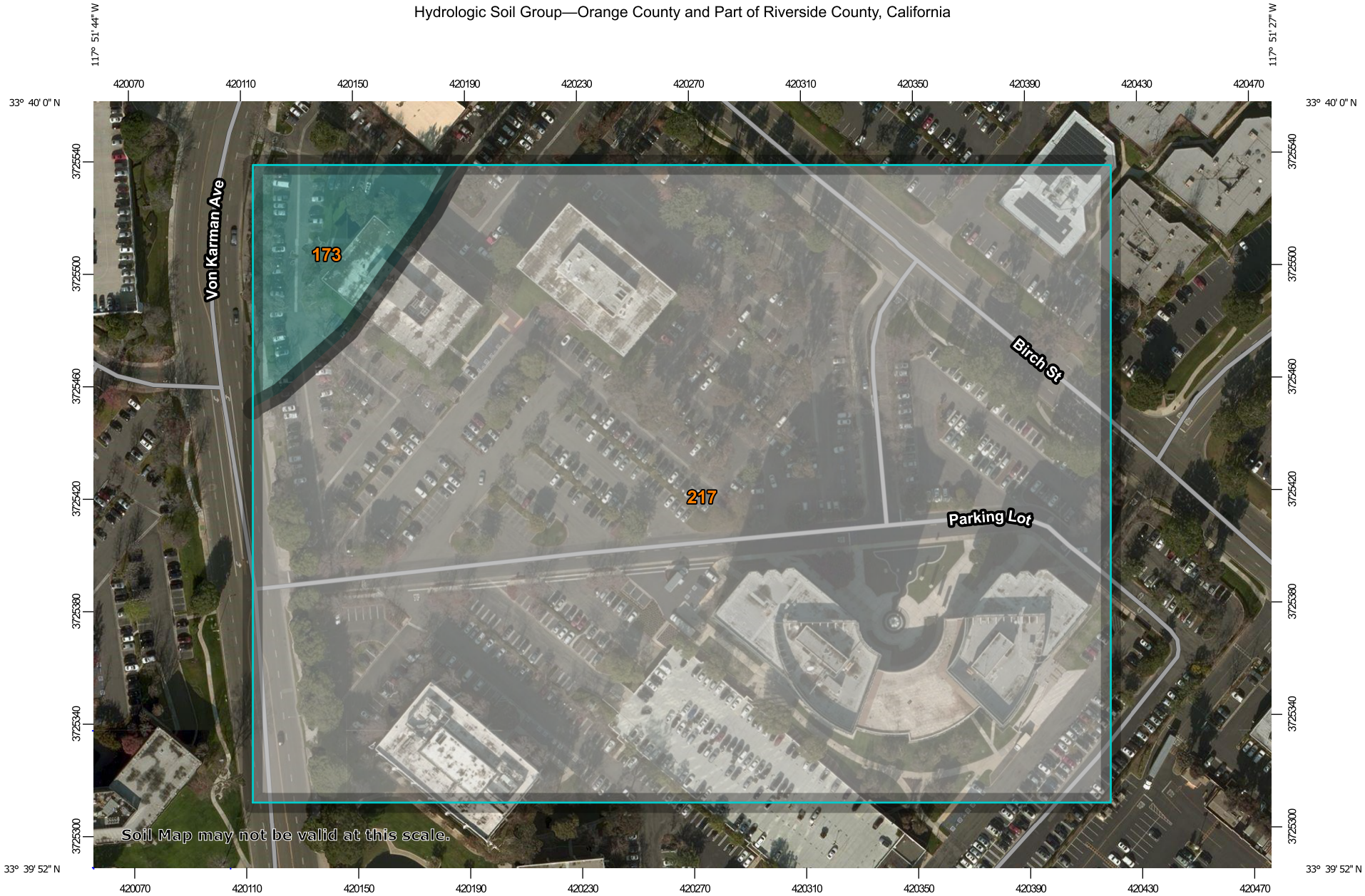
TITLE
SUSCEPTIBILITY ANALYIS
NEWPORT BAY-
NEWPORT COASTAL STREAMS

JOB
ORANGE COUNTY
WATERSHED
MASTER PLANNING
ORANGE CO. CA

SCALE	1" = 4000'
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/30/10
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-3d



Map Scale: 1:1,920 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 13, Sep 16, 2019

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

Date(s) aerial images were photographed: Jan 3, 2015—Jan 17, 2015

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
173	Myford sandy loam, 2 to 9 percent slopes	C	0.9	5.4%
217	Xeralfic arents, loamy, 2 to 9 percent slopes		16.3	94.6%
Totals for Area of Interest			**17.2**	**100.0%**

Description

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

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

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

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

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

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

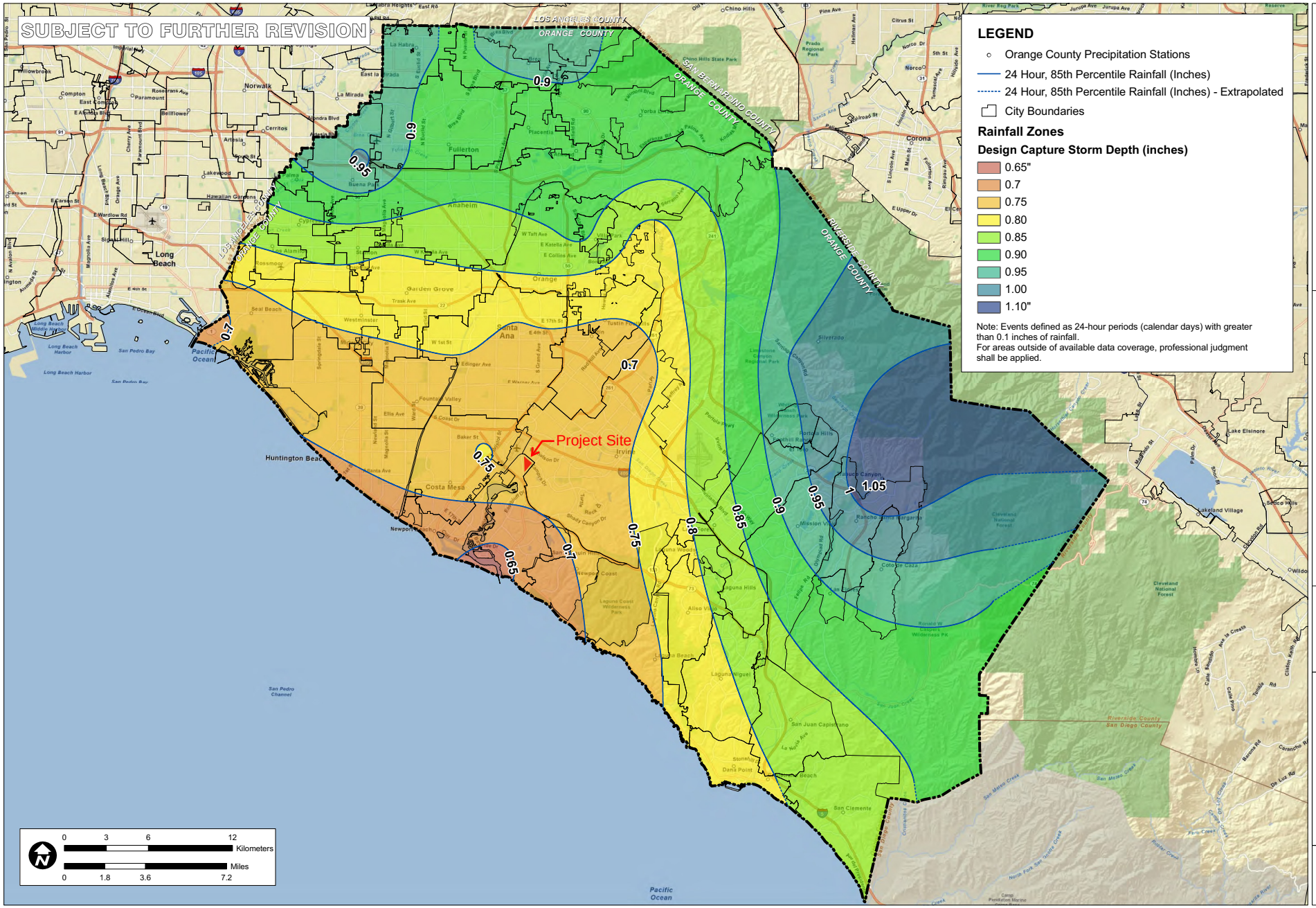
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



TITLE
RAINFALL ZONES

ORANGE COUNTY
TECHNICAL GUIDANCE
DOCUMENT

CA
ORANGE CO.

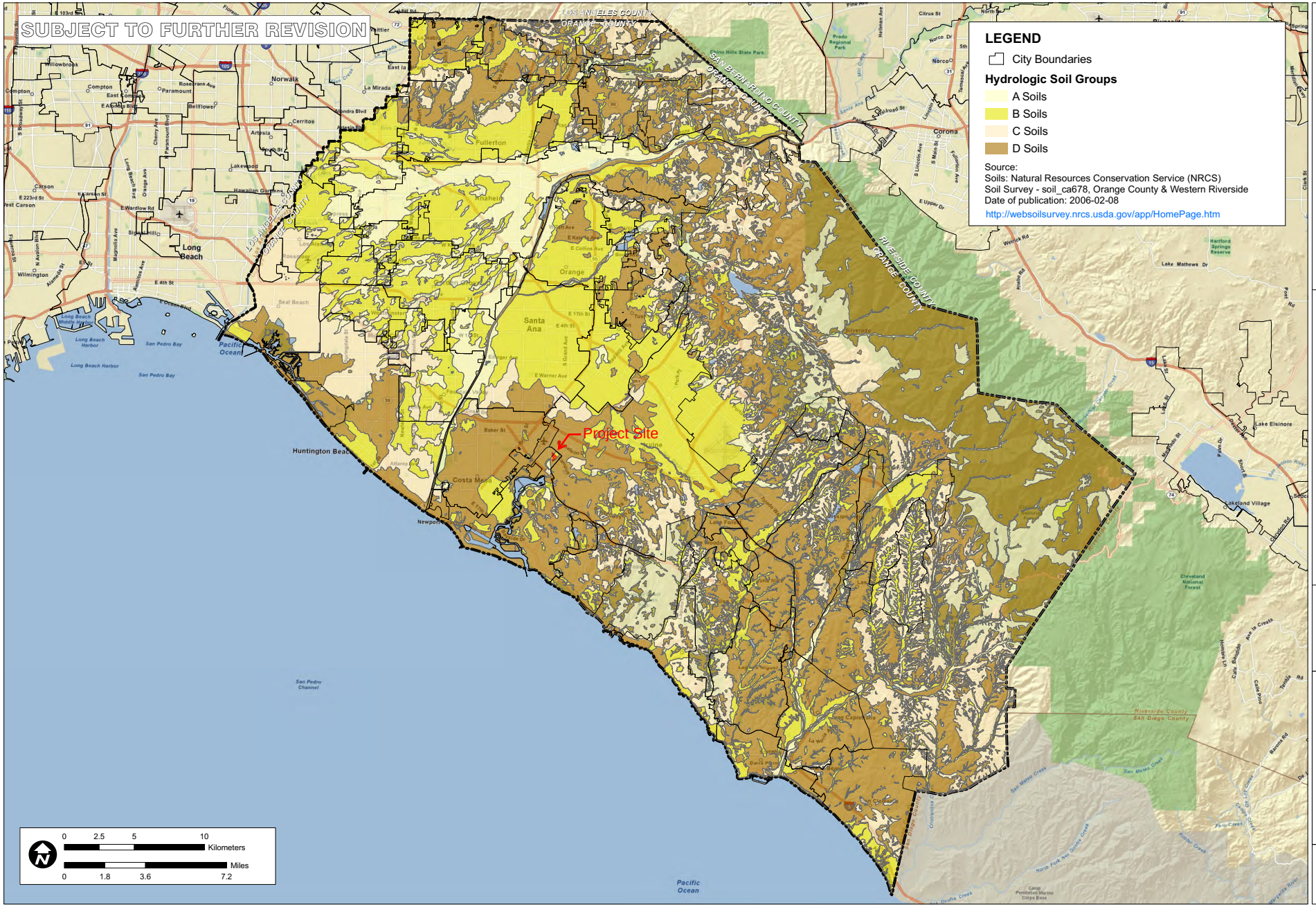
JOB

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/23/10
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-1

P:\Y526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\Y526E_FigureXVI-1_RainfallZones_20110215.mxd



TITLE
NRCS HYDROLOGIC SOILS GROUPS

JOB
ORANGE COUNTY INFILTRATION STUDY
CA
ORANGE CO.

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

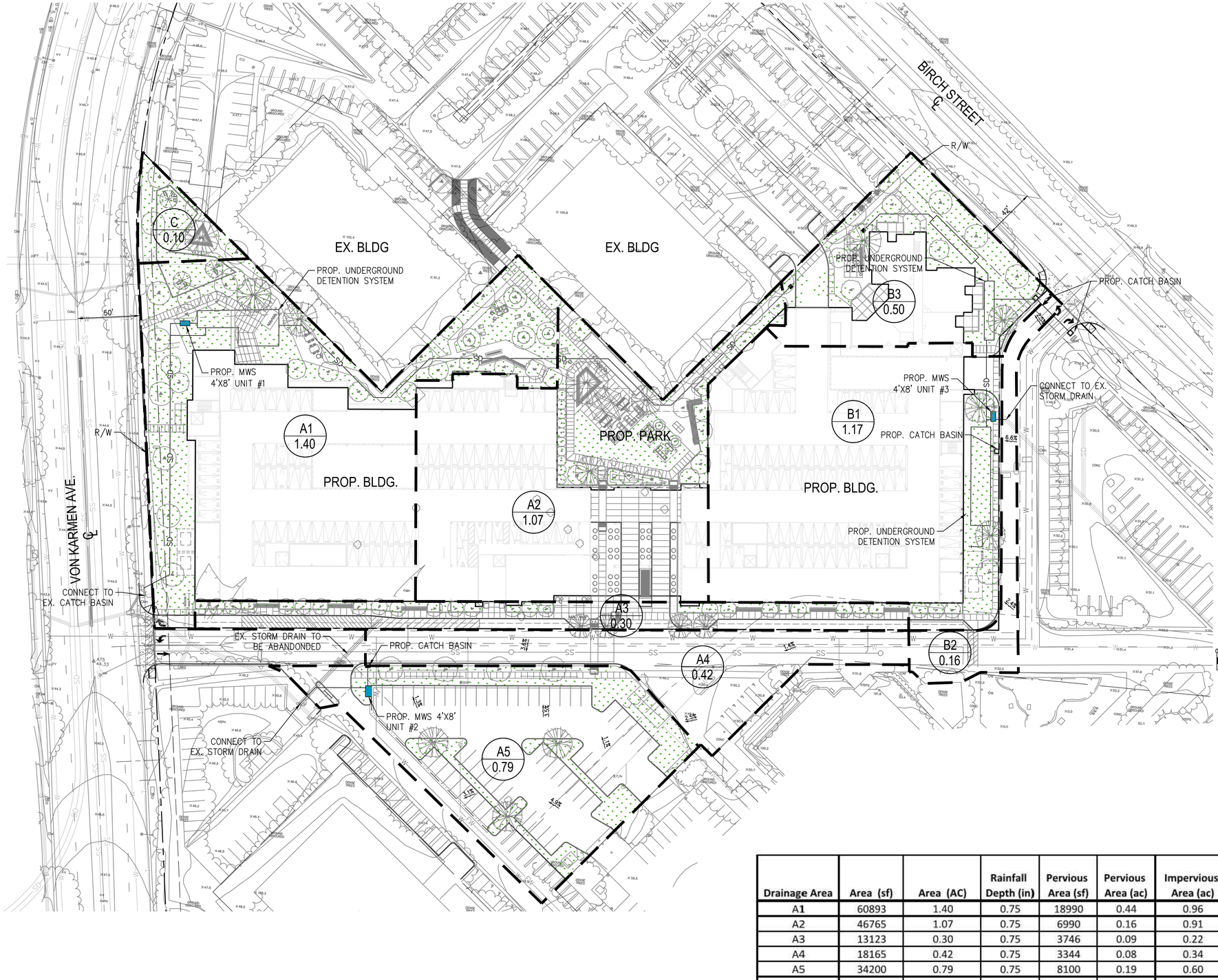
PACE
Advanced Water Engineering

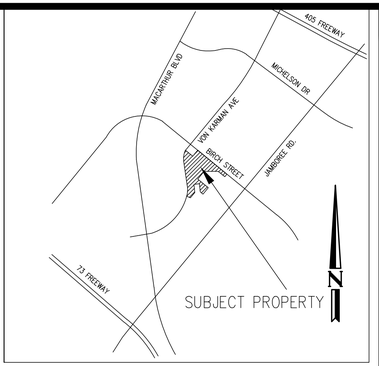
FIGURE
XVI-2a

P:\Y526E\6-GIS\Mxds\Reports\UnfiltrationFeasability_20110215\Y526E_FigureXVI-2a_HydroSoils_20110215.mxd

Attachment D

Drainage Maps & Hydrology Narrative





VICINITY MAP

NTS

LEGEND

- PROPERTY LINE
- PROPOSED MWS UNIT
- X / X.XX — DRAINAGE AREA / ACREAGE
- DRAINAGE AREAS
- PROPOSED LANDSCAPE

STORM DRAIN SIGNAGE DETAIL

Drainage Area	Area (sf)	Area (AC)	Rainfall Depth (in)	Pervious Area (sf)	Pervious Area (ac)	Impervious Area (ac)	Impervious ratio	C (0.75ximp+0.15)	DCV(cf) (CxdxA)	BMP USED
A1	60893	1.40	0.75	18990	0.44	0.96	0.69	0.67	2,535	MWS #1 (4'X8')
A2	46765	1.07	0.75	6990	0.16	0.91	0.85	0.79	2,303	MWS #1 (4'X8')
A3	13123	0.30	0.75	3746	0.09	0.22	0.71	0.69	563	MWS #2 (4'X6')
A4	18165	0.42	0.75	3344	0.08	0.34	0.82	0.76	865	MWS #2 (4'X6')
A5	34200	0.79	0.75	8100	0.19	0.60	0.76	0.72	1,544	MWS #2 (4'X6')
B1	50917	1.17	0.75	4500	0.10	1.07	0.91	0.83	2,653	MWS #3 (4'X8')
B2	7063	0.16	0.75	0	0.00	0.16	1.00	0.90	397	MWS #3 (4'X8')
B3	21697	0.50	0.75	8500	0.20	0.30	0.61	0.61	822	MWS #3 (4'X8')
C	4170	0.10	0.75	2963	0.07	0.03	0.29	0.37	96	MWS #1 (4'X8')
D	51366	1.18	0.75	8100	0.19	0.99	0.84	0.78	2,510	MWS #4 (4'X6')
Total	308,359	7.08		65,233	1.50	5.58			11,778	

NO	DESCRIPTION	BY	DATE	CHK
	REVISIONS			

TAIT
Since 1964
701 N. Parkcenter Drive
Santa Ana, CA 92705
p: 714/560/8200
www.tait.com
f: 714/560/8211
Los Angeles Ontario
Sacramento San Diego
San Francisco Bolse
Dallas Denver
Phoenix Portland

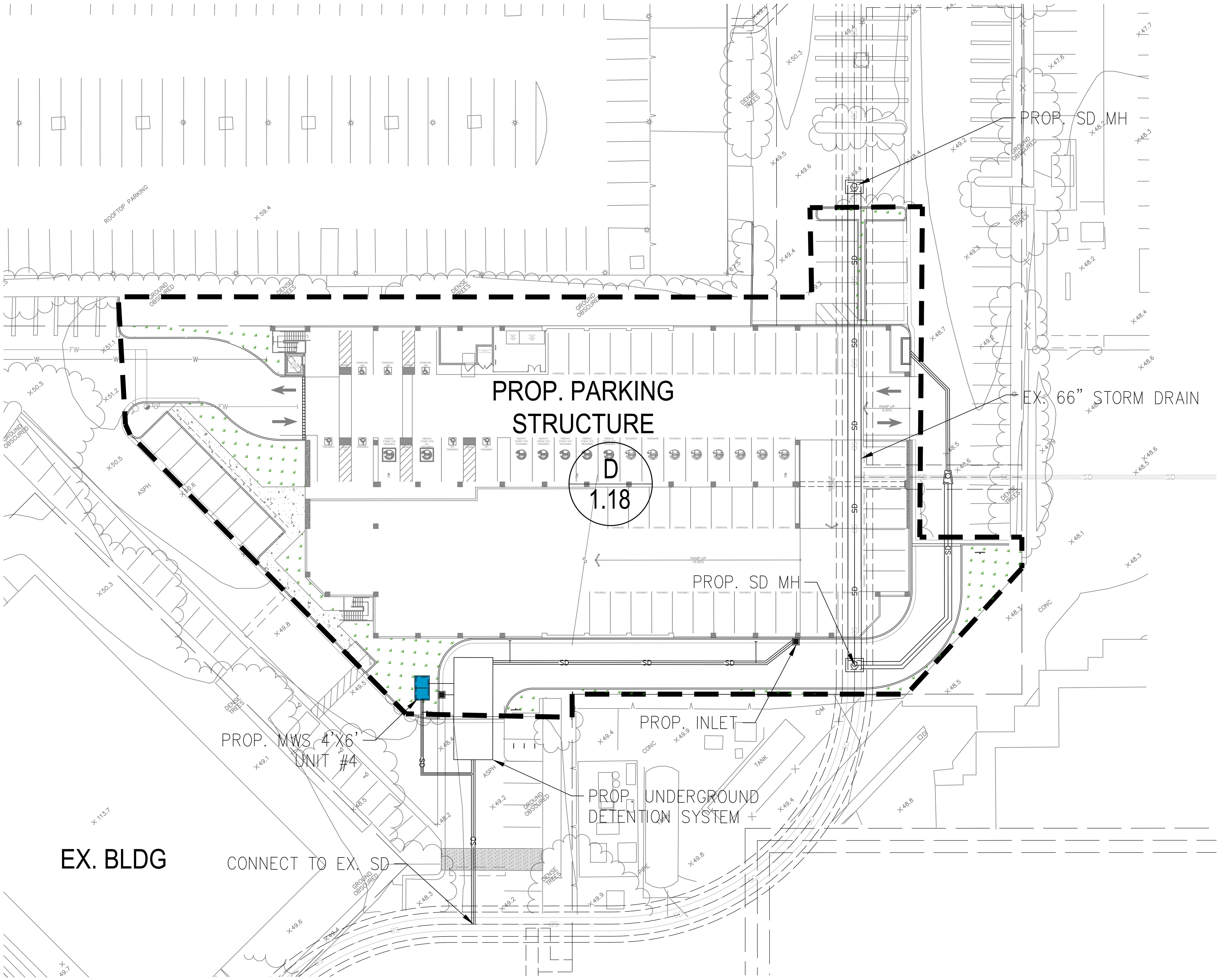
PROPOSED WQMP EXHIBIT

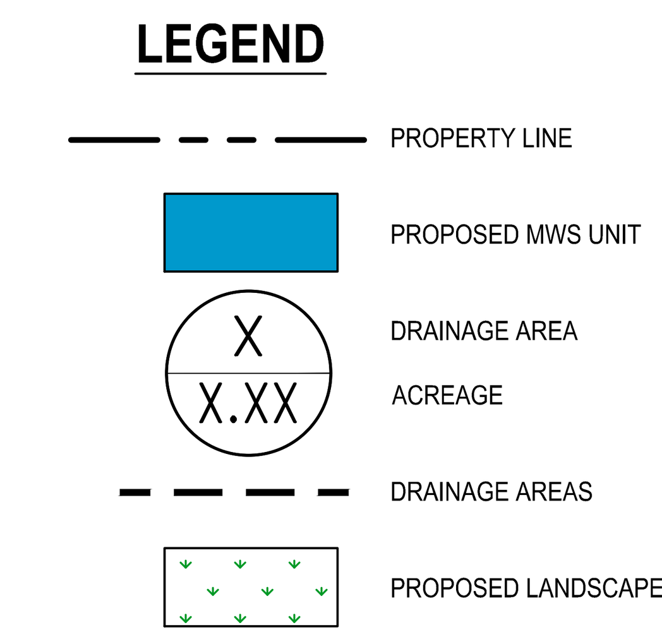
RESIDENCES AT 4400 VON KARMAN
CITY OF NEWPORT BEACH
TPG (KCN) ACQUISITION, LLC
5000 BIRCH ST., SUITE 600
NEWPORT BEACH, CA 92660

DRAWN:
DATE: 8/21/20
CHECKED: MT
DATE: 8/21/20
REVISION #: 1
DATE: 8/21/20
JOB NO.: SP8507

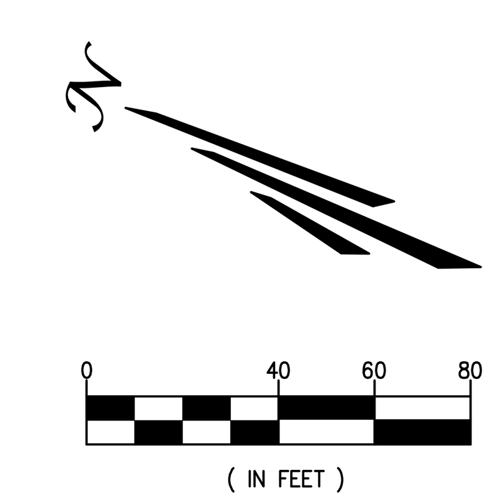
01

K:\Drawings\SP\SP8507 – Newport Beach\ENG\Conceptual Plans\SP8507– WQMP.dwg
PLOTTED: 10/26/2020 1:55:59 PM BY Michael Tran PAGESETUP: ----- PLOTSTYLE: Tait2014.ctb





STORM DRAIN SIGNAGE DETAIL



NO.	DESCRIPTION	BY	DATE	CHK
	REVISIONS			

TAIT
Since 1964
701 N. Parkcenter Drive
Santa Ana, CA 92705
p: 714/560/8200 f: 714/560/8211
www.tait.com
Los Angeles Sacramento San Francisco Dallas Phoenix
Ontario San Diego Boise Denver Portland

PROPOSED WQMP EXHIBIT

RESIDENCES AT 4400 VON KARMAN

CITY OF NEWPORT BEACH

TPG (KCN) ACQUISITION, LLC

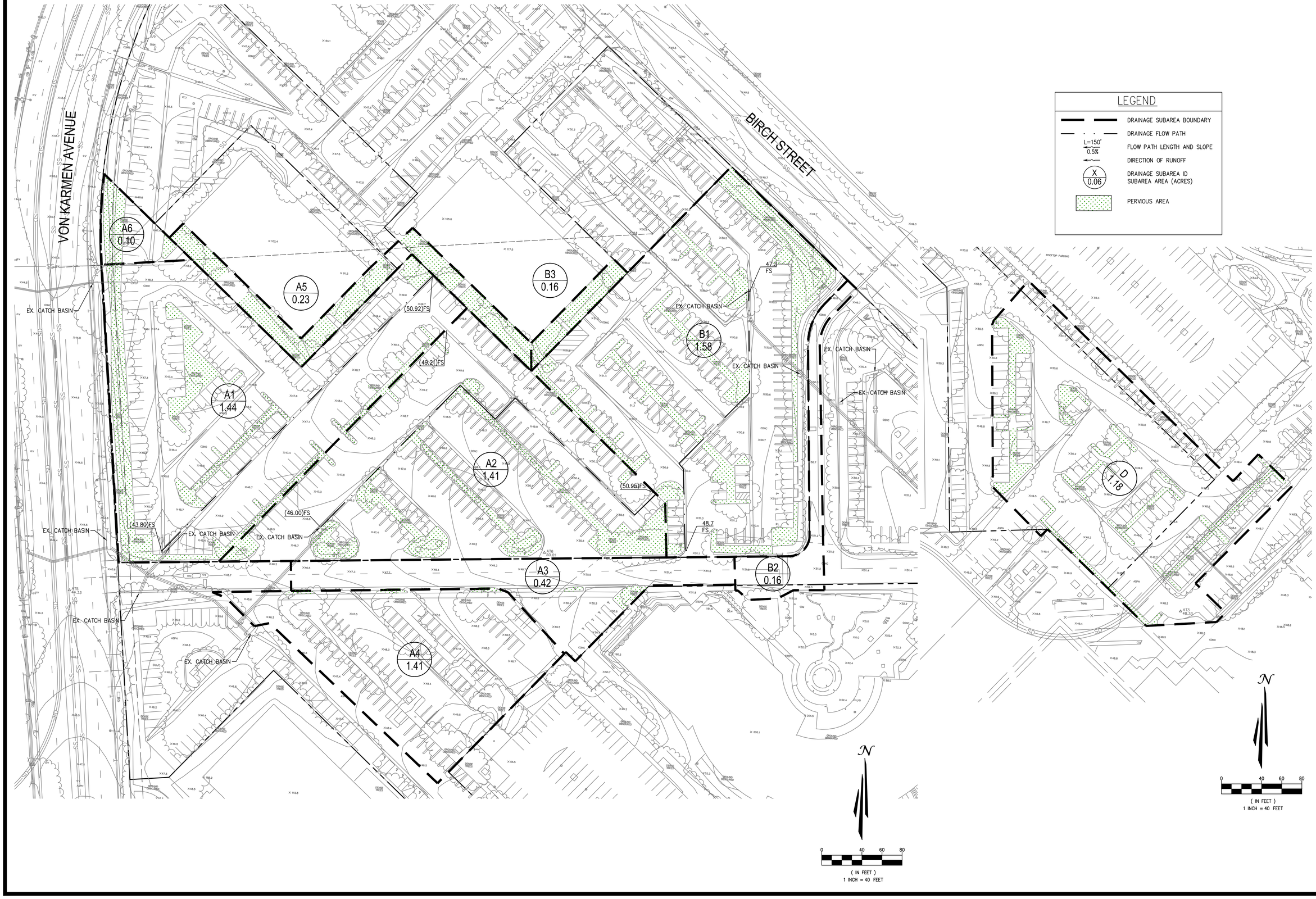
5000 BIRCH ST., SUITE 600

NEWPORT BEACH, CA 92660

DRAWN:
DATE: 8/21/20
CHECKED: MT
DATE: 8/21/20
REVISION #: 1
DATE: 8/21/20
JOB NO: SP8507

02

K:\Drawings\SP\SP8507 – Newport Beach\ENG\Conceptual Plans\SP8507–WQMP.dwg
PLOTTED: 10/26/2020 1:57:04 PM BY Michael Tran PAGESETUP: ---- PLOTSTYLE: Tait2014.ctb



LEGEND

- DRAINAGE SUBAREA BOUNDARY
- DRAINAGE FLOW PATH
- L=150' / 0.5% — FLOW PATH LENGTH AND SLOPE
- DIRECTION OF RUNOFF
- X / 0.06 — DRAINAGE SUBAREA ID / SUBAREA AREA (ACRES)
- PERVIOUS AREA

NO	DESCRIPTION	BY	DATE	CHK
	REVISIONS			

TAIT
Since 1964
701 N. Parkcenter Drive
Santa Ana, CA 92705
p: 714/560/8200
f: 714/560/8211
www.tait.com
Los Angeles Sacramento San Francisco Dallas Phoenix
Ontario San Diego Boise Denver Portland

EXISTING HYDROLOGY

KOLL UPTOWN APARTMENTS
CITY OF NEWPORT BEACH
THE PICERNE GROUP
5000 BIRCH ST., SUITE 600
NEWPORT BEACH, CA 92660

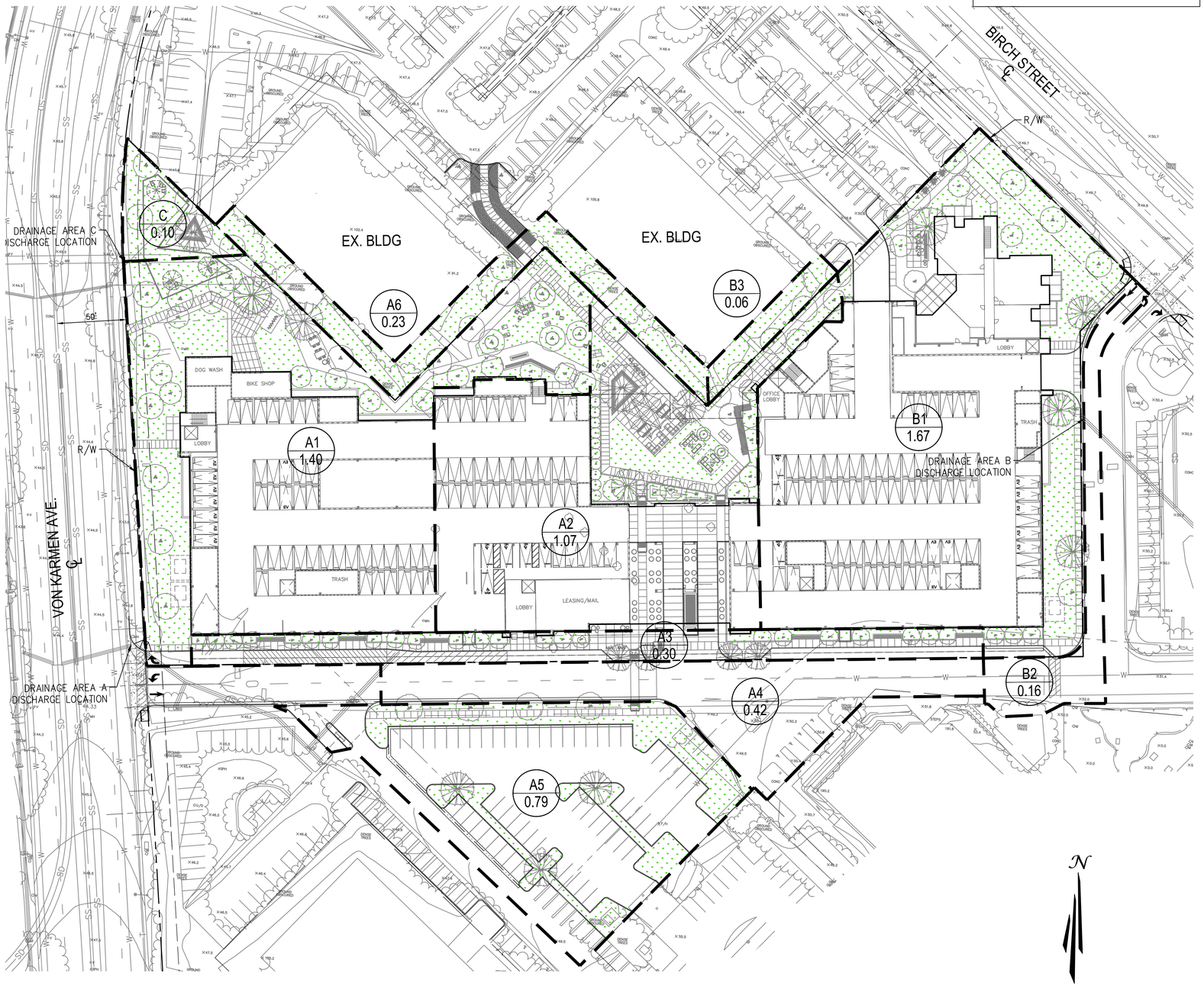
DRAWN:
DATE: 4/30/20
CHECKED: MT
DATE: 4/30/20
REVISION #: 1
DATE: 4/30/20
JOB NO.: SP8507

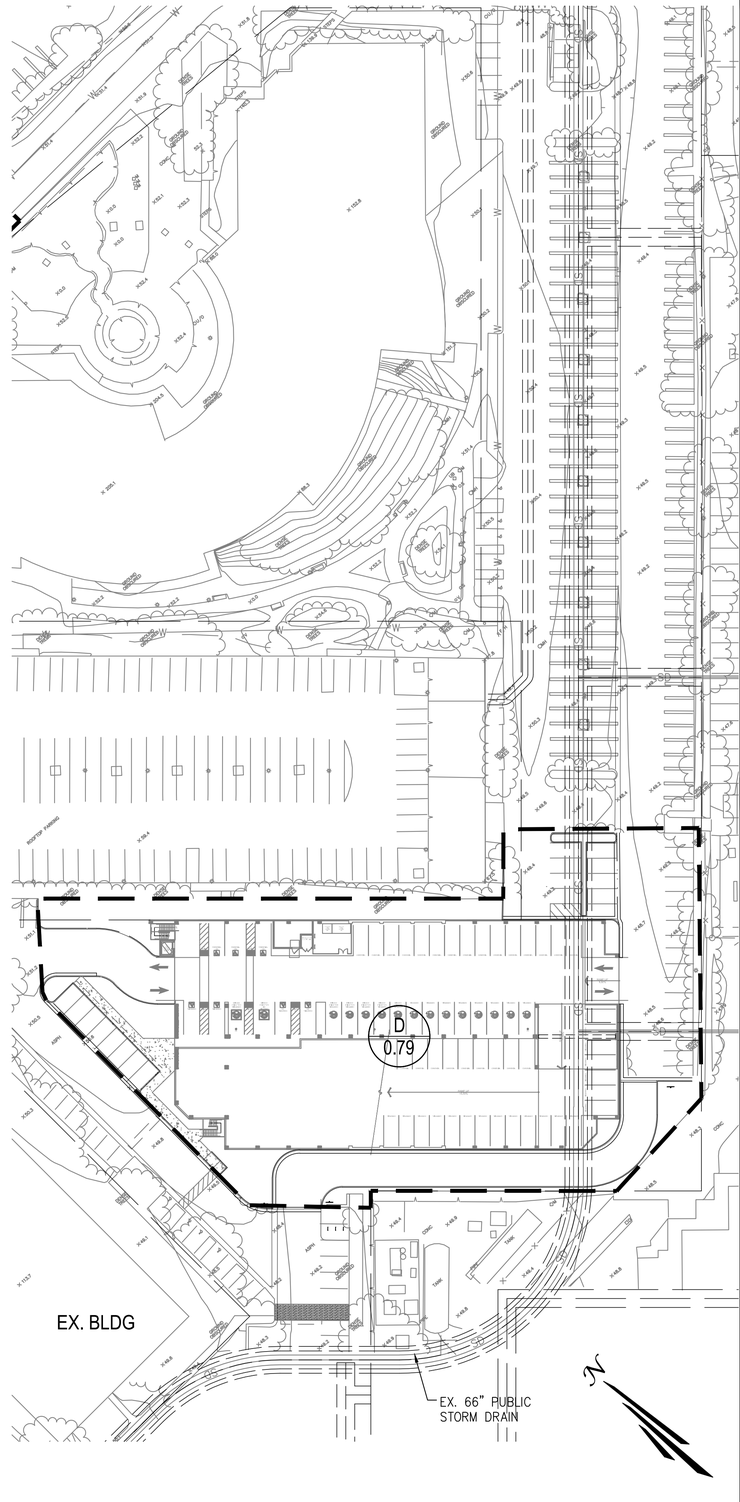
01

K:\Drawings\SP\SP8507 – Newport Beach\ENG\Conceptual Plans\SP8507-HYD-EX.dwg
PLOTTED: 5/8/2020 9:49:43 AM BY Michael Tron PAGESETUP: ---- PLOTSTYLE: Tait2014.ctb

LEGEND

- DRAINAGE SUBAREA BOUNDARY
- DRAINAGE FLOW PATH
- L=150' / 0.5% — FLOW PATH LENGTH AND SLOPE
- DIRECTION OF RUNOFF
- X / 0.06 — DRAINAGE SUBAREA ID / SUBAREA AREA (ACRES)
- PERVIOUS AREA





NO	DESCRIPTION	BY	DATE	CHK
	REVISIONS			

TAIT
Since 1964
701 N. Parkcenter Drive
Santa Ana, CA 92705
p: 714/560/8200
f: 714/560/8211
www.tait.com
Los Angeles Sacramento San Francisco Dallas Phoenix
Ontario San Diego Boise Denver Portland

PROPOSED HYDROLOGY

RESIDENCES AT 4400 VON KARMAN

CITY OF NEWPORT BEACH

TPG (KCN) ACQUISITION, LLC

5000 BIRCH ST., SUITE 600

NEWPORT BEACH, CA 92660

DRAWN: —
DATE: 8/21/20
CHECKED: MT
DATE: 8/21/20
REVISION #: 1
DATE: 8/21/20
JOB NO: SP8507

01

K:\Drawings\SP\SP8507 – Newport Beach\ENG\Conceptual Plans\SP8507–HYD–PROP.dwg
PLOTTED: 10/26/2020 2:16:52 PM BY Michael Tron PAGESETUP: ---- PLOTSTYLE: tait2014.ctb

IN THE CITY OF NEWPORT BEACH, COUNTY OF ORANGE, STATE OF CALIFORNIA

RESIDENCES AT 4400 VON KARMAN
CONCEPTUAL GRADING PLAN

LEGAL DESCRIPTION

PARCEL 1:

THAT CERTAIN PARCEL OF LAND SITUATED IN THE CITY OF NEWPORT BEACH, COUNTY OF ORANGE, STATE OF CALIFORNIA, BEING THAT PORTION OF PARCEL 2 OF PARCEL MAP NO. 91–155 AS SHOWN ON A MAP THEREOF, FILED IN BOOK 266, PAGES 16 THROUGH 22 OF PARCEL MAPS IN THE OFFICE OF THE COUNTY RECORDER OF SAID ORANGE COUNTY, DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHEASTERLY CORNER OF SAID PARCEL 2 OF PARCEL MAP NO. 91–155; THENCE ALONG THE NORTHEASTERLY LINE THEREOF NORTH 49°21'34" WEST 584.54 FEET TO THE TRUE POINT OF BEGINNING; THENCE LEAVING SAID NORTHEASTERLY LINE SOUTH 41°05'02" WEST 54.87 FEET; THENCE SOUTH 04°16'29" EAST 257.91 FEET; THENCE SOUTH 85°43'31" WEST 685.70 FEET TO A LINE PARALLEL WITH AND 1.00 FEET EASTERLY OF THE EASTERLY RIGHT–OF–WAY LINE OF VON KARMAN AVENUE AS SHOWN ON SAID PARCEL MAP NO 91–155; THENCE ALONG SAID PARALLEL LINE NORTH 06°59'31" WEST 296.00 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHEASTERLY AND HAVING A RADIUS OF 549.00 FEET; THENCE ALONG SAID CURVE NORTHEASTERLY 90.98 FEET THROUGH A CENTRAL ANGLE OF 09°29'40" TO THE NORTHWESTERLY PROLONGATION OF THE SOUTHWESTERLY LINE OF THAT CERTAIN PARCEL LABELED N.A.P. OF SAID PARCEL MAP NO. 91–155 HAVING A BEARING AND DISTANCE OF "NORTH 49°21'34" WEST 204.00 FEET"; THENCE ALONG THE NORTHWESTERLY PROLONGATION OF THE SOUTHWESTERLY LINE AND THE SOUTHEASTERLY LINE OF SAID N.A.P. PARCEL AND ITS NORTHEASTERLY PROLONGATION THROUGH THE FOLLOWING COURSES: SOUTH 49°21'34" EAST 274.72 FEET; THENCE NORTH 40°38'26" EAST 156.94 FEET TO THE SOUTHWESTERLY LINE OF THAT CERTAIN PARCEL LABELED N.A.P. OF SAID PARCEL MAP NO. 91–155 HAVING A BEARING AND DISTANCE OF "NORTH 49°21'34" EAST 204.44 FEET"; THENCE ALONG SAID SOUTHWESTERLY LINE AND THE SOUTHEASTERLY LINE OF SAID N.A.P. PARCEL AND ITS NORTHEASTERLY PROLONGATION THROUGH THE FOLLOWING COURSES: SOUTH 49°21'34" EAST 166.34 FEET; THENCE NORTH 40°38'26" EAST 284.73 FEET TO SAID NORTHEASTERLY LINE OF PARCEL 2; THENCE ALONG SAID NORTHEASTERLY LINE SOUTH 49°21'34" EAST 157.28 FEET TO THE TRUE POINT OF BEGINNING.

CONTAINING: 4.51 ACRES, MORE OF LESS.

PARCEL 2:

THAT CERTAIN PARCEL OF LAND SITUATED IN THE CITY OF NEWPORT BEACH, COUNTY OF ORANGE, STATE OF CALIFORNIA, BEING THAT PORTION OF PARCEL 2 OF PARCEL MAP NO. 91–155 AS SHOWN ON A MAP THEREOF, FILED IN BOOK 266, PAGES 16 THROUGH 22 OF PARCEL MAPS, TOGETHER WITH PARCEL 1 OF PARCEL MAP NO. 82–713 AS SHOWN ON A MAP THEREOF, FILED IN BOOK 181, PAGES 13 THROUGH 19 OF PARCEL MAPS, BOTH IN THE OFFICE OF THE COUNTY RECORDER OF SAID ORANGE COUNTY.

EXCEPTING THEREFROM THAT CERTAIN PARCEL DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHEASTERLY CORNER OF SAID PARCEL 2 OF PARCEL MAP NO. 91–155; THENCE ALONG THE NORTHEASTERLY LINE THEREOF NORTH 49°21'34" WEST 584.54 FEET TO THE TRUE POINT OF BEGINNING; THENCE LEAVING SAID NORTHEASTERLY LINE SOUTH 41°05'02" WEST 54.87 FEET; THENCE SOUTH 04°16'29" EAST 257.91 FEET; THENCE SOUTH 85°43'31" WEST 685.70 FEET TO A LINE PARALLEL WITH AND 1.00 FEET EASTERLY OF THE EASTERLY RIGHT–OF–WAY LINE OF VON KARMAN AVENUE AS SHOWN ON SAID PARCEL MAP NO 91–155; THENCE ALONG SAID PARALLEL LINE NORTH 06°59'31" WEST 296.00 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHEASTERLY AND HAVING A RADIUS OF 549.00 FEET; THENCE ALONG SAID CURVE NORTHEASTERLY 90.98 FEET THROUGH A CENTRAL ANGLE OF 09°29'40" TO THE NORTHWESTERLY PROLONGATION OF THE SOUTHWESTERLY LINE OF THAT CERTAIN PARCEL LABELED N.A.P. OF SAID PARCEL MAP NO. 91–155 HAVING A BEARING AND DISTANCE OF "NORTH 49°21'34" WEST 204.00 FEET"; THENCE ALONG THE NORTHWESTERLY PROLONGATION OF THE SOUTHWESTERLY LINE AND THE SOUTHEASTERLY LINE OF SAID N.A.P. PARCEL AND ITS NORTHEASTERLY PROLONGATION THROUGH THE FOLLOWING COURSES: SOUTH 49°21'34" EAST 274.72 FEET; THENCE NORTH 40°38'26" EAST 156.94 FEET TO THE SOUTHWESTERLY LINE OF THAT CERTAIN PARCEL LABELED N.A.P. OF SAID PARCEL MAP NO. 91–155 HAVING A BEARING AND DISTANCE OF "NORTH 49°21'34" EAST 204.44 FEET"; THENCE ALONG SAID SOUTHWESTERLY LINE AND THE SOUTHEASTERLY LINE OF SAID N.A.P. PARCEL AND ITS NORTHEASTERLY PROLONGATION THROUGH THE FOLLOWING COURSES: SOUTH 49°21'34" EAST 166.34 FEET; THENCE NORTH 40°38'26" EAST 284.73 FEET TO SAID NORTHEASTERLY LINE OF PARCEL 2; THENCE ALONG SAID NORTHEASTERLY LINE SOUTH 49°21'34" EAST 157.28 FEET TO THE TRUE POINT OF BEGINNING.

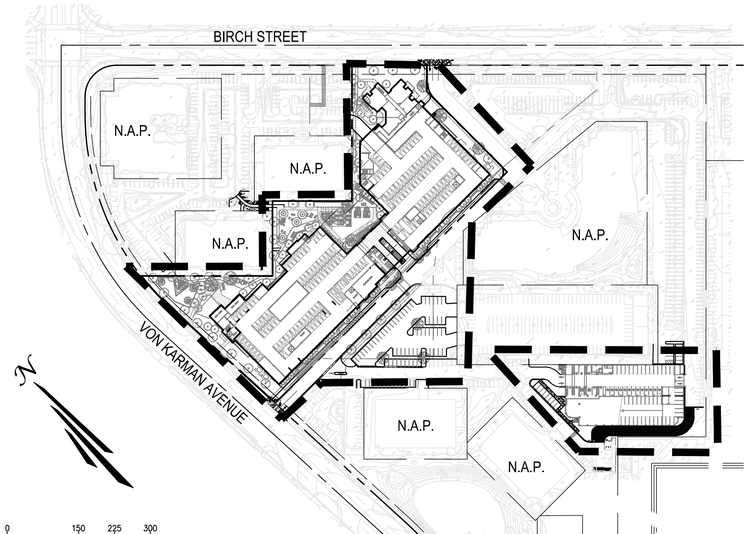
CONTAINING: 20.09 ACRES, MORE OF LESS.

BENCHMARK

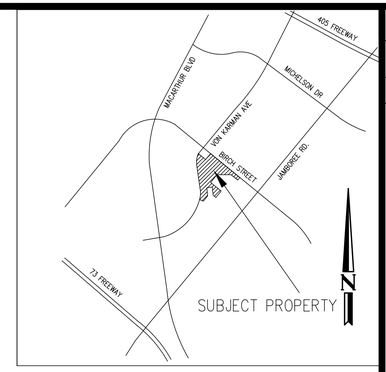
DESCRIBED BY OCS 2001 – FOUND 3 3\4" OCS ALUMINUM BENCHMARK DISK STAMPED "3J–13–70", SET IN THE TOP OF A 4 IN. BY 4 IN. CONCRETE POST. MONUMENT IS LOCATED IN THE SOUTHERLY CORNER OF THE INTERSECTION OF JAMBOREE ROAD AND FAIRCHILD, 72.3 FT. WESTERLY OF THE CENTERLINE OF FAIRCHILD AND 57.2 FT. SOUTHERLY OF THE CENTER OF THE CENTER MEDIAN ALONG MACARTHUR, 2.8 FT. WESTERLY OF THE WEST END OF THE SOUTHWEST CURB RETURN. MONUMENT IS DOWN 0.1 FT. FROM THE TOP OF CURB.
ELEVATION: 54.54 (NAVD88)

BASIS OF BEARINGS

THE BEARINGS SHOWN HEREON ARE BASED ON THE LINE BETWEEN O.C.S. HORIZONTAL CONTROL STATION GPS NO. 6175R1 AND STATION GPS NO. 6168R1 BEING N06°59'37"W PER RECORDS ON FILE IN THE OFFICE OF THE ORANGE COUNTY SURVEYOR, BASED ON THE CALIFORNIA COORDINATE SYSTEM (CCS83) ZONE VI, NAD 1983 (2007.00 EPOCH OCS GPS ADJUSTMENT).



INDEX MAP
SCALE: 1" = 150'



VICINITY MAP
NTS

APPLICANT

TPG (KCN) ACQUISITION, LLC
5000 BIRCH ST, SUITE 600
NEWPORT BEACH, CA 92660
(949) 267–1529

CIVIL

TAIT & ASSCOAITES
701 N. PARKCENTER DR.
SANTA ANA, CA 92705
(714) 560–8200

FLOOD NOTE

PER FEMA MAP PANEL 286 OF 539, MAP NUMBER 06059C0286J DATED DECEMBER 3, 2009, SUBJECT PROPERTY IS DETERMINED TO BE ZONE X – AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN.

GEOTECHNICAL ENGINEER

KLING CONSULTING GROUP, INC
18008 SKY PARK CIRCLE, SUITE 250
IRVINE, CA 92614
(949) 797–6241

ARCHITECT

TCA ARCHITECTS
19782 MACARTHUR BLVD, SUITE 300
IRVINE, CA 92612
(949) 862–0270

LANDSCAPE ARCHITECT

MJS LANDSCAPE ARCHITECTURE
507 30TH ST.
NEWPORT BEACH, CA 92663
(949) 675–9964

SHEET INDEX

UTILITY COMPANIES:

AT&T
PHONE: (800) 288–2020
LINK: AT&T U–VERSE

CR&R ENVIRONMENTAL SERVICES
2051 PLACENTIA AVE.
COSTA MESA, CA 92627
PHONE: (949) 625–6735

NEWPORT BEACH CITY UTILITIES
WATER DEPARTMENT
949 W. 16TH STREET
NEWPORT BEACH, CA 92663
PHONE: (949) 644–3011

SOUTHERN CALIFORNIA EDISON
P.O. BOX 800
RANCHO CUCAMONGA, CA 91770
PHONE: (800) 655–4555

SOUTHERN CALIFORNIA GAS
COMPANY
CENTRALIZED CORRESPONDENCE
MONTEREY PARK, CA 91756
PHONE: (800) 427–2200

TIME WARNER CABLE
9260 TOPANGA CANYON BLVD.
CHATSWORTH, CA 91311
PHONE: (800) 892–2253

EARTHWORK

STATEMENT OF QUANTITIES:
CUT: 100,593 CUBIC YARDS + 438 CUBIC YARDS (STORMWATER DETENTION VOLUME)
FILL: 516 CUBIC YARDS
NET: 100,515 CUBIC YARDS (EXPORT)

NOTE: THE QUANTITIES AS SHOWN HEREON ARE FOR PERMIT AND/OR BONDING PURPOSES ONLY. THE GRADING CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFICATION OF QUANTITIES PRIOR TO THE START OF GRADING AND ACCOUNT FOR DISTRIBUTING ANY EXCESS MATERIAL OR SUPPLYING ANY DEFICIENCIES TO BRING SITE TO DESIGN GRADE. THE ABOVE CUT AND FILL FIGURES REPRESENT PURE VOLUME FIGURES ONLY. THERE IS NO CONSIDERATION TAKEN FOR SHRINKAGE, SUBSIDENCE, OR ANY OTHER LOSS FACTOR. THE CONTRACTOR'S BID WILL BE THE SOLE BASIS FOR ALL PAYMENTS FOR WORK DONE.

UNDERGROUND SERVICE ALERT
811
Call: TOLL FREE
1-800-422-4133
KNOW WHAT'S BELOW.
CALL BEFORE YOU DIG.
TWO WORKING DAYS BEFORE YOU DIG

UNAUTHORIZED CHANGES & USES:

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS. CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY, THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL.

ENGINEERS NOTE TO CONTRACTOR:

THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITIES, PIPES, AND/OR STRUCTURES SHOWN ON THESE PLANS WERE OBTAINED BY A SEARCH OF AVAILABLE RECORDS. TO THE BEST OF OUR KNOWLEDGE, THERE ARE NO EXISTING UTILITIES EXCEPT AS SHOWN ON THESE PLANS. THE CONTRACTOR SHALL ASCERTAIN THE TRUE VERTICAL AND HORIZONTAL LOCATION OF THOSE UNDERGROUND UTILITIES TO BE USED AND SHALL BE RESPONSIBLE FOR ANY DAMAGE TO ANY PUBLIC OR PRIVATE UTILITIES, SHOWN OR NOT SHOWN HEREON. IF THE CONTRACTOR ENCOUNTERS ANY DISCREPANCIES, CONFLICTS OR AREAS WHICH HE FEELS UNWORKABLE, HE SHALL NOTIFY THE GRADING ENGINEER IMMEDIATELY PRIOR TO CONTINUING OR DEVIATING FROM THIS PLAN.

NO	DESCRIPTION	BY	DATE	CHK
	REVISIONS			

TAIT
Since 1964
701 N. Parkcenter Drive
Santa Ana, CA 92705
p: 714/560/8200 f: 714/560/8211
www.tait.com
Los Angeles Sacramento San Francisco Dallas Phoenix
Ontario San Diego Boise Denver Portland

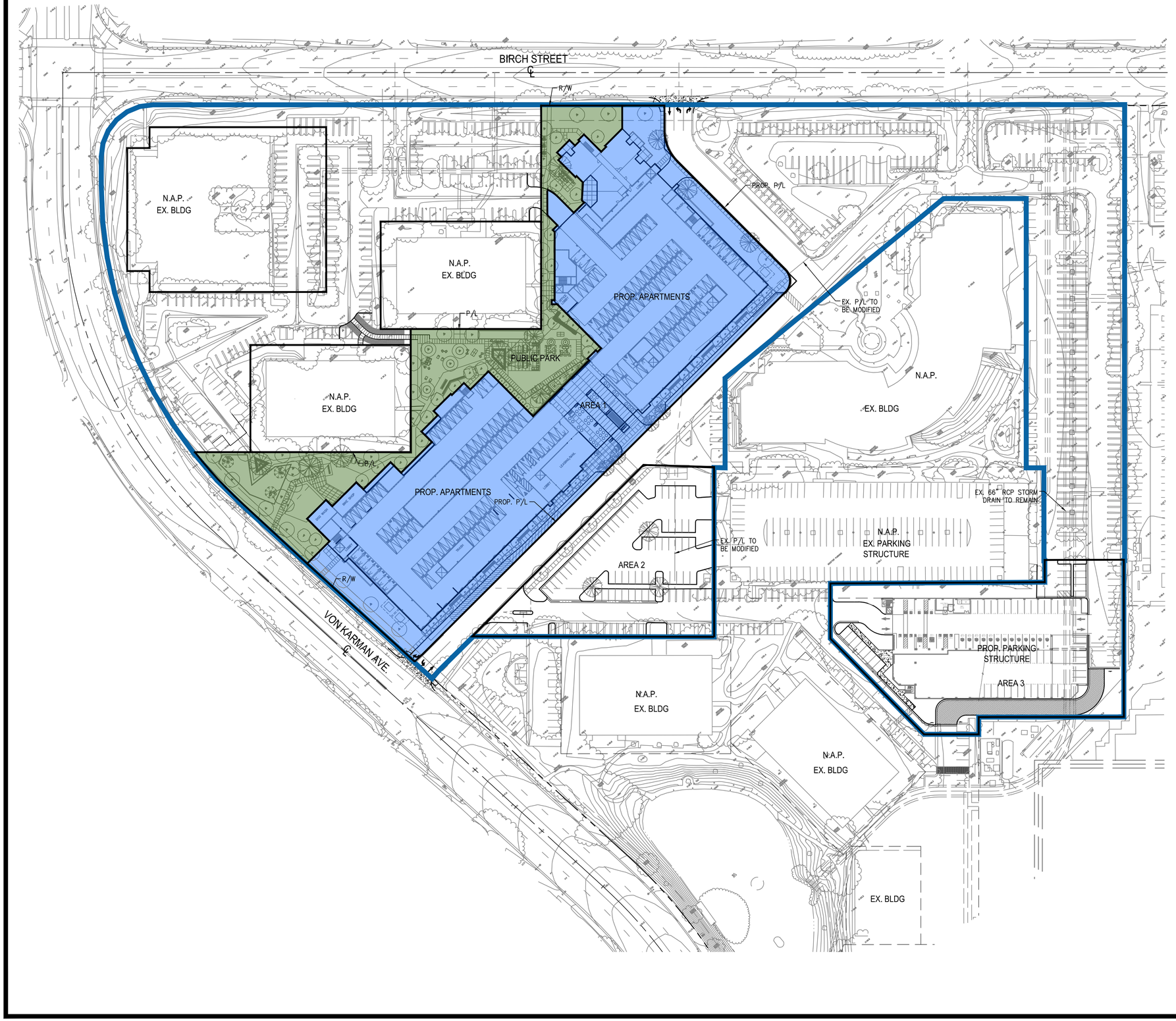
TITLE SHEET

RESIDENCES AT 4400 VON KARMAN
CITY OF NEWPORT BEACH
TPG (KCN) ACQUISITION, LLC
5000 BIRCH ST., SUITE 600
NEWPORT BEACH, CA 92660

DRAWN:
DATE: 8/21/20
CHECKED: MT
DATE: 8/21/20
REVISION #: 1
DATE: 8/21/20
JOB NO.: SP8507

C1.01

K:\Drawings\SP\SP8507 – Newport Beach\ENG\Conceptual Plans\SP8507–TS.dwg
PLOTTED: 10/26/2020 2:13:10 PM BY Michael Tran PAGESETUP: ---- PLOTSTYLE: Tait2014.ctb



DEVELOPMENT AREAS LEGEND

MIXED USE VILLAGE PROJECT LIMITS (±13 ACRES)

PUBLIC PARK AREA* (1.1 ACRES)

AREA	LAND USE:	AREA(ACRE)
1*	RESIDENTIAL DEVELOPMENT AREA	3.4
2	PROPOSED ACCESS AND PARKING	1.0
3	PARKING STRUCTURE	1.5
TOTAL DEVELOPMENT AREA		±5.9

*LOT 1 (AREA 1 & PUBLIC PARK) OF FUTURE LOT LINE ADJUSTMENT ~ 4.5± ACRES

N

0 60 90 120

(IN FEET)
1 INCH = 60 FEET

NO	DESCRIPTION	BY	DATE	CHK
	REVISIONS			

TAIT
Since 1964

701 N. Parkcenter Drive
Santa Ana, CA 92705
p: 714/560/8200 f: 714/560/8211
www.tait.com

Los Angeles Sacramento San Francisco Dallas Phoenix
Ontario San Diego Boise Denver Portland

CONCEPTUAL SITE PLAN

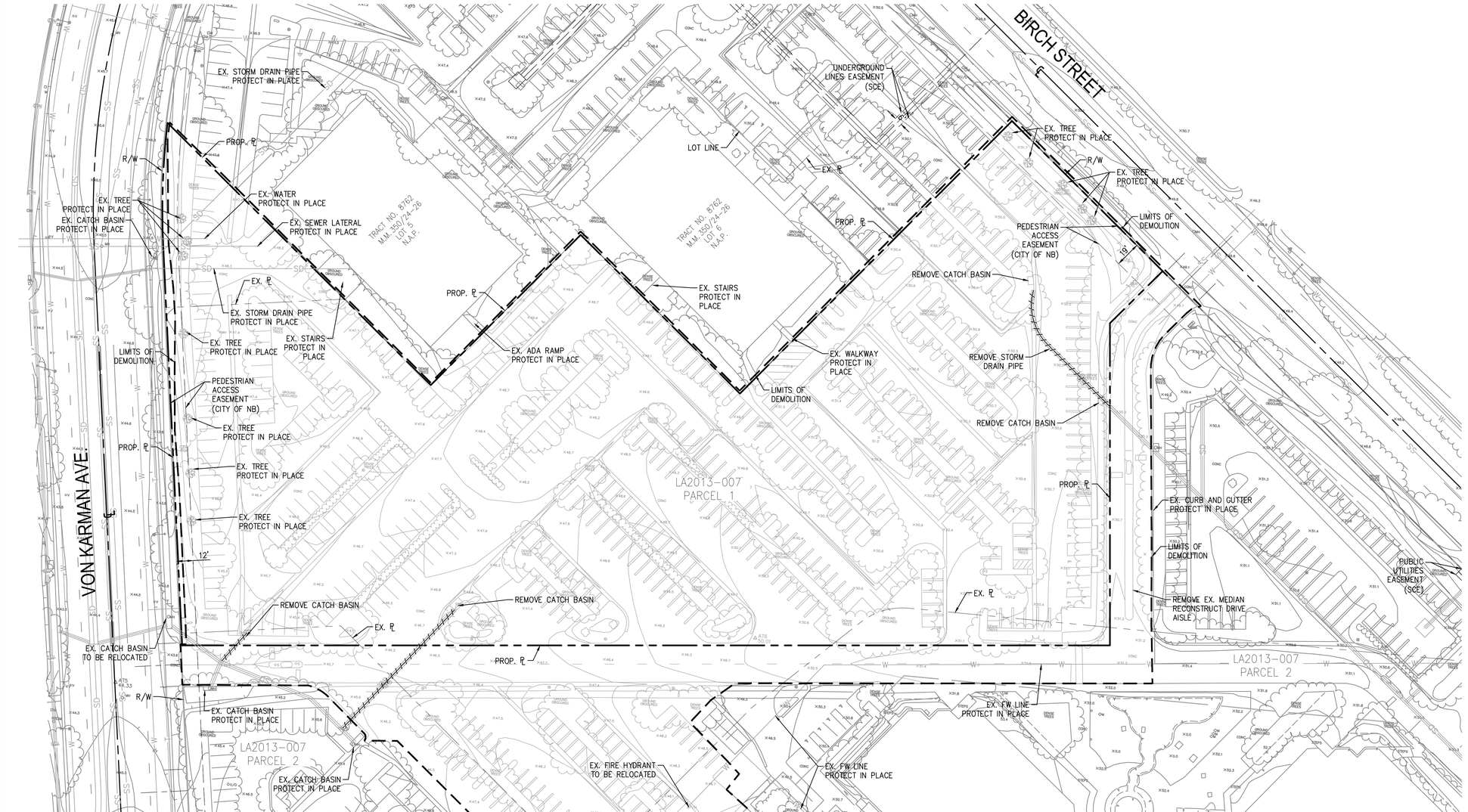
RESIDENCES AT 4400 VON KARMAN
CITY OF NEWPORT BEACH

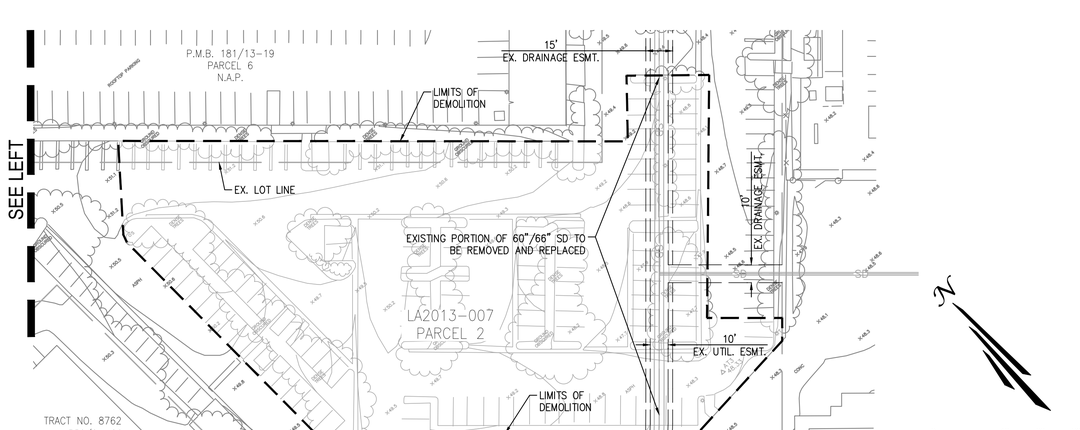
TPG (KCN) ACQUISITION, LLC
5000 BIRCH ST., SUITE 600
NEWPORT BEACH, CA 92660

DRAWN:
DATE: 8/21/20
CHECKED: MT
DATE: 8/21/20
REVISION #: 1
DATE: 8/21/20
JOB NO.: SP8507

C2.01

K:\Drawings\SP\SP8507 – Newport Beach\ENG\Conceptual Plans\SP8507–SP–01.dwg
PLOTTED: 10/26/2020 2:13:24 PM BY Michael Tron PAGESETUP: ----- PLOTSTYLE: Tait2014.ctb





LEGEND

- EXISTING CONTOURS
- CENTERLINE
- RIGHT OF WAY/ PROPERTY LINE
- CITY EASEMENT LINE
- SS — EXISTING SANITARY SEWER
- EXISTING STORM DRAIN
- W — EXISTING WATER
- LIMIT OF DEMOLITION
- REMOVE EXISTING UTILITY PIPE

NOTE:

REMOVE AND DISPOSE ALL EXISTING SURFACE IMPROVEMENTS AND ALL CONFLICTING SUBSURFACE IMPROVEMENTS WITHIN LIMITS OF DEMOLITION. ITEMS TO BE PROTECTED IN PLACE ARE NOTED PER PLAN.

UNDERGROUND SERVICE ALERT

811 Call: TOLL FREE 1-800-422-4133

KNOW WHAT'S BELOW. CALL BEFORE YOU DIG.

TWO WORKING DAYS BEFORE YOU DIG

UNAUTHORIZED CHANGES & USES:

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS. CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY, THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL.

ENGINEERS NOTE TO CONTRACTOR:

THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITIES, PIPES, AND/OR STRUCTURES SHOWN ON THESE PLANS WERE OBTAINED BY A SEARCH OF AVAILABLE RECORDS. TO THE BEST OF OUR KNOWLEDGE, THERE ARE NO EXISTING UTILITIES EXCEPT AS SHOWN ON THESE PLANS. THE CONTRACTOR SHALL ASCERTAIN THE TRUE VERTICAL AND HORIZONTAL LOCATION OF THOSE UNDERGROUND UTILITIES TO BE USED AND SHALL BE RESPONSIBLE FOR ANY DAMAGE TO ANY PUBLIC OR PRIVATE UTILITIES, SHOWN OR NOT SHOWN HEREON. IF THE CONTRACTOR ENCOUNTERS ANY DISCREPANCIES, CONFLICTS OR AREAS WHICH HE FEELS UNWORKABLE, HE SHALL NOTIFY THE GRADING ENGINEER IMMEDIATELY PRIOR TO CONTINUING OR DEVIATING FROM THIS PLAN.

NO	DESCRIPTION	BY	DATE	CHK
	REVISIONS			

TAIT
Since 1964
701 N. Parkcenter Drive
Santa Ana, CA 92705
p: 714/560/8200
f: 714/560/8211
www.tait.com
Los Angeles Ontario Sacramento San Diego San Francisco Dallas Denver Phoenix Portland Boise

CONCEPTUAL LIMITS OF IMPACT PLAN

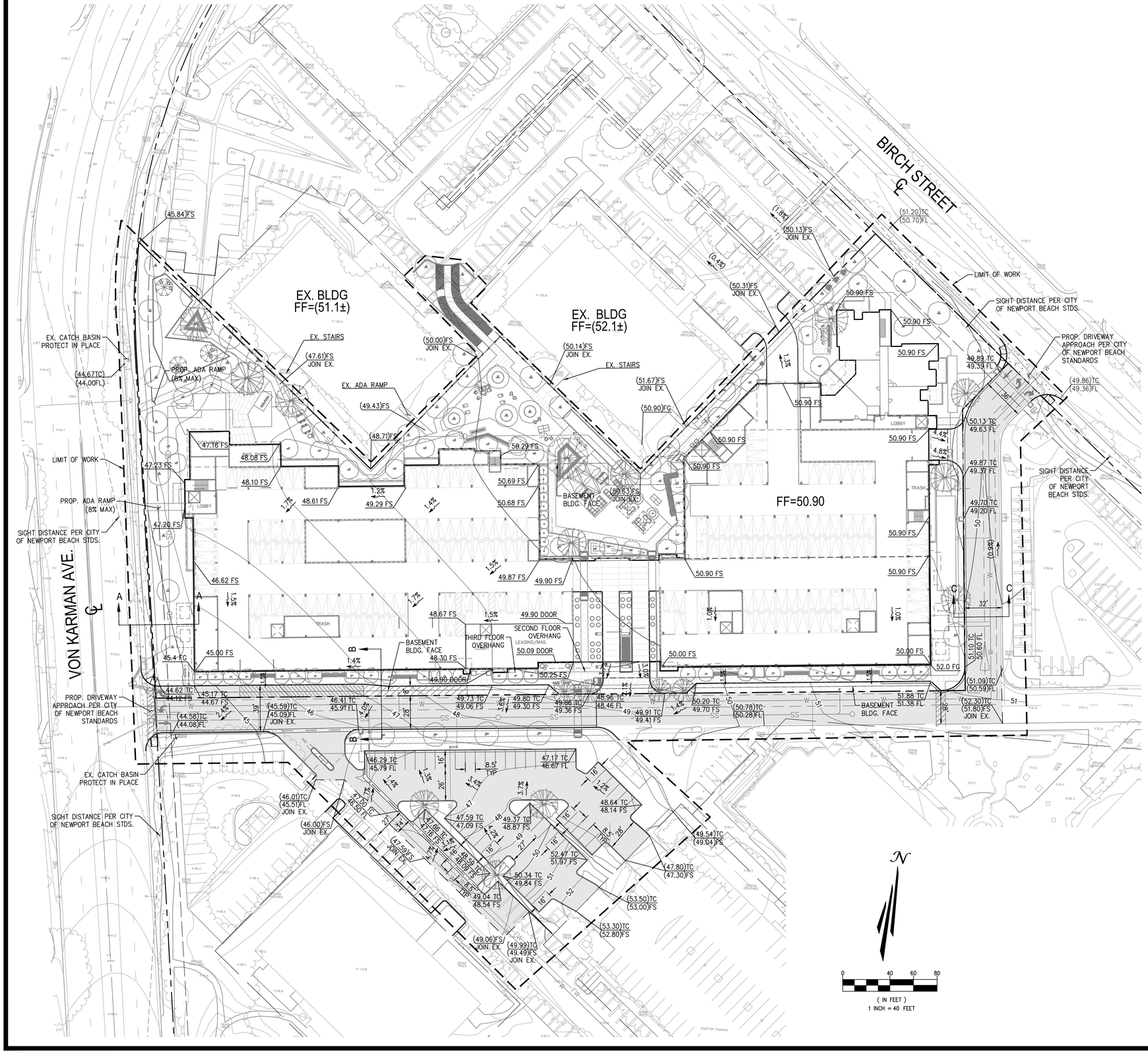
RESIDENCES AT 4400 VON KARMAN

TPG (KCN) ACQUISITION, LLC
CITY OF NEWPORT BEACH
5000 BIRCH ST., SUITE 600
NEWPORT BEACH, CA 92660

DRAWN:
DATE: 8/21/20
CHECKED: MT
DATE: 8/21/20
REVISION #: 1
DATE: 8/21/20
JOB NO.: SP8507

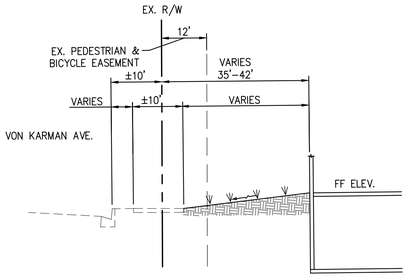
C3.01

K:\Drawings\SP\SP8507 – Newport Beach\ENG\Conceptual Plans\SP8507–GM.dwg
PLOTTED: 10/26/2020 2:13:33 PM BY Michael Tran PAGESETUP:---- PLOTSTYLE: Tait2014.ctb

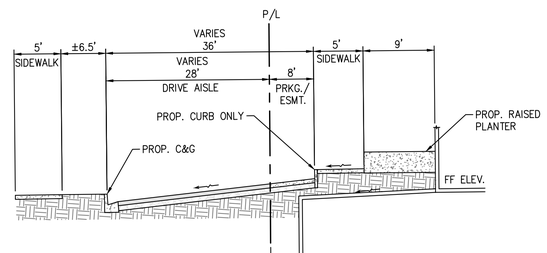


LEGEND

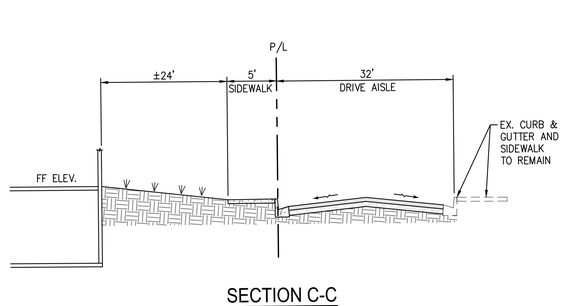
33	EXISTING CONTOURS	WM	WATER METER
33	PROPOSED CONTOURS	FF	FINISH FLOOR
	CENTERLINE	GFF	GARAGE FINISH FLOOR
	RIGHT OF WAY	℄	CENTER LINE
	PROPERTY LINE	P/L	PROPERTY LINE
	CITY EASEMENT LINE	R/W	RIGHT-OF-WAY
	PROPOSED CURB	PA	PLANTED AREA
	EXISTING CURB	PP	POWER POLE
R	RIDGE LINE/ GRADE BREAK	FS	FINISHED SURFACE
FW	PROPOSED FIRE WATER LINE	TC	TOP OF CURB
SS	PROPOSED SANITARY SEWER	TG	TOP OF GRATE
W	PROPOSED WATER	SS	SANITARY SEWER
	PROPOSED STORM DRAIN	SD	STORM DRAIN
SS	EXISTING SANITARY SEWER	DW	DOMESTIC WATER
	EXISTING STORM DRAIN	RW	RECLAIMED WATER
W	EXISTING WATER	DCDA	DOUBLE CHECK DETECTOR ASSEMBLY
	LIMIT OF WORK	FH	FIRE HYRANT
	PROPOSED PCC PAVEMENT	ST	STREET LIGHT
	PROPOSED AC PAVEMENT	EV	ELECTRIC VEHICLE
	PROPOSED LANDSCAPE	CAV	CLEAN AIR VEHICLE
		(E)	EXISTING
		(P)	PROPOSED
			EXISTING FIRE HYDRANT
			PROPOSED FIRE HYDRANT
			WATER VALVE
		Ⓓ	PROPOSED STORM DRAIN MANHOLE



SECTION A-A
NTS



SECTION B-B
NTS



SECTION C-C
NTS

NO	DESCRIPTION	BY	DATE	CHK
	REVISIONS			

TAIT
Since 1964
701 N. Parkcenter Drive
Santa Ana, CA 92705
p: 714/560/8200
www.tait.com
f: 714/560/8211
Los Angeles Ontario
Sacramento San Diego
San Francisco Boise
Dallas Denver
Phoenix Portland

CONCEPTUAL GRADING PLAN

RESIDENCES AT 4400 VON KARMAN

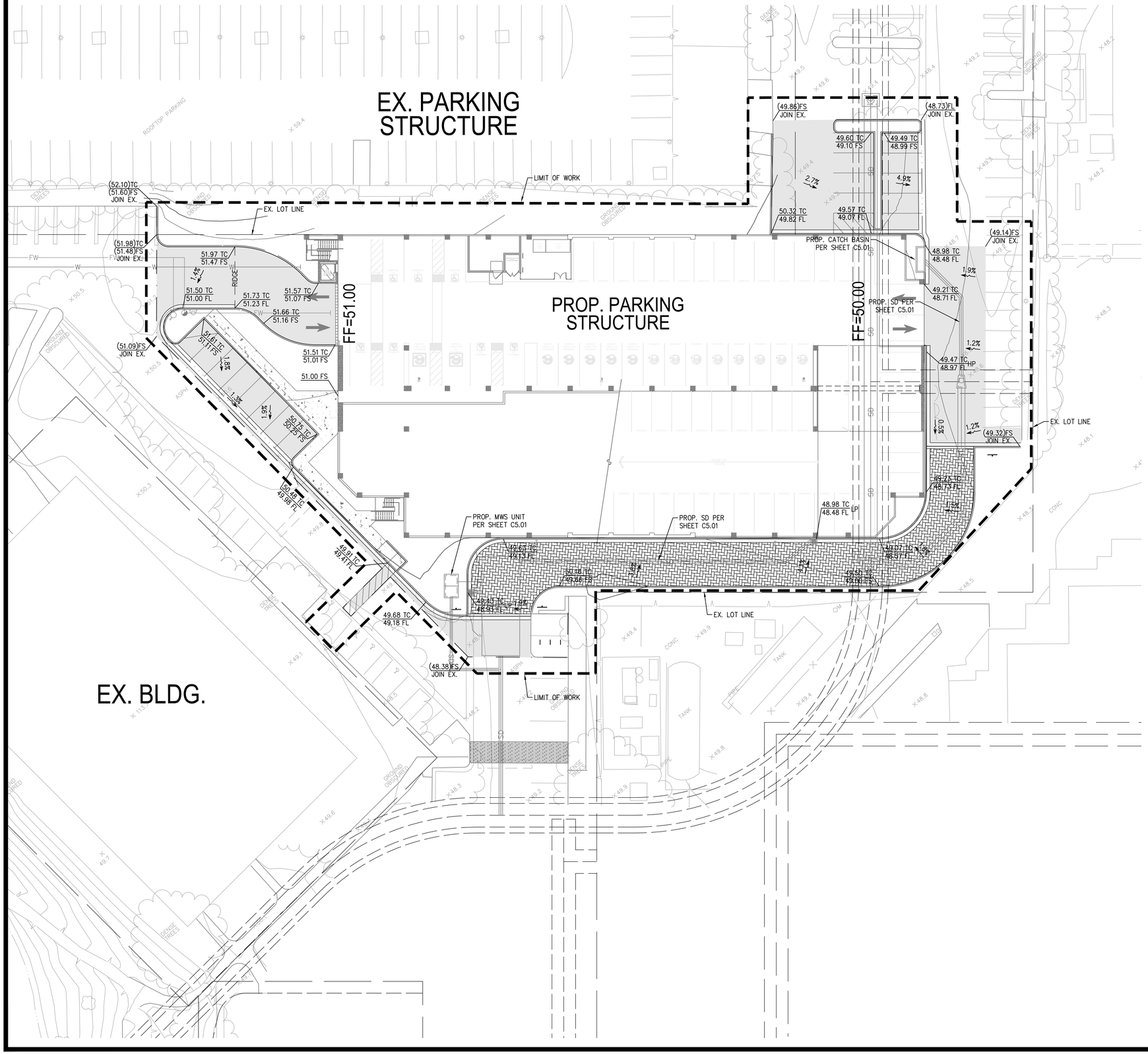
TPG (KCN) ACQUISITION, LLC

CITY OF NEWPORT BEACH
5000 BIRCH ST., SUITE 600
NEWPORT BEACH, CA 92660

DRAWN:
DATE: 8/21/20
CHECKED: MT
DATE: 8/21/20
REVISION #: 1
DATE: 8/21/20
JOB NO.: SP8507

C4.01

K:\Drawings\SP\SP8507 – Newport Beach\ENG\Conceptual Plans\SP8507–CR.dwg
PLOTTED: 10/26/2020 2:13:50 PM BY Michael Tron PAGESETUP: ----- PLOTSTYLE: Tait2014.ctb



LEGEND

33	EXISTING CONTOURS	WM	WATER METER
33	PROPOSED CONTOURS	FF	FINISH FLOOR
	CENTERLINE	GFF	GARAGE FINISH FLOOR
	RIGHT OF WAY	℄	CENTER LINE
	PROPERTY LINE	P.L.	PROPERTY LINE
	CITY EASEMENT LINE	R/W	RIGHT-OF-WAY
	PROPOSED CURB	PA	PLANTED AREA
	EXISTING CURB	PP	POWER POLE
R	RIDGE LINE/ GRADE BREAK	FS	FINISHED SURFACE
FW	PROPOSED FIRE WATER LINE	TC	TOP OF CURB
SS	PROPOSED SANITARY SEWER	TG	TOP OF GRATE
W	PROPOSED WATER	SS	SANITARY SEWER
	PROPOSED STORM DRAIN	SD	STORM DRAIN
SS	EXISTING SANITARY SEWER	DW	DOMESTIC WATER
	EXISTING STORM DRAIN	RW	RECLAIMED WATER
W	EXISTING WATER	DCDA	DOUBLE CHECK DETECTOR ASSEMBLY
	LIMIT OF WORK	FH	FIRE HYRANT
	PROPOSED PCC PAVEMENT	ST	STREET LIGHT
	PROPOSED AC PAVEMENT	EV	ELECTRIC VEHICLE
		CAV	CLEAN AIR VEHICLE
		(E)	EXISTING
		(P)	PROPOSED
			EXISTING FIRE HYDRANT
			PROPOSED FIRE HYDRANT
			WATER VALVE
		Ⓓ	PROPOSED STORM DRAIN MANHOLE

N

0 20 30 40

(IN FEET)
1 INCH = 20 FEET

NO	DESCRIPTION	BY	DATE	CHK
	REVISIONS			

TAIT
Since 1964

701 N. Parkcenter Drive
Santa Ana, CA 92705
p: 714.560.8200
www.tait.com
f: 714.560.8211

Los Angeles Sacramento San Francisco Dallas Phoenix
Ontario San Diego Boise Denver Portland

CONCEPTUAL GRADING PLAN

RESIDENCES AT 4400 VON KARMAN

CITY OF NEWPORT BEACH

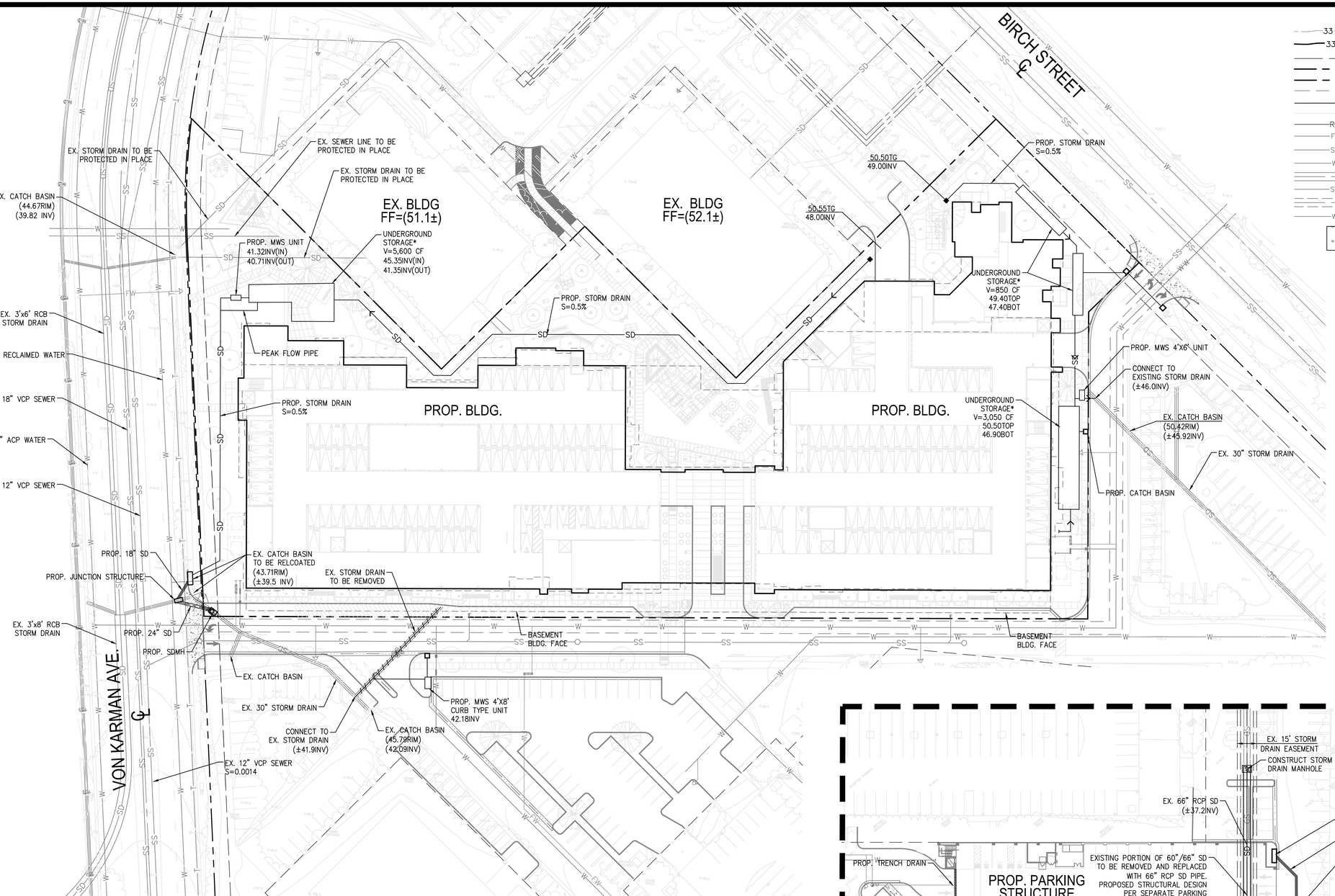
TPG (KCN) ACQUISITION, LLC

5000 BIRCH ST., SUITE 600
NEWPORT BEACH, CA 92660

DRAWN:
DATE: 8/21/20
CHECKED: MT
DATE: 8/21/20
REVISION #: 1
DATE: 8/21/20
JOB NO.: SP8507

C4.02

K:\Drawings\SP\SP8507 – Newport Beach\ENG\Conceptual Plans\SP8507-CR.dwg
PLOTTED: 10/26/2020 2:13:56 PM BY Michael Tran PAGESETUP: ---- PLOTSTYLE: Tait2014.ctb



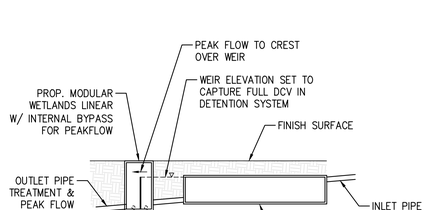
LEGEND

33	EXISTING CONTOURS	WM	WATER METER
33	PROPOSED CONTOURS	FF	FINISH FLOOR
	CENTERLINE	GFF	GARAGE FINISH FLOOR
	RIGHT OF WAY	℄	CENTER LINE
	PROPERTY LINE	P	PROPERTY LINE
	CITY EASEMENT LINE	R/W	RIGHT-OF-WAY
	PROPOSED CURB	PA	PLANTED AREA
	EXISTING CURB	PP	POWER POLE
R	RIDGE LINE/ GRADE BREAK	FS	FINISHED SURFACE
FW	PROPOSED FIRE WATER LINE	TC	TOP OF CURB
SS	PROPOSED SANITARY SEWER	TG	TOP OF GRATE
W	PROPOSED WATER	SS	SANITARY SEWER
	PROPOSED STORM DRAIN	SD	STORM DRAIN
SS	EXISTING SANITARY SEWER	DW	DOMESTIC WATER
	EXISTING STORM DRAIN	RW	RECLAIMED WATER
W	EXISTING WATER	DCDA	DOUBLE CHECK DETECTOR ASSEMBLY
	PROPOSED LANDSCAPE	FH	FIRE HYRANT
		ST	STREET LIGHT
		EV	ELECTRIC VEHICLE
		MWS	MODULAR WETLAND SYSTEM
		(E)	EXISTING
		(P)	PROPOSED
			EXISTING FIRE HYDRANT
			PROPOSED FIRE HYDRANT
			WATER VALVE
		Ⓓ	PROPOSED STORM DRAIN MANHOLE

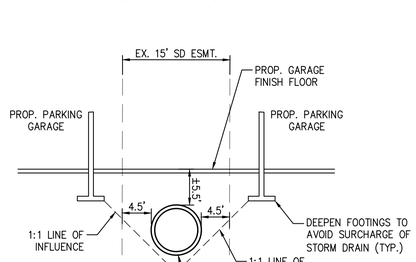
*NOTE:
UNDERGROUND STORAGE IS SCHEMATICALLY SHOWN. FINAL SYSTEM TO BE MODIFIED TO AVOID CONFLICT WITH TREES

N

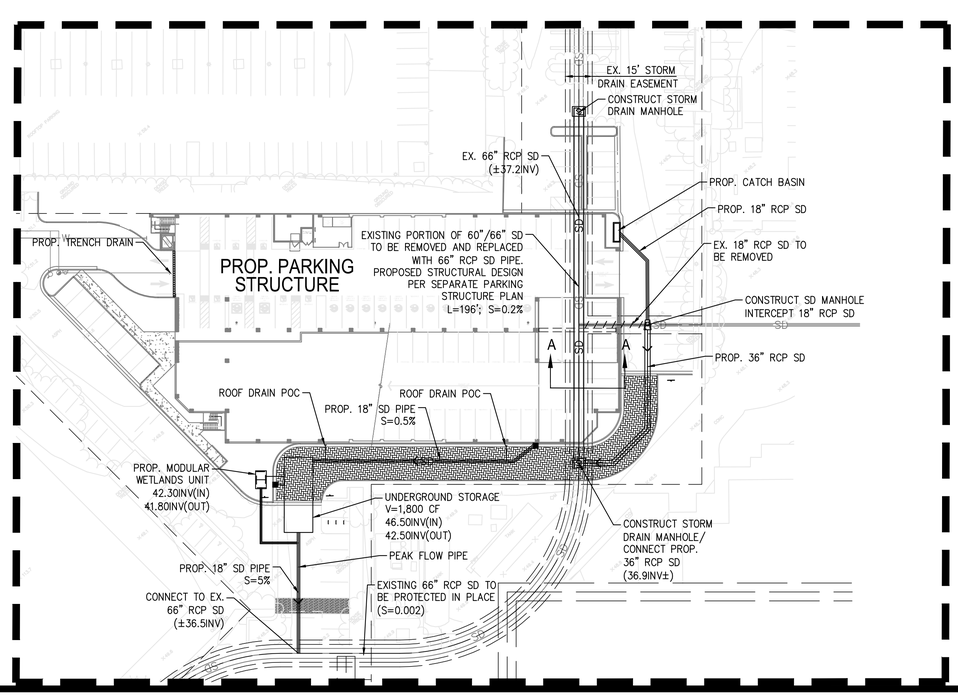
0 40 60 80
(IN FEET)
1 INCH = 40 FEET



TYPICAL DETENTION AND MODULAR WETLANDS SECTION
NTS



SECTION A-A
NTS



N

0 40 60 80
(IN FEET)
1 INCH = 40 FEET

NO	DESCRIPTION	BY	DATE	CHK
	REVISIONS			

TAIT
Since 1964
701 N. Parkcenter Drive
Santa Ana, CA 92705
p: 714.560.8200
www.tait.com
f: 714.560.8211
Los Angeles Ontario
Sacramento San Diego
San Francisco Bolse
Dallas Denver
Phoenix Portland

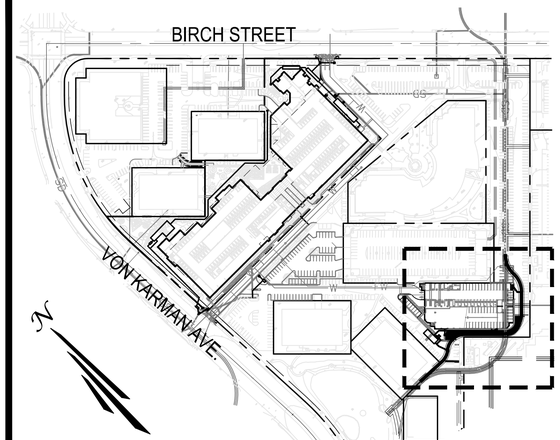
CONCEPTUAL STORM DRAIN PLAN

RESIDENCES AT 4400 VON KARMAN
CITY OF NEWPORT BEACH
TPG (KCN) ACQUISITION, LLC
5000 BIRCH ST., SUITE 600
NEWPORT BEACH, CA 92660

DRAWN: MT
DATE: 8/21/20
CHECKED: MT
DATE: 8/21/20
REVISION #: 1
DATE: 8/21/20
JOB NO.: SP8507

C5.01

K:\Drawings\SP\SP8507 - Newport Beach\ENG\Conceptual Plans\SP8507-SD.dwg
PLOTTED: 10/26/2020 2:14:14 PM BY Michael Tran PAGESETUP: ---- PLOTSTYLE: Tait2014.ctb



KEY MAP
SCALE: 1" = 200'

RCP STORM DRAIN COMPARISON TABLE			
	TOTAL LENGTH	SLOPE	MAX CAPACITY
EXISTING 66" RCP	525 LF	0.002	164 CFS
PROPOSED 72" RCP	555 LF	0.002	207 CFS

PROP. PARKING STRUCTURE

EX. 15' STORM DRAIN EASEMENT

CONSTRUCT STORM DRAIN MANHOLE (37.4INV±)

R70' L=58'

R70' L=58'

PROP. CATCH BASIN

PROP. 18" RCP SD L=59'

EX. 18" RCP SD TO BE REMOVED L=45'

CORE AND RECONNECT EX. 18" RCP SD INSTALL CONCRETE COLLAR

RECONNECT EX. 18" RCP SD

EXISTING PORTION OF 60"/66" SD RCP TO BE REMOVED. L=227'

PROP. 15' STORM DRAIN EASEMENT

PROP. 72" RCP SD L=63'; S=0.002

PROP. 72" RCP SD L=102'; S=0.002

PROP. 8'X4' MODULAR WETLANDS UNIT

ROOF DRAIN POC

PROP. 12" HDPE SD L=33'

PROP. 12" HDPE SD L=148'

PROP. CATCH BASIN

ROOF DRAIN POC

R55' L=58'

PROP. 12" HDPE SD L=20'

PROP. DETENTION SYSTEM V=1,800 CF

PROP. 12" RCP SD L=40'

R50' L=36'

CONSTRUCT STORM DRAIN MANHOLE (36.5INV±)

EXISTING 66" RCP SD TO BE ABANDONED IN PLACE

P/L

EX. WALL TO BE PROTECTED IN PLACE

PROP. 72" RCP SD L=81'; S=0.002

CONNECT TO EX. 66" RCP SD (±36.3INV)

EXISTING 66" RCP SD TO BE PROTECTED IN PLACE

EXISTING PORTION OF 66" SD RCP TO BE REMOVED. L=79'

N

0 40 60 80
(IN FEET)
1 INCH = 40 FEET

NO	DESCRIPTION	BY	DATE	CHK
	REVISIONS			

TAIT
Since 1964
701 N. Parkcenter Drive
Santa Ana, CA 92705
p: 714/560/8200
f: 714/560/8211
www.tait.com
Los Angeles Sacramento San Francisco Dallas Phoenix
Ontario San Diego Boise Denver Portland

ALTERNATE STORM DRAIN RELOCATION PLAN

RESIDENCES AT 4400 VON KARMAN

CITY OF NEWPORT BEACH

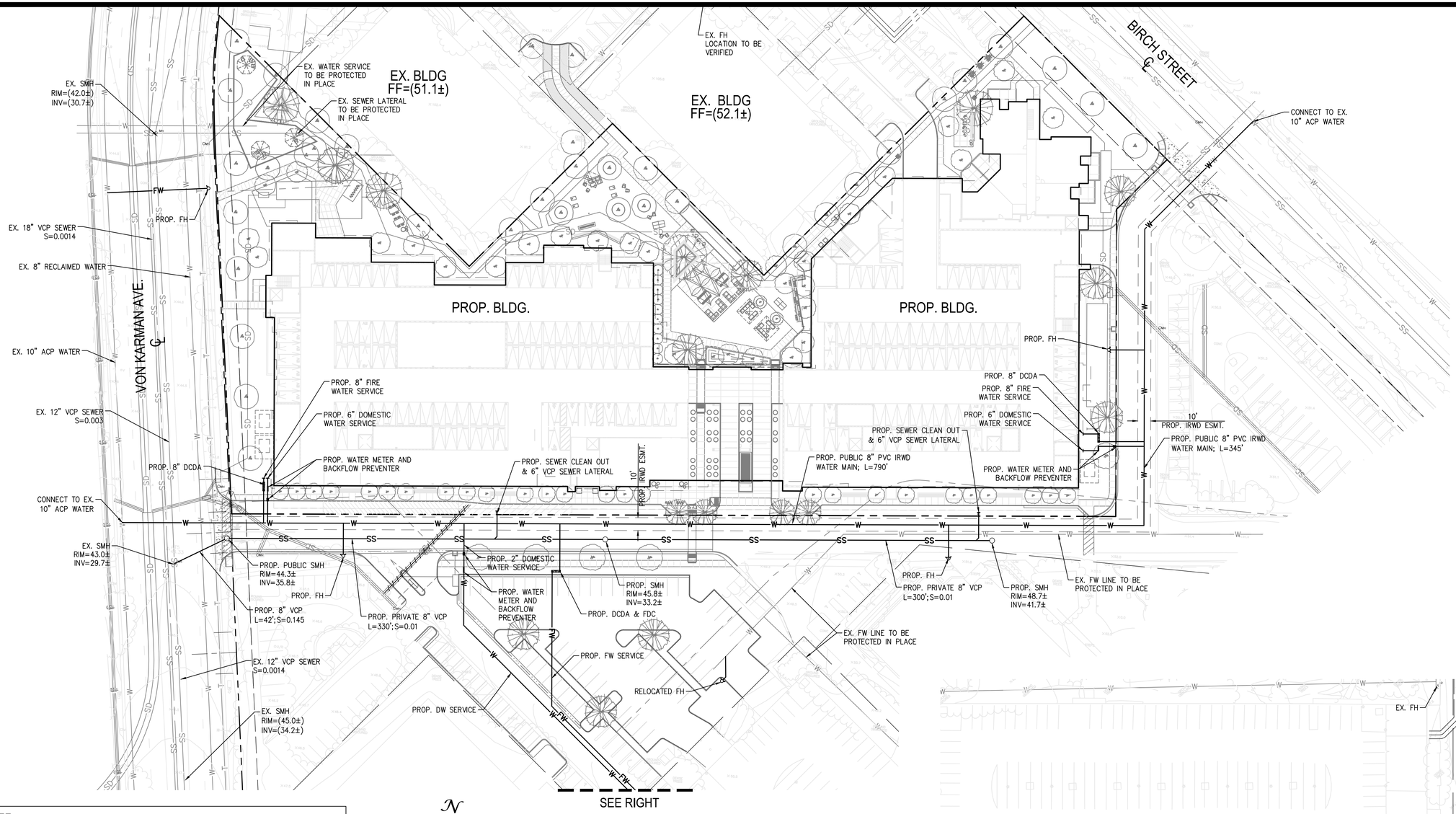
TPG (KCN) ACQUISITION, LLC

5000 BIRCH ST., SUITE 600
NEWPORT BEACH, CA 92660

DRAWN:
DATE: 8/21/20
CHECKED: MT
DATE: 8/21/20
REVISION #: 1
DATE: 8/21/20
JOB NO: SP8507

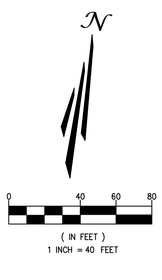
C5.02

K:\Drawings\SP\SP8507 - Newport Beach\ENG\Conceptual Plans\SP8507-SD-02.dwg
PLOTTED: 10/26/2020 2:14:34 PM BY Michael Tron PAGESETUP: ---- PLOTSTYLE: Tait2014.ctb



NOTE:
ALL SEWER IMPROVEMENTS SHALL ADHERE TO CITY OF NEWPORT STANDARD PLANS.

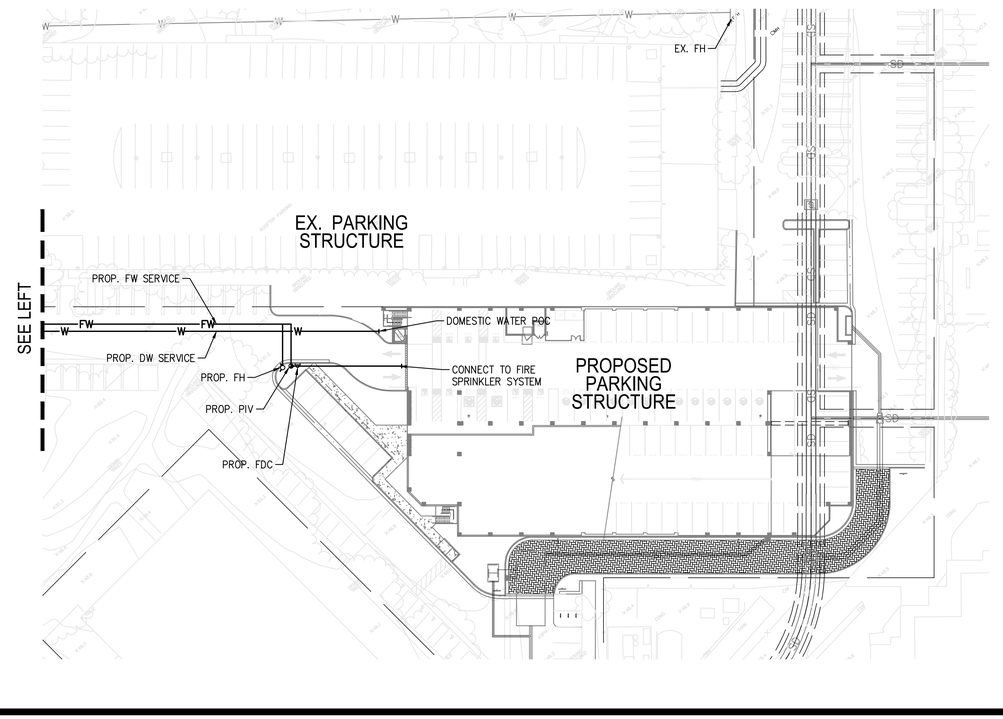
NOTE:
ALL WATER IMPROVEMENTS SHALL ADHERE TO IRVINE RANCH WATER DISTRICT STANDARD PLANS.



LEGEND

33	EXISTING CONTOURS
33	PROPOSED CONTOURS
	CENTERLINE
	RIGHT OF WAY
	PROPERTY LINE
	CITY EASEMENT LINE
	PROPOSED CURB
	EXISTING CURB
R	RIDGE LINE/ GRADE BREAK
FW	PROPOSED FIRE WATER LINE
SS	PROPOSED SANITARY SEWER
W	PROPOSED WATER
	PROPOSED STORM DRAIN
SS	EXISTING SANITARY SEWER
	EXISTING STORM DRAIN
W	EXISTING WATER
	MATCH LINE
	PROPOSED LANDSCAPE

WM	WATER METER
FF	FINISH FLOOR
GFF	GARAGE FINISH FLOOR
℄	CENTER LINE
R	PROPERTY LINE
R/W	RIGHT-OF-WAY
PA	PLANTED AREA
PP	POWER POLE
FS	FINISHED SURFACE
TC	TOP OF CURB
TG	TOP OF GRATE
SS	SANITARY SEWER
SD	STORM DRAIN
DW	DOMESTIC WATER
RW	RECLAIMED WATER
DCDA	DOUBLE CHECK DETECTOR ASSEMBLY
FH	FIRE HYRANT
ST	STREET LIGHT
EV	ELECTRIC VEHICLE
CAV	CLEAN AIR VEHICLE
(E)	EXISTING
(P)	PROPOSED
	EXISTING FIRE HYDRANT
	PROPOSED FIRE HYDRANT
	WATER VALVE
	PROPOSED STORM DRAIN MANHOLE



NO	DESCRIPTION	BY	DATE	CHK
	REVISIONS			

TAIT
Since 1964
Los Angeles Ontario
Sacramento San Diego
San Francisco Bolse
Dallas Denver
Phoenix Portland
701 N. Parkcenter Drive
Santa Ana, CA 92705
p: 714/560/8200
f: 714/560/8211
www.tait.com

CONCEPTUAL UTILITY PLAN

RESIDENCES AT 4400 VON KARMAN

CITY OF NEWPORT BEACH

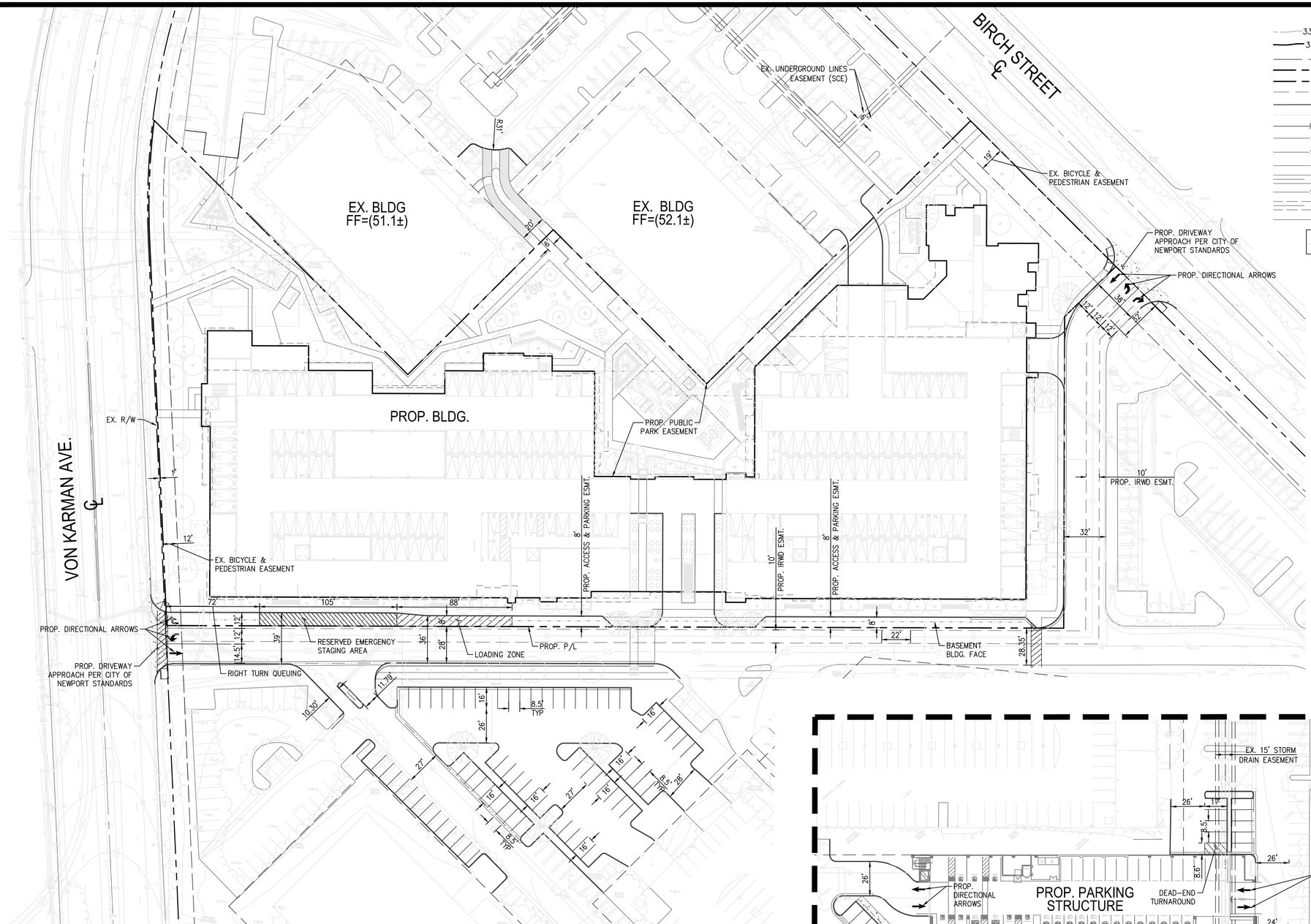
TPG (KCN) ACQUISITION, LLC

5000 BIRCH ST., SUITE 600
NEWPORT BEACH, CA 92660

DRAWN:
DATE: 8/21/20
CHECKED: MT
DATE: 8/21/20
REVISION #: 1
DATE: 8/21/20
JOB NO.: SP8507

C6.01

K:\Drawings\SP\SP8507 – Newport Beach\ENG\Conceptual Plans\SP8507–UT.dwg
PLOTTED: 10/26/2020 2:14:52 PM BY Michael Tran PAGESETUP: ---- PLOTSTYLE: Tait2014.ctb



LEGEND

EXISTING CONTOURS	WM WATER METER
PROPOSED CONTOURS	FF FINISH FLOOR
CENTERLINE	GFF GARAGE FINISH FLOOR
RIGHT OF WAY	℄ CENTER LINE
PROPERTY LINE	P PROPERTY LINE
CITY EASEMENT LINE	R/W RIGHT-OF-WAY
PROPOSED CURB	PA PLANTED AREA
EXISTING CURB	PP POWER POLE
RIDGE LINE/ GRADE BREAK	FS FINISHED SURFACE
PROPOSED FIRE WATER LINE	TC TOP OF CURB
PROPOSED SANITARY SEWER	TG TOP OF GRATE
PROPOSED WATER	SS SANITARY SEWER
PROPOSED STORM DRAIN	SD STORM DRAIN
EXISTING SANITARY SEWER	DW DOMESTIC WATER
EXISTING STORM DRAIN	RW RECLAIMED WATER
EXISTING WATER	DCDA DOUBLE CHECK DETECTOR ASSEMBLY
PROPOSED LANDSCAPE	FH FIRE HYRANT
	ST STREET LIGHT
	EV ELECTRIC VEHICLE
	MWS MODULAR WETLAND SYSTEM
	(E) EXISTING
	(P) PROPOSED
	EXISTING FIRE HYDRANT
	PROPOSED FIRE HYDRANT
	WATER VALVE
	PROPOSED STORM DRAIN MANHOLE

NO	DESCRIPTION	BY	DATE	CHK
	REVISIONS			

TAIT
Since 1964
701 N. Parkcenter Drive
Santa Ana, CA 92705
p: 714/560-8200
www.tait.com
f: 714/560-8211
Los Angeles Ontario Sacramento San Diego San Francisco Boise Dallas Denver Phoenix Portland

CONCEPTUAL HORIZONTAL CONTROL & STRIPING PLAN

RESIDENCES AT 4400 VON KARMAN

CITY OF NEWPORT BEACH

TPG (KCN) ACQUISITION, LLC

5000 BIRCH ST., SUITE 600

NEWPORT BEACH, CA 92660

DRAWN:
DATE: 8/21/20
CHECKED: MT
DATE: 8/21/20
REVISION #: 1
DATE: 8/21/20
JOB NO.: SP8507

C7.01

K:\Drawings\SP\SP8507 – Newport Beach\ENG\Conceptual Plans\SP8507-HCP.dwg
PLOTTED: 10/26/2020 2:15:10 PM BY Michael Tran PAGESETUP: ---- PLOTSTYLE: Tait2014.ctb

Attachment E

Geotechnical Report

2.3 Geologic Setting

Regionally, the subject property lies within the Peninsular Ranges Geomorphic Province of southern California. This province consists of a series of ranges separated by northwest trending valleys; sub parallel to branches of the San Andreas Fault (CGS, 2002).The Peninsular Ranges geomorphic province, one of the largest geomorphic units in western North America, extends from the Transverse Ranges geomorphic province and the Los Angeles Basin, south to Baja California. It is bound on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province. The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks (CGS, 2002). Major fault zones and subordinate fault zones found in the Peninsular Ranges Province typically trend in a northwest-southeast direction.

Regional geologic maps of the subject property and vicinity (published by the United States Geological Survey - USGS) indicate the property is underlain by late to middle Pleistocene-aged Old Paralic deposits overlain by alluvial fan deposits (map symbol $Qopf_a$). The alluvial fan deposits generally consist of cobble, gravel, sand and silt deposits issued from confined valleys, while the old paralic deposits generally consist of fine-grained sand, silt, and clay from lake, playa and estuarine deposits.

The subject property is located within an area of California known to contain a number of active and potentially active faults. The property is not located within a State of California Earthquake Fault Zone (Hart and Bryant, 1997). The active San Joaquin Hills fault is located approximately 2.6 miles from the property.

Regional seismic hazard maps (CDMG, 2001) for the subject property area indicate that the property is located within an area that is not considered susceptible to landsliding, liquefaction and/or seismic induced settlement. Additionally, no historic landslides were mapped within or adjacent to the property, nor were there any indication of landslides encountered during our site reconnaissance.

2.4 Groundwater

At the time of our subsurface exploration, a zone of heavy seepage was encountered at depths ranging from 20 to 25 feet below the ground surface. Additionally, pore pressure dissipation testing performed in CPT sounding CPT-1 indicates that groundwater was present at a depth of approximately 23 feet below the ground surface at the time of testing.

According to nearby groundwater data obtained from the Orange County Water District, the principal groundwater aquifer has ranged from approximately 50 to 110 feet below existing ground surface at the subject property in the past 10 years (Orange County Water District, 2015). In general, groundwater is expected to follow the direction of surface topography; therefore, local groundwater flow is expected to be in a general westerly direction. It should be noted that variations in groundwater may result from fluctuations in the ground surface topography, subsurface stratification, rainfall, irrigation, and other factors that may not have been evident at the time of our subsurface exploration.

3.0 REGIONAL FAULTING AND SEISMICITY

The portion of Southern California that includes the subject property is considered to be seismically active. Due to the proximity of the property area to several nearby active faults, strong ground shaking could occur at the property as a result of an earthquake on any one of the faults. Our review indicates that there are no known active faults crossing the property and the property is not located within an Alquist-Priolo Earthquake Fault Zone as defined by the State of California (Hart and Bryant, 1997, CDMG, 2000).

Rigid pavement sections were evaluated in general accordance with ACI 330R-08, based on an average daily truck traffic value of 10.

TABLE 3
Preliminary Pavement Design Recommendations

Traffic Index (TI)	Pavement Surface	Aggregate Base Material [1]
4.5 – Parking Stalls	3.0-inches Asphalt Concrete	5.0-inches
5.5 – Drive Areas	4.0-inches Asphalt Concrete	6.0-inches
Entrance/Exit Lane Areas	6.0-inches Portland Cement Concrete [2]	4.0-inches (optional)
(1) Reinforcement and control joints placed in accordance with the structural engineer's requirements		

The recommended rigid pavement section provided above is intended as a minimum guideline. If thinner or highly variable pavement sections are constructed, increased maintenance and repair could be expected. If the ADT (average daily traffic) or ADTT (average daily truck traffic) increases beyond that intended, as reflected by the assumed traffic index used for design, increased maintenance and repair could be required for the pavement section. Final pavement design should be verified by testing of soils exposed at subgrade after grading has been completed. Thicker pavement sections could result if R-Value testing indicates lower values.

9.0 DEVELOPMENT RECOMMENDATIONS

9.1 Landscape Maintenance and Planting

Water is known to decrease the physical strength of earth materials, significantly reducing stability by high moisture conditions. Surface drainage away from foundations and graded slopes should be maintained. Only the volume and frequency of irrigation necessary to sustain plant life should be applied.

Consideration should be given to selecting lightweight, deep-rooted types of landscape vegetation which require low irrigation that are capable of surviving the local climate. From a soils engineering viewpoint, "leaching" of the onsite soils is not recommended for establishing landscaping. If landscape soils are processed for the addition of amendments, the processed soils should be re-compacted to at least 90 percent relative compaction (based on ASTM D1557).

9.2 Site Drainage

Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled over slopes or the subject property. Runoff should be channeled away from slopes and structures and should not be allowed to pond and/or seep uncontrolled into the ground. Pad drainage should be directed toward an acceptable outlet. Although not required, roof gutters and down spouts may be considered to control roof drainage, discharging a minimum of 10 feet from proposed structures, or into a subsurface drainage system. Consideration should be given to eliminating open-bottom planters directly adjacent to proposed structures for a minimum distance of 10 feet. As an alternative, closed-bottom type planters could be utilized, with a properly designed drain outlet placed in the bottom of the planter.

9.3 Site Runoff Considerations - Stormwater Disposal Systems

It is EEI understanding that the Client is considering that runoff generated from the facility be disposed of in engineered subsurface features onsite.

9.3.1 Percolation Testing

Following the drilling of exploratory borings B-6 and B-7, a 3-inch diameter perforated polyvinyl chloride (PVC) pipe was placed in the hole and gravel was placed around the pipe. The test holes were presoaked in general accordance with County of Orange DEH Guidelines. During the presoaking process, it was observed that less than 30 minutes was required for a minimum 12-inch high column of water to seep away. Consequently, the borings were allowed to presoak and the test in the boring was run at approximate 10 minute intervals for a period of approximately two hours, when the highest and lowest readings from three consecutive readings were noted to be within 10 percent of each other. The reading obtained from the final 10 minute interval was then used to calculate the pre-adjusted percolation rate for each test hole. Upon conclusion of testing, the perforated pipe was removed from the test holes and the test excavations were backfilled.

We note that a soil profile's percolation rate is not the same as its infiltration rate. Therefore, the measured/calculated percolation rate was converted to an estimated infiltration rate. Therefore, the measured/calculated field percolation rate was converted to an estimated infiltration rate utilizing a reduction factor known as the Porchet method. **Table 4** presents the measured percolation rate and corresponding infiltration rate calculated for the test hole.

TABLE 4
Summary of Percolation Testing

Location	Depth (ft)	Pre-Adjusted Percolation Rate (in/hr)	Infiltration Rate (in/hr)
B-6	~13	288.0	55.38
B-7	~12	151.2	27.10

9.3.2 Summary of Findings

Based on the results of our field percolation testing, it appears that the percolation/infiltration rates presented herein are conducive to direct infiltration of surface stormwater for the preliminary design of subsurface storm water retention/disposal devices at the specific locations and approximate depths at the subject property as listed in **Table 4**.

9.3.3 Structural Setback from Retention Devices

It is recommended that retention/disposal devices be situated at least three times their depth, or a minimum of 15 feet (whichever is greater), from the outside bottom edge of structural foundations. Structural foundations include (but are not limited to) buildings, loading docks, retaining walls, and screen walls.

All stormwater disposal systems, including pervious pavement areas should be checked and maintained on regular intervals. Stormwater devices including bioswales that are located closer than 10 feet from any foundations/footings should be lined with an impermeable membrane to reduce the potential for saturation of foundation soils (also refer to **Section 7.6**).

9.4 Additional Site Improvements

Recommendations for additional grading, exterior concrete flatwork design and construction can be provided upon request.

If in the future, additional property improvements were planned for the site, recommendations concerning the design and construction of improvements would be provided upon request.

9.5 Trenching

All temporary excavations for grading purposes and installation of underground utilities should be constructed in accordance with OSHA guidelines and local safety codes. Temporary excavations over 4 feet in height should be evaluated by the project engineer, and could require shoring, sloping, or a combination thereof. Temporary excavations within the onsite materials should be stable at 1.5:1 inclinations for cuts less than 20 feet in height.

Footing trench excavations for structures and walls should be observed and approved by a representative of the project soils engineer prior to placing reinforcement. Footing trench spoil and excess soils generated from utility trench excavations should be compacted to a minimum relative compaction of 90 percent (based on ASTM D1557) if not removed from the subject property. All excavations should conform to OSHA and local safety codes.

9.6 Utility Backfill

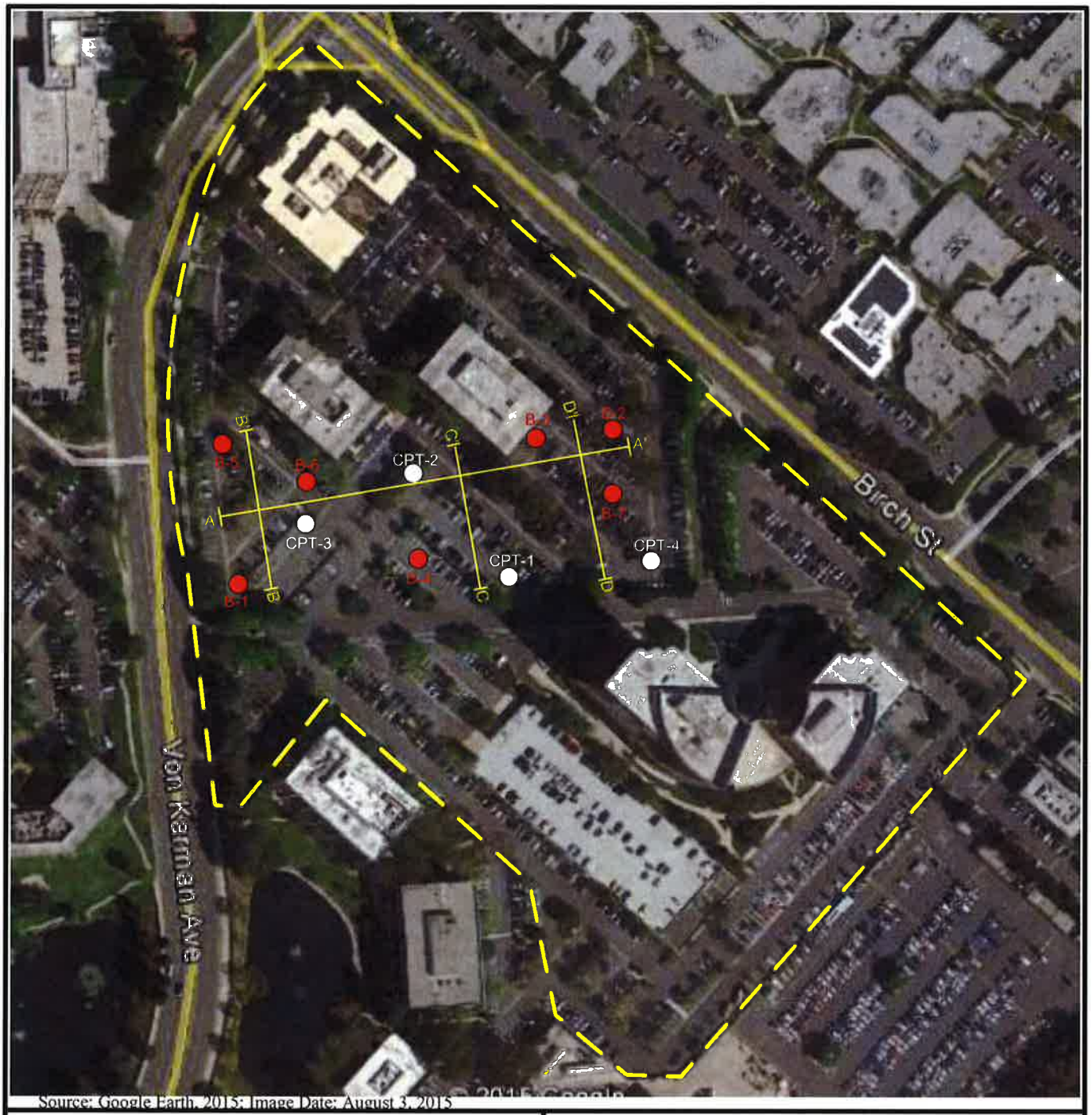
Fill around the pipe should be placed in accordance with details shown on the drawings, and should be placed in layers not to exceed 8-inches loose (unless otherwise approved by the Geotechnical Engineer) and compacted to at least 90 percent of the maximum dry density as determined in accordance with ASTM D1557 (Modified Proctor).

The Geotechnical Engineer should approve all backfill material. Select material should be used when called for on the drawings, or when recommended by the Geotechnical Engineer. Care should be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints. The backfill should be kept free from stones, chunks of highly plastic clay, or other objectionable material. Backfill soils should be non-expansive, non-corrosive, and compatible with native earth materials. Backfill materials and testing should be in accordance with the CBC 2013 and City specifications.

All pipe backfill areas should be graded and maintained in such a condition that erosion or saturation will not damage the pipe bed or backfill. Flooding trench backfill is not recommended. Heavy equipment should not be operated over any pipe until it has been properly backfilled with a minimum 2 to 3 feet of cover. The utility trench should be systematically backfilled to allow maximum time for natural settlement. Backfill should not occur over porous, wet, or spongy subgrade surfaces. Should these conditions exist, the areas should be removed, replaced and recompacted.

10.0 PLAN REVIEW

Once the detailed and approved site and grading plans are available, they should be submitted to this office for review and comment, to reduce the potential for discrepancies between plans and recommendations presented herein. If conditions were found to differ substantially from those stated, appropriate recommendations would be provided. Additional field studies may be warranted once the final conceptual plans are produced.



Source: Google Earth, 2015; Image Date: August 3, 2015

LEGEND

B-7 — Approximate Boring Locations

CPT-4 — Approximate CPT Locations

D D' — Approximate Cross-Section Locations

Scale: 1" = 200'

0 200FT 400FT

N

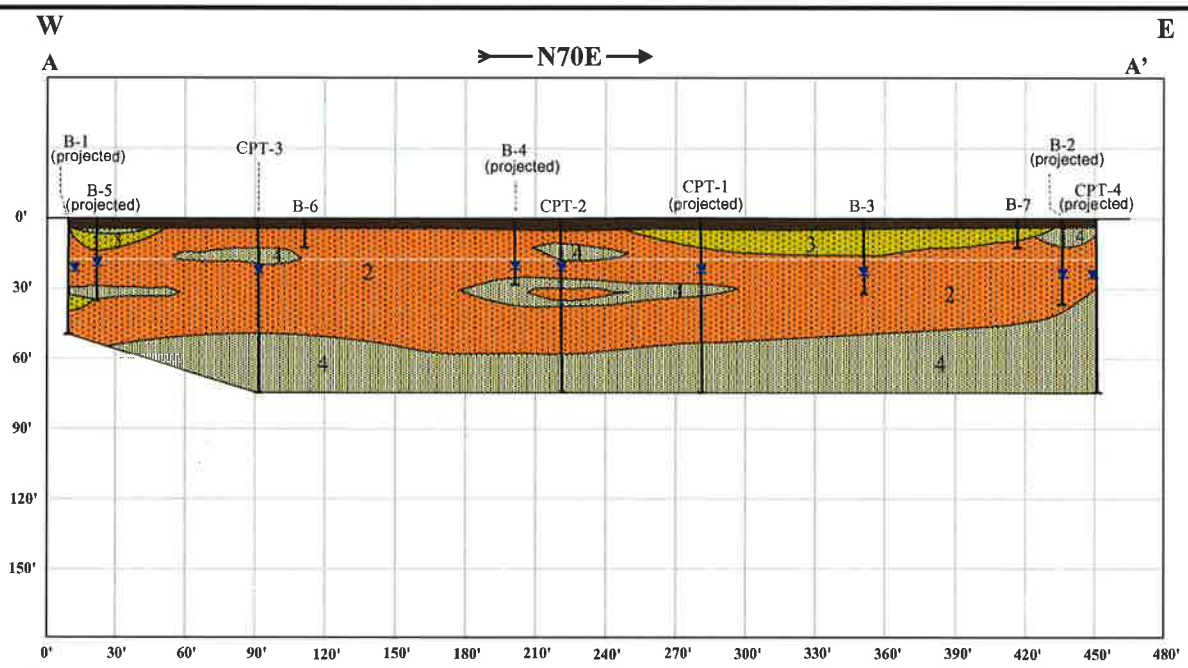
Note: All Locations Are Approximate

BORING LOCATION MAP

Shopoff Land Fund II, LP
The Towers at Koll Center
Newport Beach, California
EEI Project No. SHO – 72189.4
Created July 2015

EEI Geotechnical & Environmental Solutions

FIGURE 3



LEGEND (Detailed description in Section 6.0 of this report)

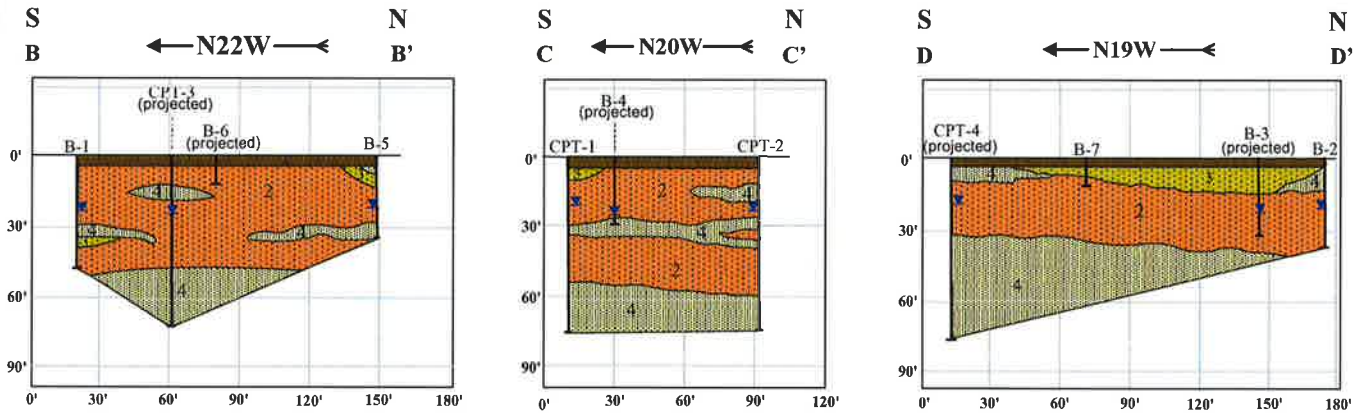
- Fill: Sands, Silts Clays and Gravels
- Older Alluvial Fan Deposits: SAND, with trace Gravel, Silt or Clay
- Older Alluvial Fan Deposits: SILTY-SAND and SANDY-CLAY
- Older Alluvial Fan Deposits: CLAYS and SILTS
- Groundwater/seepage encountered

SCALE
1" = 60ft

CROSS-SECTION A-A'
Shopoff Land Fund II, LP
The Towers at Koll Center
Newport Beach, California
EEI Project No. SHO-72189.4
Created July 2015

EEI

FIGURE 4a



LEGEND (Detailed description in Section 6.0 of this report)

- Fill: Sands, Silts Clays and Gravels
- Older Alluvial Fan Deposits: SAND, with trace Gravel, Silt or Clay
- Older Alluvial Fan Deposits: SILTY-SAND and SANDY-CLAY
- Older Alluvial Fan Deposits: CLAYS and SILTS
- Groundwater/seepage encountered

SCALE
1" = 60ft

CROSS-SECTION B-B'.C-C'.D-D'
Shopoff Land Fund II, LP
The Towers at Koll Center
Newport Beach, California
EEI Project No. SHO-72189.4
Created July 2015

EEI

FIGURE 4b

Attachment F

Water Quality Impairment List

8	San Diego Creek Reach 1	River & Stream	80111000 / 18070201	• Benthic Community Effects ◦ Source Unknown	7.8 Miles	2014	5A	2027
				• DDT (Dichlorodiphenyltrichloroethane) ◦ See TMDL documentation	7.8 Miles	2014	5B	2013
				The USEPA approved the Newport Bay Organochlorine compounds TMDL on November 12, 2013 which includes this pollutant (Total DDT-sum of 4,4'- and 2,4'- isomers of DDT, DDE, and DDD) for San Diego Creek. The data used for the TMDL assessment includes additional data and may use different assessment guidelines than those used in the integrated report. Nonetheless, it is important to note that this pollutant is being addressed by an USEPA approved TMDL.				
				• Indicator Bacteria ◦ Source Unknown	7.8 Miles	2014	5A	2019
				While this Decision was based on a sufficient number of exceedances the of E. coli Single Sample objective, it should be noted that Enterococcus, Fecal Coliform and Total Coliform objectives no longer apply to the REC 1 Beneficial Use for fresh waters in Region 8. As such the Enterococcus, Fecal Coliform and Total Coliform LOEs will be retired. Further, the Single Sample objective was only used because of the lack of representative 30-day, 5-sample Geomean values, as per the Region 8 Basin Plan (2016 update) on page 4-17, footnote 3. When representative 30-day, 5-sample Geomean values are collected the Single Sample E. coli LOE will be retired.				
				• Malathion ◦ Source Unknown	7.8 Miles	2014	5A	2027
				• Nutrients ◦ Source Unknown	7.8 Miles	1996	5B	1999
				• Sedimentation/Siltation ◦ Source Unknown	7.8 Miles	1996	5B	1999
				• Selenium ◦ Source Unknown	7.8 Miles	2006	5A	2007
				• Toxaphene ◦ See TMDL documentation	7.8 Miles	2006	5B	2013
				• Toxicity ◦ Source Unknown	7.8 Miles	2014	5A	2025
8	Newport Bay, Upper (Ecological Reserve)	Estuary	80111000 / 18070201	• Chlordane ◦ See TMDL documentation	653 Acres	2006	5B	2013
				• Copper ◦ Marinas and Recreational Boating	653 Acres	2006	5A	2007
				• DDT (Dichlorodiphenyltrichloroethane) ◦ See TMDL documentation	653 Acres	2006	5B	2013
				• Indicator Bacteria ◦ Source Unknown	653 Acres	2010	5B	2000
				The following LOEs had been incorrectly linked to Upper Newport Bay during the 2010 cycle : 8075, 8076, 8077 and 8078. They have not been used in the Final Use Rating in the 2014 cycle and will be retired prior to the next cycle. They have been copied over to Lower Newport Bay (where the sampling points are located) and have new LOE #'s.				
				• Malathion ◦ Source Unknown	653 Acres	2014	5A	2027
				• Nutrients ◦ Source Unknown	653 Acres	2006	5B	1999
				• PCBs (Polychlorinated biphenyls) ◦ See TMDL documentation	653 Acres	2006	5B	2013
				• Sedimentation/Siltation ◦ Agriculture ◦ Channel Erosion ◦ Construction/Land Development ◦ Erosion/Siltation	653 Acres	2006	5B	1999
				• Toxicity ◦ Source Unknown	653 Acres	2014	5A	2027

8	Newport Bay, Lower (entire lower bay, including Rhine Channel, Turning Basin and South Lido Channel to east end of H-J Moorings)	Bay & Harbor	80114000 / 18070201	• Chlordane ◦ See TMDL documentation	767 Acres	2006	5B	2013
				• Copper ◦ Marinas and Recreational Boating	767 Acres	2006	5A	2019
				• DDT (Dichlorodiphenyltrichloroethane) ◦ See TMDL documentation	767 Acres	1990	5B	2013
				• Indicator Bacteria ◦ Source Unknown	767 Acres	2010	5B	2000
				The following LOEs had been incorrectly linked to Lower Newport Bay during the 2010 cycle : 8147, 8148, 8149, 8150, 8151, 8152, 8153, 8154, 8155, 8156, 8157, 8158, 8159, 8160, 8161, 8162, 28355, 28357, 28361, 28367, 28373, 28377, 28379, 28381, 28383. They have not been used in the Final Use Rating in the 2014 cycle and will be retired prior to the next cycle. They have been copied over to Upper Newport Bay (where the sampling points are located) and have new LOE #'s. LOE 26162 was created during the 2010 cycle and incorrectly combined sampling locations in both Upper and Lower Newport Bay. The data in LOE 26162 has been reanalyzed and 2 new LOEs have been created for those data in the proper waterbodies. LOE 26162 is not used in the Final Use Rating in the 2014 cycle and will be retired prior to the next cycle. In the 2010 cycle, the Shellfish Harvest Objective that was used in the LOEs was the Ocean Plan Total Coliform value, rather than the existing Region 8 Basin Plan Objective that was based on Fecal Coliform. While combining the LOEs written using the Ocean Plan Total Coliform objective results in a delisting for the Shellfish Harvest Beneficial Use, analysis of the 2008 -2010 Fecal Coliform data from the Beach Watch program resulted in 7 months of exceedance out of 23 months (where samples were collected) and based on weight of evidence, the decision was made to leave the Shellfish Harvest listing in place for Fecal Coliform.				
				• Nutrients ◦ Source Unknown	767 Acres	1992	5B	1999
				• PCBs (Polychlorinated biphenyls) ◦ See TMDL documentation	767 Acres	1990	5B	2013
				• Toxicity ◦ Source Unknown	767 Acres	2014	5A	2019

Attachment G

Infiltration BMP Feasibility Worksheet & Summary of Harvested

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

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

Worksheet J: Summary of Harvested Water Demand and Feasibility

1	What demands for harvested water exist in the tributary area (check all that apply):			
2	Toilet and urinal flushing		☐	
3	Landscape irrigation		☑	
4	Other:_____		☐	
5	What is the design capture storm depth? (**Figure III.1**)	d	0.75	inches
6	What is the project size?	A	X	ac
7	What is the acreage of impervious area?	IA	X	ac
	For projects with multiple types of demand (toilet flushing, indoor demand, and/or other demand)			
8	What is the minimum use required for partial capture? (**Table X.6**)	N/A		gpd
9	What is the project estimated wet season total daily use?	N/A		gpd
10	Is partial capture potentially feasible? (Line 9 > Line 8?)	N/A		
	For projects with only toilet flushing demand			
11	What is the minimum TUTIA for partial capture? (**Table X.7**)	N/A		
12	What is the project estimated TUTIA?	N/A		

Worksheet J: Summary of Harvested Water Demand and Feasibility

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

Provide supporting assumptions and citations for controlling demand calculation:

Line 14: KL x Line 7
Line 14: 1.43 x 0.84 =
Line 15: Landscape area = 0.30
Line 15 < Line 14 ; Therefore, re-sure for irrigation is not feasible

Worksheet I: Summary of Groundwater-related Feasibility Criteria

1	Is project large or small? (as defined by Table VIII.2) circle one	Large		Small
2	What is the tributary area to the BMP?	A	x	acres
3	What type of BMP is proposed?	Bio-Filtration BMP's		
4	What is the infiltrating surface area of the proposed BMP?	A_{BMP}	0	sq-ft
5	What land use activities are present in the tributary area (list all) Uncovered Parking Areas, Landscape Areas & Trash/Debris Collection Areas			
6	What land use-based risk category is applicable?	L	M	H
7	If M or H, what pretreatment and source isolation BMPs have been considered and are proposed (describe all): All grated inlets will be equipped with Catch Basin Filter Inserts with model selection designed to treat specific pollutants of concern. Also applicable structural and non-structural source control BMP's			
8	What minimum separation to mounded seasonally high groundwater applies to the proposed BMP? See Section VIII.2 (circle one)	5 ft		10 ft
9	Provide rationale for selection of applicable minimum separation to seasonally high mounded groundwater: Per Section VIII.2 "BMP's for which 5-foot minimum separation applies include" -Rain gardens and dispersion trenches -Bioretention and planters -Permeable pavement -Similar BMPs infiltrating over an extensive surface area and providing robust pretreatment or embedded treatment processes.			
10	What is separation from the infiltrating surface to seasonally high groundwater?	SHGWT	N/A	ft
11	What is separation from the infiltrating surface to mounded seasonally high groundwater?	Mounded SHGWT	N/A	ft
12	Describe assumptions and methods used for mounding analysis:			
13	Is the site within a plume protection boundary (See Figure	Y	N	N/A

Worksheet I: Summary of Groundwater-related Feasibility Criteria

	VIII.2)?	
14	Is the site within a selenium source area or other natural plume area (See Figure VIII.2)?	Y N N/A
15	Is the site within 250 feet of a contaminated site?	Y N N/A
16	If site-specific study has been prepared, provide citation and briefly summarize relevant findings:	
17	Is the site within 100 feet of a water supply well, spring, septic system?	Y N N/A
18	Is infiltration feasible on the site relative to groundwater-related criteria?	Y N

Provide rationale for feasibility determination:

Although groundwater was not encountered until depths of 23feet below ground surface and sufficient infiltration rates,

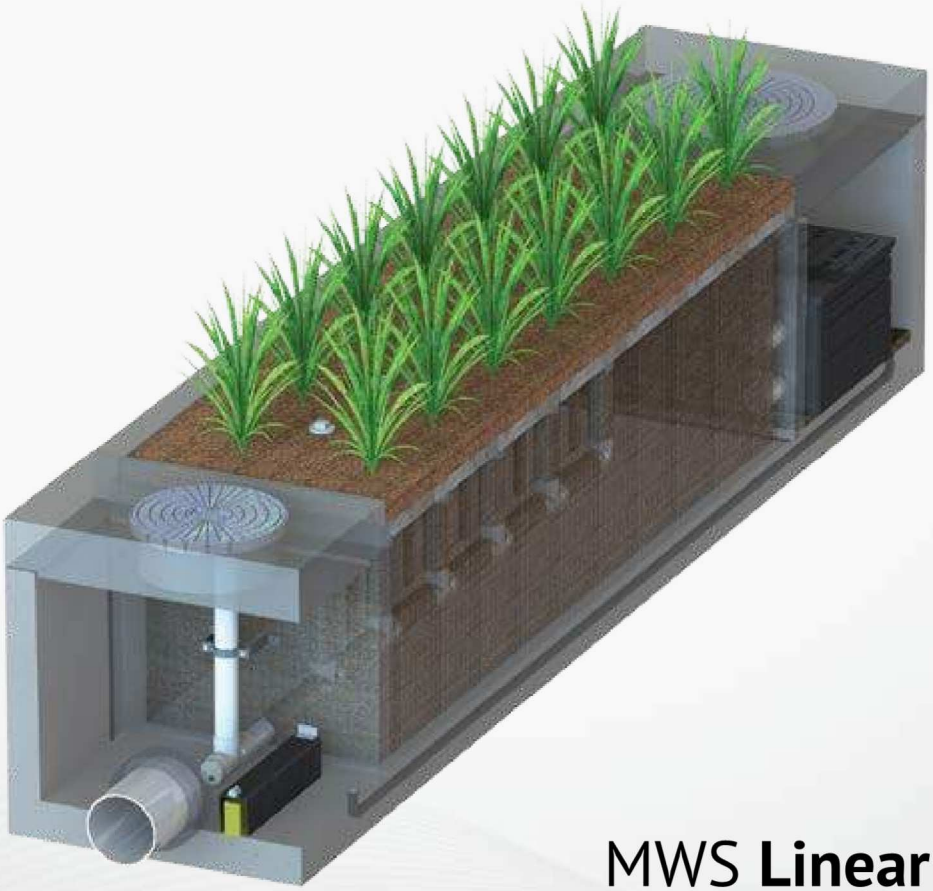
Note: if a single criterion or group of criteria would render infiltration infeasible, it is not necessary to evaluate every question in this worksheet.

Attachment H

Proprietary BMP's info & Details

MODULAR WETLANDS™

*Advanced **Stormwater** Biofiltration*



MWS **Linear**

Contents

The Urban Impact

For hundreds of years natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as our cities grow and develop, these natural wetlands have perished under countless roads, rooftops, and parking lots.

Plant A Wetland

Without natural wetlands our cities are deprived of water purification, flood control, and land stability. Modular Wetlands and the MWS Linear re-establish nature's presence and rejuvenate water ways in urban areas.

MWS **Linear**

The Modular Wetland System Linear represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint and higher treatment capacity. While most biofilters use little or no pre-treatment, the MWS Linear incorporates an advanced pre-treatment chamber that includes separation and pre-filter cartridges. In this chamber sediment and hydrocarbons are removed from runoff before it enters the biofiltration chamber, in turn reducing maintenance costs and improving performance.

Applications

The MWS Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.

Industrial

Many states enforce strict regulations for discharges from industrial sites. The MWS Linear has helped various sites meet difficult EPA mandated effluent limits for dissolved metals and other pollutants.

Residential

Low to high density developments can benefit from the versatile design of the MWS Linear. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.

Streets

Street applications can be challenging due to limited space. The MWS Linear is very adaptable, and offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.

Parking Lots

Parking lots are designed to maximize space and the MWS Linear's 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.

Commercial

Compared to bioretention systems, the MWS Linear can treat far more area in less space - meeting treatment and volume control requirements.

Mixed Use

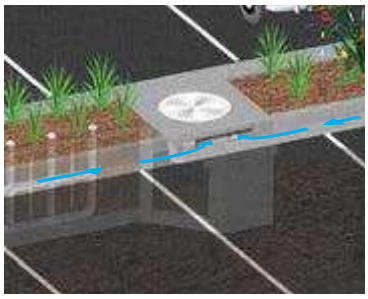
The MWS Linear can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

More applications are available on our website: www.ModularWetlands.com/Applications

- Agriculture
- Reuse
- Low Impact Development
- Waste Water

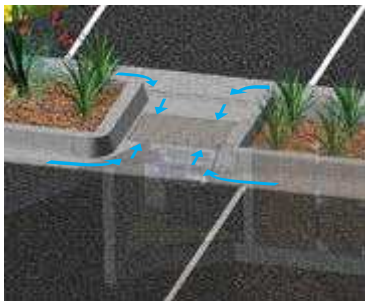
Configurations

The MWS Linear is the preferred biofiltration system of Civil Engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your stormdrain design.



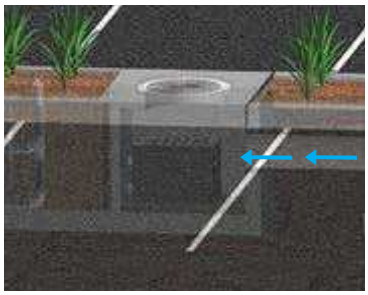
Curb Type

The *Curb Type* configuration accepts sheet flow through a curb opening and is commonly used along road ways and parking lots. It can be used in sump or flow by conditions. Length of curb opening varies based on model and size.



Grate Type

The *Grate Type* configuration offers the same features and benefits as the *Curb Type* but with a grated/drop inlet above the systems pre-treatment chamber. It has the added benefit of allowing for pedestrian access over the inlet. ADA compliant grates are available to assure easy and safe access. The *Grate Type* can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.



Vault Type

The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pre-treatment chamber, meaning the MWS Linear can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/bioretention systems. Another benefit of the "pipe in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.

Downspout Type

The *Downspout Type* is a variation of the *Vault Type* and is designed to accept a vertical downspout pipe from roof top and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

Advantages & Operation

The MWS Linear is the most efficient and versatile biofiltration system on the market, and the only system with horizontal flow which improves performance, reduces footprint, and minimizes maintenance. Figure-1 and Figure-2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.

Featured Advantages

- Horizontal Flow Biofiltration
- Greater Filter Surface Area
- Pre-Treatment Chamber
- Patented Perimeter Void Area
- Flow Control
- No Depressed Planter Area

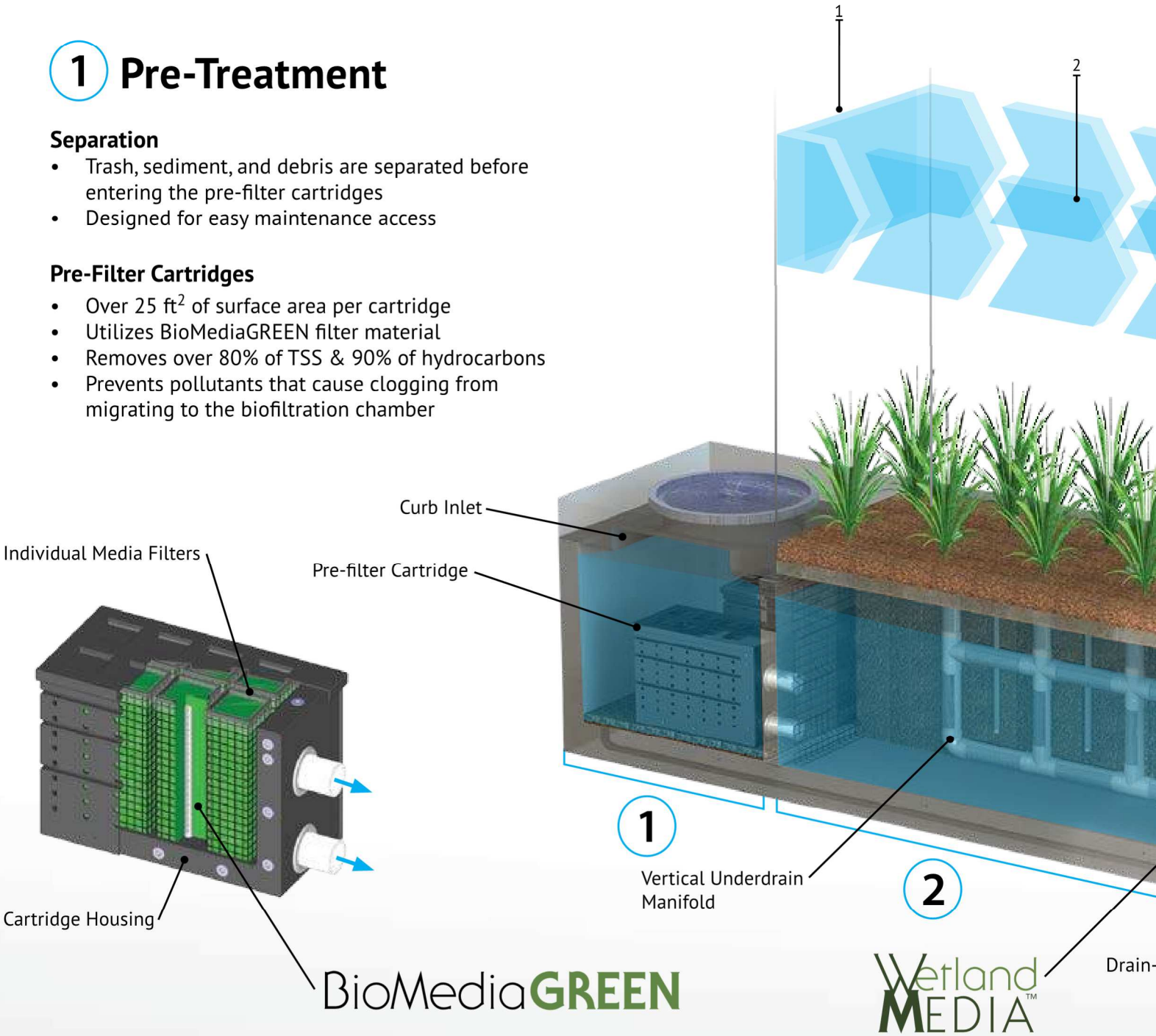
1 Pre-Treatment

Separation

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

Pre-Filter Cartridges

- Over 25 ft^2 of surface area per cartridge
- Utilizes BioMediaGREEN filter material
- Removes over 80% of TSS & 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber



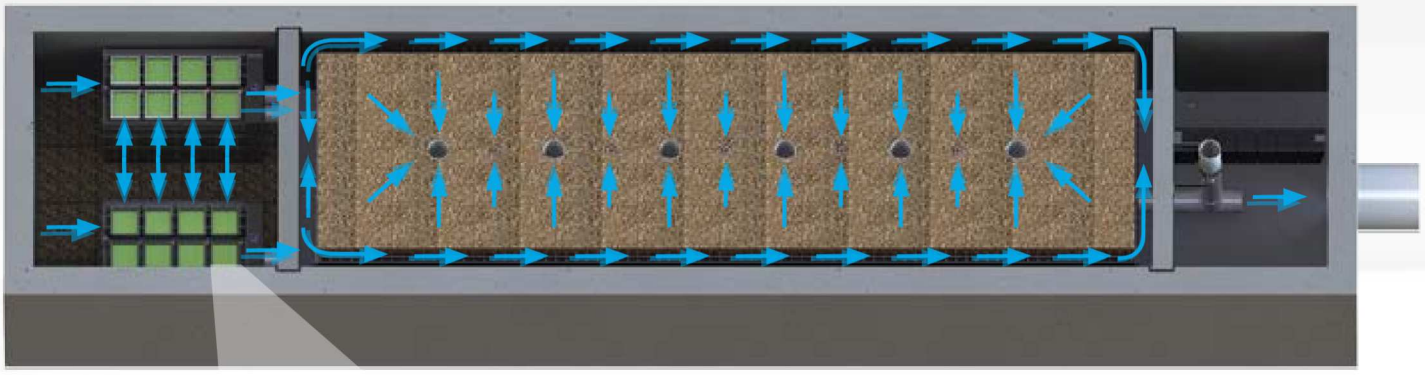
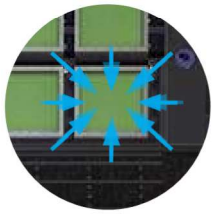


Fig. 2 - Top View

2x to 3x More Surface Area Than Traditional Downward Flow Bioretention Systems.



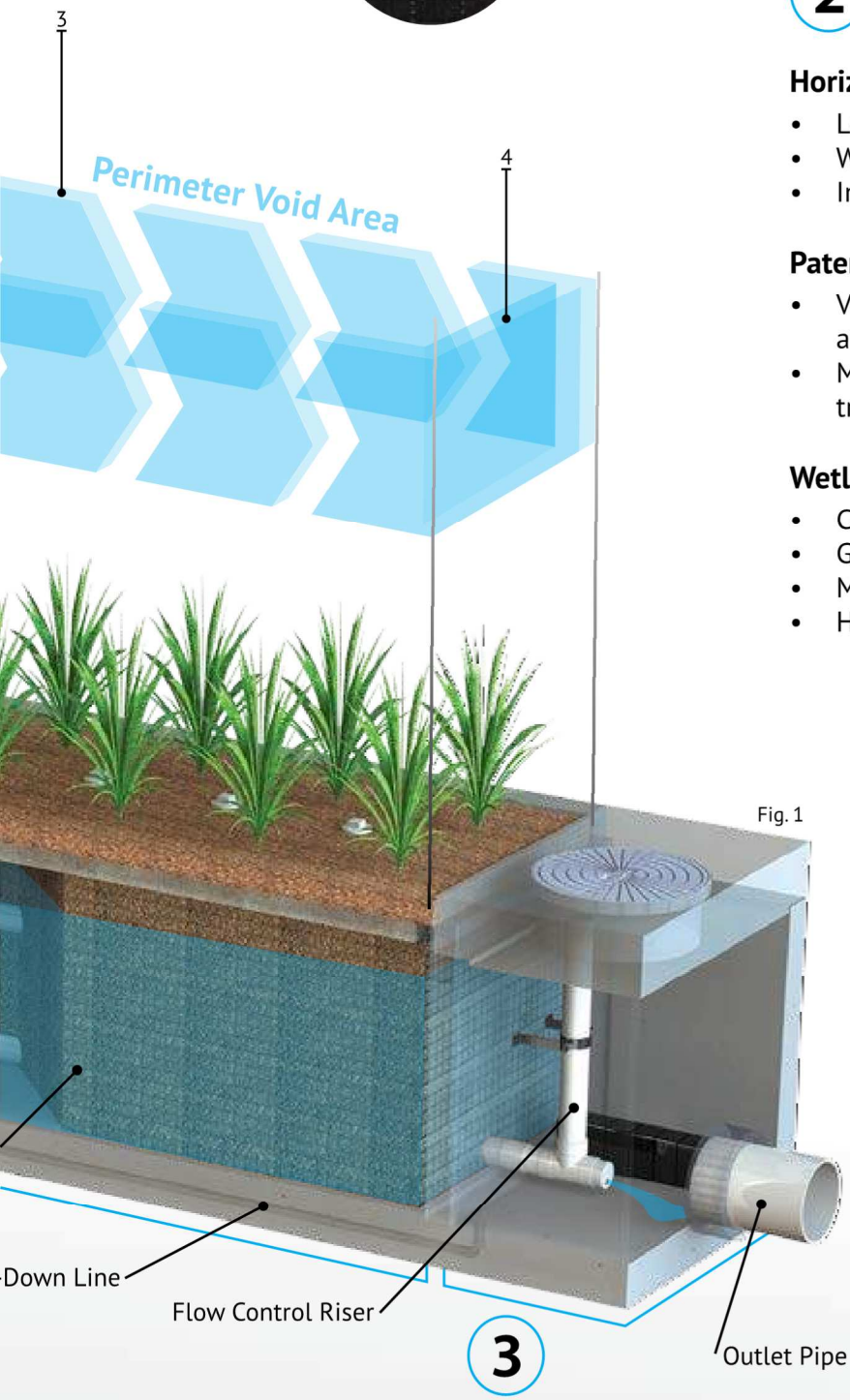


Fig. 1

2 Biofiltration

Horizontal Flow

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

Patented Perimeter Void Area

- Vertically extends void area between the walls and the WetlandMEDIA on all four sides.
- Maximizes surface area of the media for higher treatment capacity

WetlandMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and light weight

3 Discharge

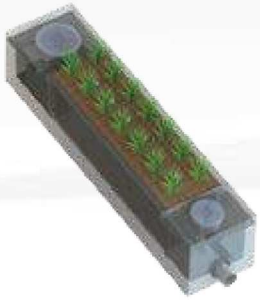
Flow Control

- Orifice plate controls flow of water through WetlandMEDIA to a level lower than the media's capacity.
- Extends the life of the media and improves performance

Drain-Down Filter

- The Drain-Down is an optional feature that completely drains the pre-treatment chamber
- Water that drains from the pre-treatment chamber between storm events will be treated

Orientations



Side-By-Side

The *Side-By-Side* orientation places the pre-treatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side. This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.

End-To-End

The *End-To-End* orientation places the pre-treatment and discharge chambers on opposite ends of the biofiltration chamber therefore minimizing the width of the system to 5 ft (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is bypass must be external.

Bypass

Internal Bypass Weir (Side-by-Side Only)

The *Side-By-Side* orientation places the pre-treatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pre-treatment chamber directly to the discharge chamber.

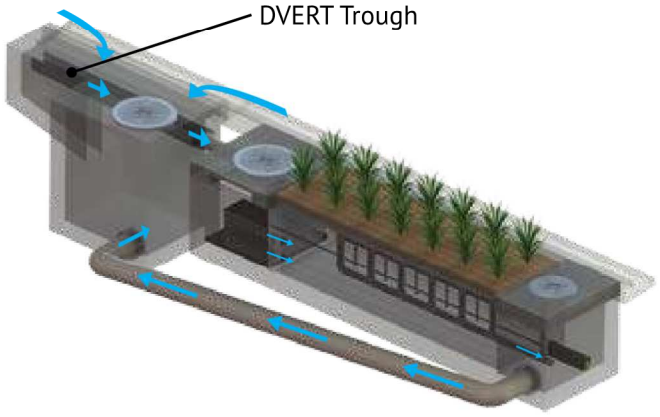
External Diversion Weir Structure

This traditional offline diversion method can be used with the MWS Linear in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the MWS Linear for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

Flow By Design

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the MWS Linear and into the standard inlet downstream.

DVERT Low Flow Diversion



This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the MWS Linear via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allows the MWS Linear to be installed anywhere space is available.

Performance

The MWS Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons and bacteria. Since 2007 the MWS Linear has been field tested on numerous sites across the country. With it's advanced pre-treatment chamber and innovative horizontal flow biofilter, the system is able to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. With the same biological processes found in natural wetlands, the MWS Linear harnesses natures ability to process, transform, and remove even the most harmful pollutants.

Approvals

The MWS Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation, and perhaps the world.

Washington State TAPE Approved

The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft^2 loading rate. The highest performing BMP on the market for all main pollutant categories.

TSS	Total Phosphorus	Ortho Phosphorus	Nitrogen	Dissolved Zinc	Dissolved Copper	Total Zinc	Total Copper	Motor Oil
85%	64%	67%	45%	66%	38%	69%	50%	95%

DEQ Assignment

The Virginia Department of Environmental Quality assigned the MWS Linear, the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) Technical Criteria.

Maryland Department Of The Environment Approved

Granted ESD (Environmental Site Design) status for new construction, redevelopment and retrofitting when designed in accordance with the Design Manual.

MASTEP Evaluation

The University of Massachusetts at Amherst – Water Resources Research Center, issued a technical evaluation report noting removal rates up to 84% TSS, 70% Total Phosphorus, 68.5% Total Zinc, and more.

Rhode Island DEM Approved

Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% Pathogens, 30% Total Phosphorus, and 30% Total Nitrogen.

Flow Based Sizing

The MWS Linear can be used in stand alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

Treatment Flow Sizing Table

Model #	Dimensions	WetlandMedia Surface Area	Treatment Flow Rate (cfs)
MWS-L-4-4	4' x 4'	23 ft^2	0.052
MWS-L-4-6	4' x 6'	32 ft^2	0.073
MWS-L-4-8	4' x 8'	50 ft^2	0.115
MWS-L-4-13	4' x 13'	63 ft^2	0.144
MWS-L-4-15	4' x 15'	76 ft^2	0.175
MWS-L-4-17	4' x 17'	90 ft^2	0.206
MWS-L-4-19	4' x 19'	103 ft^2	0.237
MWS-L-4-21	4' x 21'	117 ft^2	0.268
MWS-L-8-8	8' x 8'	100 ft^2	0.230
MWS-L-8-12	8' x 12'	151 ft^2	0.346
MWS-L-8-16	8' x 16'	201 ft^2	0.462

Volume Based Sizing

Many states require treatment of a water quality volume and do not offer the option of flow based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume based design installed downstream of ponds, detention basins, and underground storage systems.

Treatment Volume Sizing Table

Model #	Treatment Capacity (cu. ft.) @ 24-Hour Drain Down	Treatment Capacity (cu. ft.) @ 48-Hour Drain Down
MWS-L-4-4	1140	2280
MWS-L-4-6	1600	3200
MWS-L-4-8	2518	5036
MWS-L-4-13	3131	6261
MWS-L-4-15	3811	7623
MWS-L-4-17	4492	8984
MWS-L-4-19	5172	10345
MWS-L-4-21	5853	11706
MWS-L-8-8	5036	10072
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145

Installation

The MWS Linear is simple, easy to install, and has a space efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles pre-cast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians are available to supervise installations and provide technical support.

Maintenance

Reduce your maintenance costs, man hours, and materials with the MWS Linear. Unlike other biofiltration systems that provide no pre-treatment, the MWS Linear is a self-contained treatment train which incorporates simple and effective pre-treatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pre-treatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pre-treatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long term operation and there is absolutely no need to replace expensive biofiltration media.

Plant Selection

Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the MWS Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the MWS Linear, giving the plants more "contact time" so that pollutants are more successfully decomposed, volatilized and incorporated into the biomass of The MWS Linear's micro/macro flora and fauna.

A wide range of plants are suitable for use in the MWS Linear, but selections vary by location and climate. View suitable plants by selecting the list relative to your project location's hardy zone.

Please visit **www.ModularWetlands.com/Plants** for more information and various plant lists.

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

Installation Guidelines for Modular Wetland System

Delivery & Unloading/Lifting

1. Modular Wetland Systems, Inc. shall deliver the unit(s) to the site in coordination with the Contractor.

2. The Contractor will require spreader bars and chains/cables to safely and securely lift the main structure, lids and risers (if applicable). Modular Wetlands will supply a set of suitable lifting hooks, knuckles, shackles and eye bolts with each project at no extra charge.

3. The main structure and lid can be lifted together or separately.

   Please see Modular Wetland Weights and Lifting Details. Contact Modular Wetlands for additional lifting details.

Inspection

1. Inspection of the Modular Wetland unit and all parts contained in or shipped outside of the unit shall be inspected at time of delivery by the site Engineer/Inspector and the Contractor. Any non-conformance to approved drawings or damage to any part of the system shall be documented on the Modular Wetland shipping ticket. Damage to the unit during and after unloading shall be corrected at the expense of the Contractor. Any necessary repairs to the Modular Wetland unit shall be made to the acceptance of the Engineer/Inspector.

Site Preparation

1. The Contractor is responsible for providing adequate and complete site/inlet protection when the Modular Wetland unit is installed prior to final site stabilization (full landscaping, grass cover, final paving, and street sweeping completed).

2. The Contractor shall adhere to all jurisdictional and/or OSHA safety rules in providing temporary shoring of the excavation.

3. The Contractor or Owner is responsible for appropriately barricading the Modular Wetland unit from traffic (in accordance with local codes).

Installation Guidelines for Modular Wetland System

Installation

1. Each unit shall be constructed at the locations and elevations according to the sizes shown on the approved drawings. Any modifications to the elevation or location shall be at the direction of and approved by the Engineer.

2. The unit shall be placed on the compacted sub-grade with a minimum 6-inch gravel base matching the final grade of the curb line in the area of the unit. The unit is to be placed such that the unit and top slab match the grade of the curb in the area of the unit. Compact undisturbed sub-grade materials to 95% of maximum density at +1% to 2% of the optimum moisture. Unsuitable material below sub-grade shall be replaced to site engineer's approval. Please see Modular Wetlands Weights and Lifting Details. Contact Modular Wetlands for guidance where slope exceeds 5%.

3. Once the unit is set, the internal wooden forms and protective silt fabric cover must be left intact (if WetlandMedia pre-installed). The top lid(s) should be sealed onto the box section before backfilling, using a non-shrink grout, butyl rubber or similar waterproof seal. The boards on the top of the lid and boards sealed in the unit's throat must NOT be removed. The Supplier will remove these sections at the time of activation.

4. Outlet connections shall be aligned and sealed to meet the approved drawings with modifications necessary to meet site conditions and local regulations. The correct outlet will be marked on the Modular Wetland unit.

5. Backfilling should be performed in a careful manner, bringing the appropriate fill material up in 6-inch lifts on all sides. Precast sections shall be set in a manner that will result in a watertight joint. In all instances, installation of the Modular Wetland unit shall conform to ASTM specification C891 "Standard Practice for Installation of Underground Precast Utility Structures" unless specified otherwise in contract documents.

6. It is the responsibility of the Contractor to provide curb and gutter and transition to the Modular Wetland unit for proper stormwater flow into the system through the throat, pipe or grate opening. A standard drawing of the throat and gutter detail is available in the following section; however the plans and contract documents supersede all standard drawings. Several variations of the standard design are available. Effective bypass for the Modular Wetland System is essential for correct operation (i.e. bypass to an overflow at lower elevation).

Installation Procedure

A set of lifting hooks, shackles, knuckles and eye bolts are provided by Modular Wetlands with the first delivery of every project.

The contractor **MUST** provide all rigging And lifting apparatus, such as all cables and chains or straps.

It is the contractor's responsibility to provide suitable lifting equipment to off-load the Modular Wetland unit.

Modular Wetland units are designed to be off-loaded using the contractor's spreader bar.

1. Apply Butyl Tape Seal

Apply butyl tape seal along the top of the box section. Butyl tape seal is provided with every unit.

Modular Wetland installed protective throat board and installed silt fabric must be left in place to protect the unit from construction sediment.

2. Unload and Set Box

Unload the Modular Wetland unit
the prepared hole with appropriate sub-grade.*

* Compacted sub-grade with a minimum
of six inches of gravel base which must match
the final grade of curb line the area of the unit.

3. Set Top On Box

Set the top slab on the box.

The Contractor is responsible for providing
adequate and complete site/inlet protection
when the Modular Wetland is installed prior
to final site stabilization (full landscaping,
grass cover, final paving, and street sweeping
completed).

4. Connect Outfall Pipe

The correct outlet will be marked on the
Modular Wetland.

Invert of outlet pipe **MUST** be even
with the floor of the system.

5. Install Curb & Gutter

It is the responsibility of the Contractor to provide curb and gutter and transition to the Modular Wetland for proper flow into the system through a 5”- 7” throat opening. A standard drawing of the throat and gutter detail in the following section. CONTRACTOR RESPONSIBLE FOR GROUTING IN ANY VISIBLE LIFTING POINTS.

6. Activation

Activation is performed **ONLY** by Modular Wetland personnel.

Activation can occur once the project site is fully stabilized (full landscaping, grass cover, final paving and street sweeping completed) and there is a 5” - 7” throat opening.

Call 760-433-7640 to schedule your activation.

NOTE: WetlandMedia Installation

For Larger models (MWS-L-4-13 and above) the system will be delivered without WetlandMedia pre-installed to minimize pick weight and prevent contamination of the media during construction. For these models the WetlandMedia will be delivered in bulk or in super sacks. It will be responsibility of the contractor to fill the system with the WetlandMedia during the installation process. Installation of the WetlandMedia can be done after the unit is fully installed to avoid contamination. See following pages for details.

WetlandMedia Install (if applicable)

1. Fill WetlandMedia

Position super sack of WetlandMedia over wetland chamber. Bottom of sack should not be more than 2' above top of system. Open sack and fill evenly*.

* One to several hundred cubic yards of WetlandMedia will be required based upon the model number and size of the system. For large scale jobs WetlandMedia will be delivered in bulk and will require a bobcat of similar to fill the system. All equipment is the responsibility of the contractor.

2. Install Plant Propagation Layer

Fill WetlandMedia up to 9" below the top of the wetland chamber. Level out the WetlandMedia as shown. Ensure that the level does not vary more than one inch or plant growth will be affected.

3. Install Plant Propagation Layer

Utilize plant propagation blocks provided by the manufacturer. Each block is approximately 40" by 6" by 3" thick. Blocks shall be placed side by side and end to end and cover the entire length and width of the wetland chamber unless specified.

4. Finish Filling WetlandMedia

After plant propagation blocks are installed repeat step 1 and fill the system to the top of the wetland chamber as shown. WetlandMedia must be filled within 2” of the top of the unit.

5. Planting

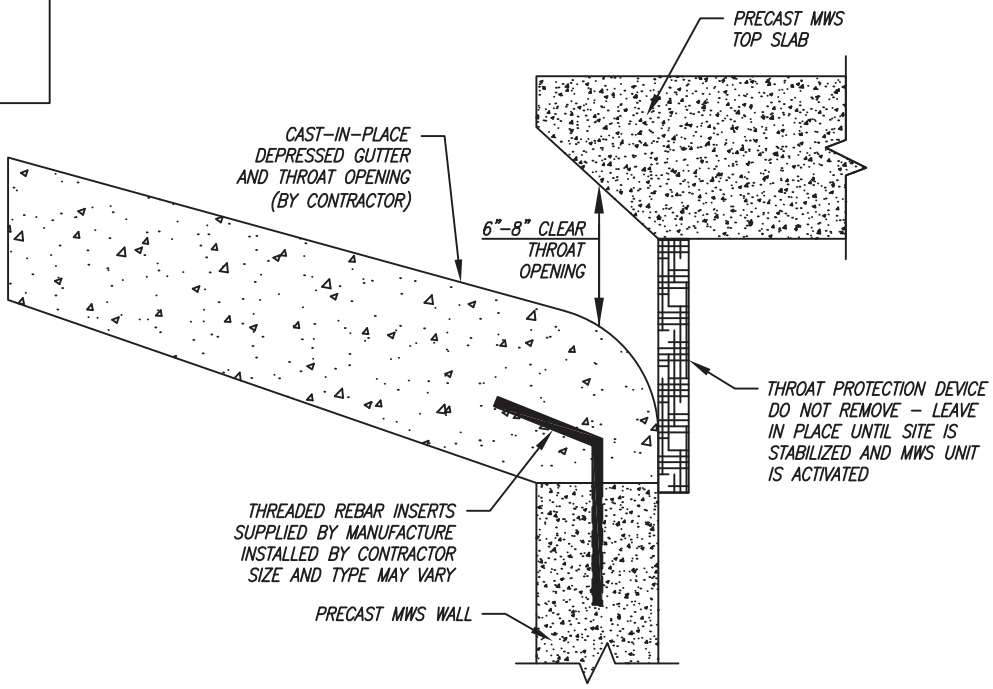
After system is filled with WetlandMedia planting of vegetation can begin. Utilizing 1 gallon plants dig down until The plant propagation blocks are reached. Remove plant and it’s root ball from the container. Set the bottom of the root ball on the tops of the blocks. Fill hole back in with WetlandMedia. After planting a thorough watering of the plants is necessary. The plant propagation blocks must be saturated to provide a water source for the plants during the establishment phase. It is recommended that hand watering is done three times a week for the first two months. Hand water can be supplemented with drip or spray irrigation after the second week. Please call the manufacturer for more details on plants, planting arrangement and irrigation options.

NOTE: planting is required on all units, including units delivered with WetlandMedia pre-installed.

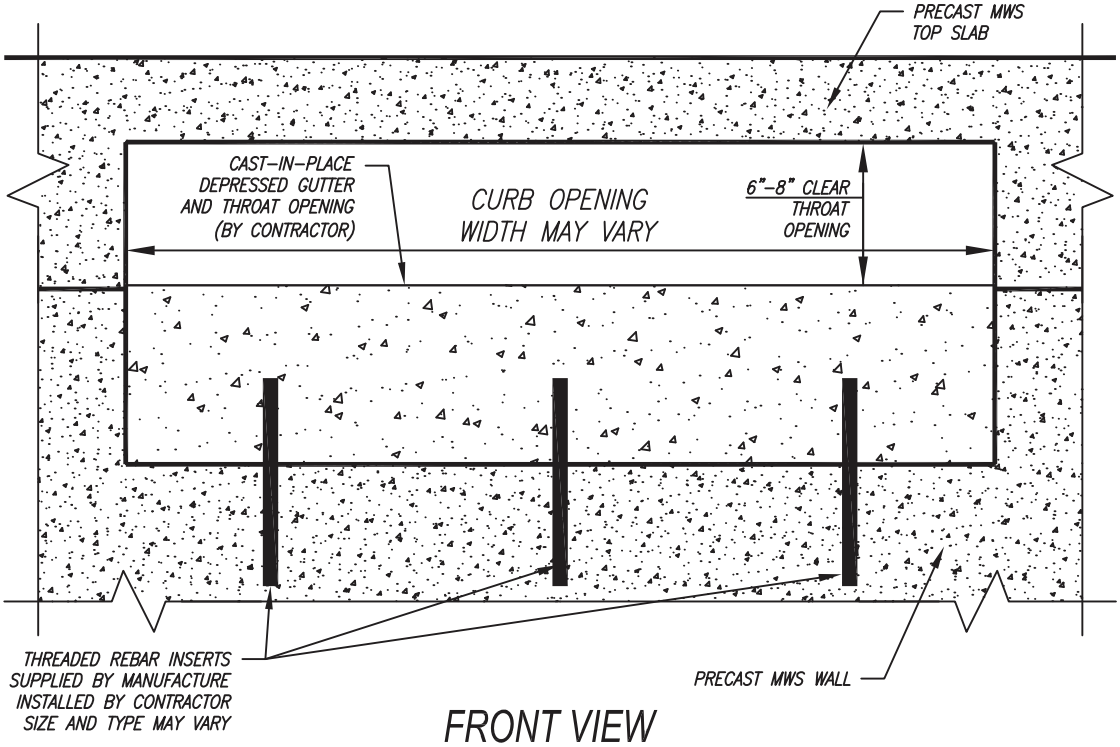
Curb and Gutter Details

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com



SECTION VIEW
STANDARD MODULAR WETLAND CURB OPENING



FRONT VIEW
STANDARD MODULAR WETLAND CURB OPENING

MODULAR WETLAND SYSTEMS INC.
P.O. BOX 869
OCEANSIDE, CA 92049
www.ModularWetlands.com

	NAME	DATE
DRAWN	John	5/3/13
EDITED		

TITLE: MWS LINEAR 2.0 CURB INLET DETAILS

COMMENTS:

SIZE	DWG. NO.	REV

SCALE NTS	UNITS = INCHES	SHEET 1 OF 1

Weights and Lifting Details

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

MWS-L 2.0 Max Pick Weights

Model #	Size (O.D)	Size (I.D)	Unit Weight (lbs)	Media Weight (lbs)	Total Weight (lbs)
MWS-L-4-4	5' x 5'	4' x 4'	7500.0	1447.1	8947.1
MWS-L-4-6 MWS-L-4-6.5	5' x 7' 5 x 7.5'	4' x 6' 4' x 6.5'	11,000 11,500	1619.2	12,619.2 13,119.2
MWS-L-4-8	5' x 9'	8' x 4'	12500	3570	16070
MWS-L-4-13	5' x 14'	13' x 4'	21200	5306	26506
MWS-L-4-15	5' x 16'	15' x 4'	23700	7236	30936
MWS-L-4-17	5' x 18'	17' x 4'	26500	9165	35665
MWS-L-4-19	5' x 20'	19' x 4'	28300	11095	39395
MWS-L-4-21	5' x 22'	21' x 4'	30000	13024	43024

Max Pick Weight if Shipped Without Media Installed

Max Pick Weight if Shipped With Media Installed

Note: All weights listed hereon are standard max pick weights, actual pick weights may vary based upon state and local regulations and variation in concerte and rebar standards. For project specific pick weights contact the manufacturer prior to shipping of the unit(s). Is is the contractors responsibility to off-load the unit with an adequate size crane. Units are shipped with WetlandMEDIA in superbags and installed by contractor.

When Available see project contract terms, if lifting points are on the inside of the unit due to custom designs or installations requiring pionts to be on the inside the media will be shipped in bags and the contractor will be reponsibile to install after the unit is installed. For example, units places against a wall.

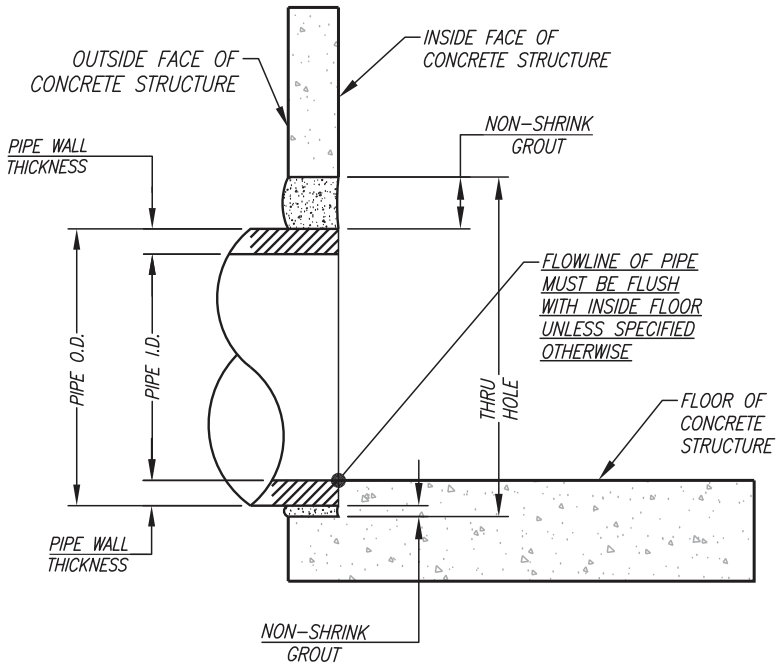
For Questions or Comments Please Call 760-433-7640 or email: info@modularwetlands.com

MODULAR WETLANDS

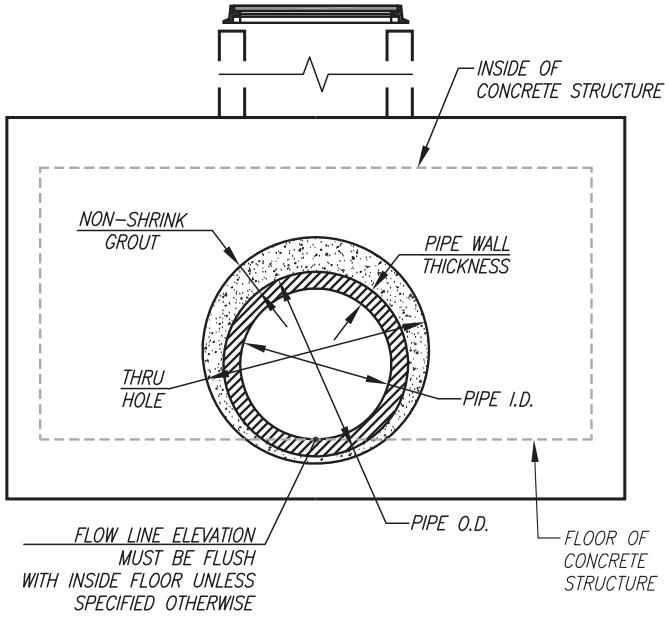
Connection Details

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com



ELEVATION VIEW



END VIEW

INSTALLATION NOTES

1. ALL CONNECTION PIPES SUPPLIED AND INSTALLED BY CONTRACTOR. MODULAR WETLAND UNIT WILL BE DELIVERED WITH A THRU HOLE AND ITS THE CONTRACTORS RESPONSIBILITY TO SUPPLY PIPE, AND ALL LABOR AND MATERIAL TO CONNECT PIPE AND SEAL UNIT WATER TIGHT INCLUDING BUT NOT LIMITED TO GROUT, CONCRETE LUG, REBAR, PLUG, ANCHORS, COUPLER, FITTINGS AND/OR ALL SUPPORT AND CONNECTING HARDWARE.
2. ALL CONNECTIONS ARE TO BE FLUSH WITH THE INSIDE SURFACE OF THE CONCRETE STRUCTURE. (CAN NOT INTRUDE BEYOND FLUSH) ALL PIPE FLOWLINES SHALL BE FLUSH WITH INSIDE FLOOR UNLESS SPECIFIED OTHERWISE.
3. ALL GROUT AND/OR CONCRETE SHALL BE NON–SHRINK AND MEET OR EXCEED LOCAL PIPE CONNECTION STANDARDS.
4. REFER TO AGENCY SPECIFICATIONS WHERE APPLICABLE.

MODULAR WETLANDS

PIPE CONNECTION
STANDARD DETAIL

Flow Based Sizing

The MWS Linear can be used in stand alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

Treatment Flow Sizing Table

Model #	Dimensions	WetlandMedia Surface Area	Treatment Flow Rate (cfs)
MWS-L-4-4	4' x 4'	23 ft^2	0.052
MWS-L-4-6	4' x 6'	32 ft^2	0.073
MWS-L-4-8	4' x 8'	50 ft^2	0.115
MWS-L-4-13	4' x 13'	63 ft^2	0.144
MWS-L-4-15	4' x 15'	76 ft^2	0.175
MWS-L-4-17	4' x 17'	90 ft^2	0.206
MWS-L-4-19	4' x 19'	103 ft^2	0.237
MWS-L-4-21	4' x 21'	117 ft^2	0.268
MWS-L-8-8	8' x 8'	100 ft^2	0.230
MWS-L-8-12	8' x 12'	151 ft^2	0.346
MWS-L-8-16	8' x 16'	201 ft^2	0.462

Volume Based Sizing

Many states require treatment of a water quality volume and do not offer the option of flow based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume based design installed downstream of ponds, detention basins, and underground storage systems.

Treatment Volume Sizing Table

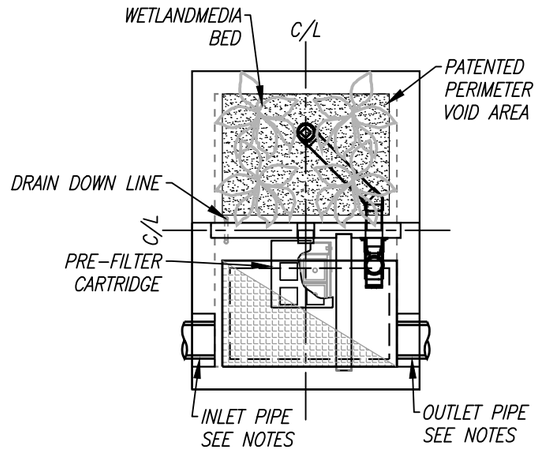
MWS UNITS 1 & 4

Model #	Treatment Capacity (cu. ft.) @ 24-Hour Drain Down	Treatment Capacity (cu. ft.) @ 48-Hour Drain Down
MWS-L-4-4	1140	2280
MWS-L-4-6	1600	3200
MWS-L-4-8	2518	5036
MWS-L-4-13	3131	6261
MWS-L-4-15	3811	7623
MWS-L-4-17	4492	8984
MWS-L-4-19	5172	10345
MWS-L-4-21	5853	11706
MWS-L-8-8	5036	10072
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145

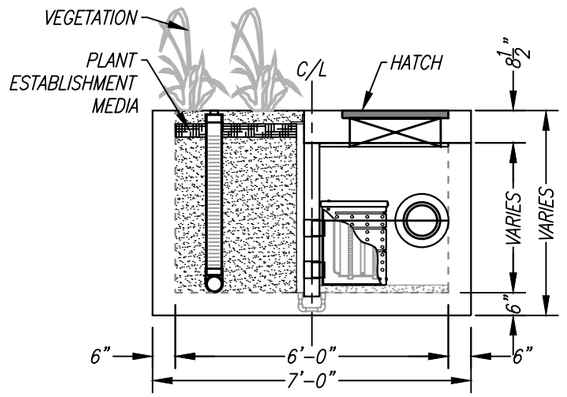
MWS UNITS 2 & 3

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.073	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	24" X 42"	OPEN PLANTER	N/A
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



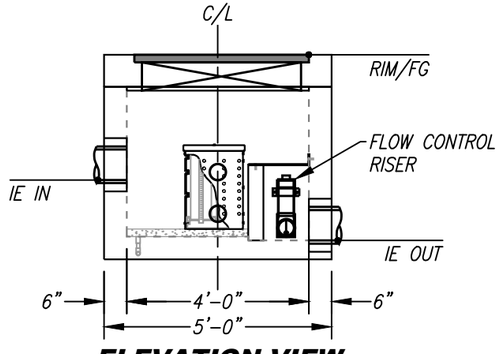
LEFT END VIEW

INSTALLATION NOTES

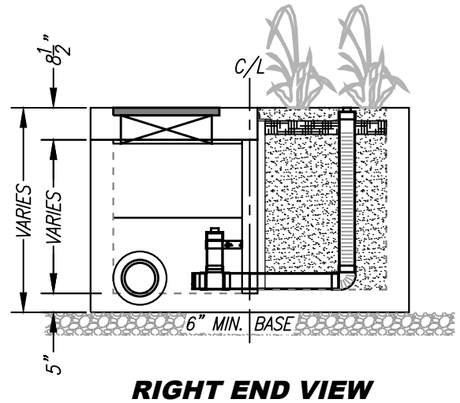
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. 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 PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
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. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

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 BIO CLEAN.



ELEVATION VIEW



RIGHT END VIEW

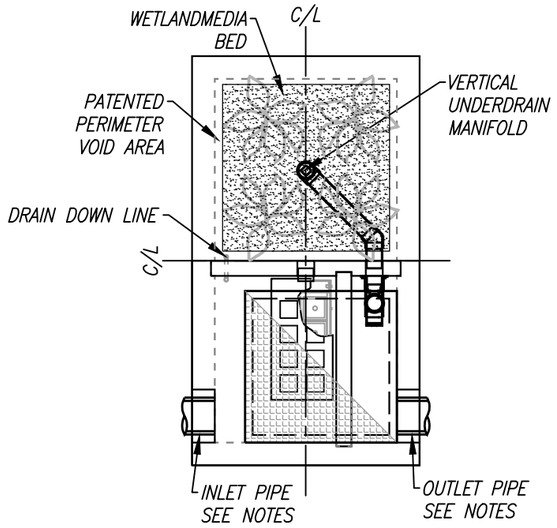
TREATMENT FLOW (CFS)	0.073
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	1.3
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-4-6-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

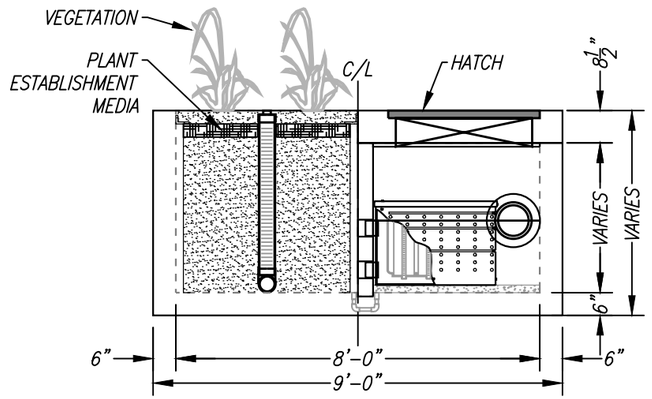
5/23/19 10:LEF

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.115	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	36" X 36"	OPEN PLANTER	N/A
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



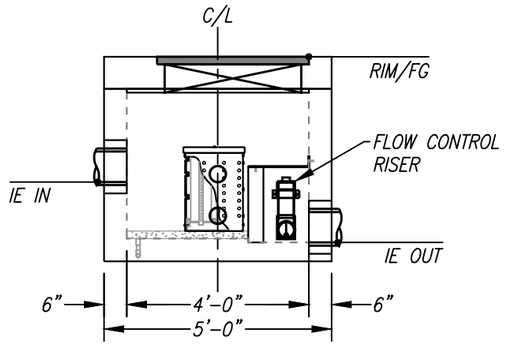
LEFT END VIEW

INSTALLATION NOTES

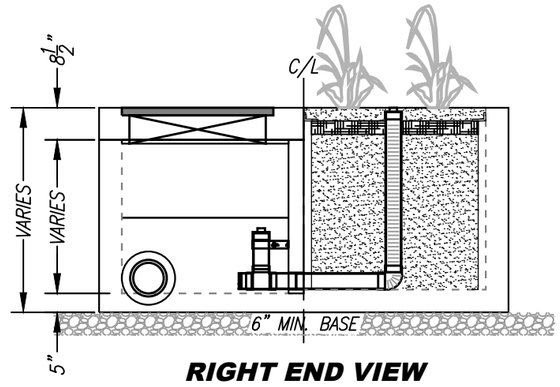
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. 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 PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
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. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

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 BIO CLEAN.



ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.115
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

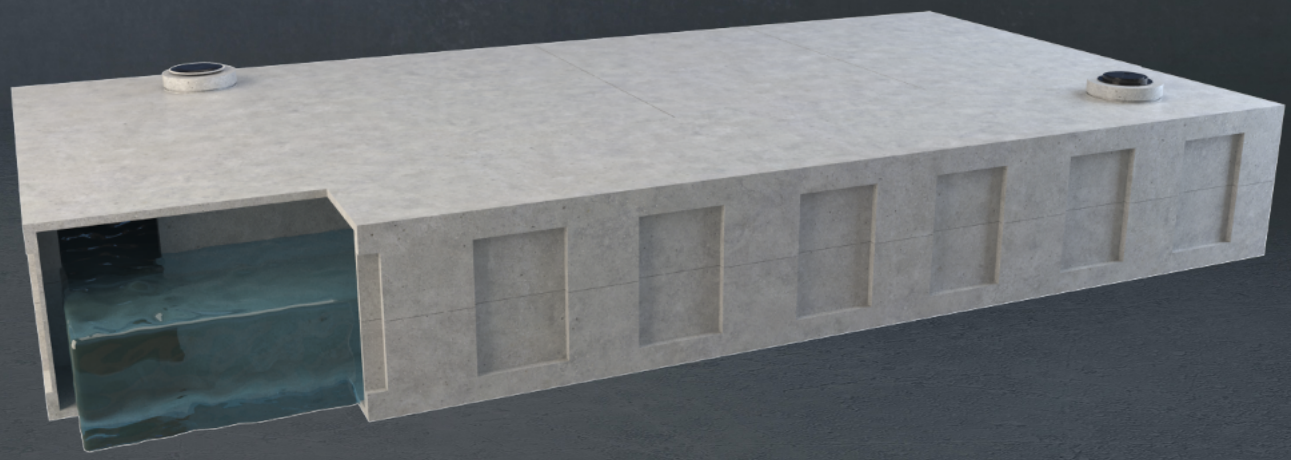
MWS-L-4-8-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

5/23/19 10:LEF

Oldcastle Infrastructure™
A CRH COMPANY

STORMCAPTURE®

Design Summary



PROJECT INFORMATION

PROJECT NAME:

PROJECT CITY:

PROJECT STATE: AL

COMPANY:

SITE TYPE: Commercial

SYSTEM DESIGN

System Type:
| Detention

Module Construction Type:
| Base with Top Slab

Storage Volume Required (cf):
| 850

Configured Storage Volume (cf):
| 849

System Internal Height (ft):
| 2

Nominal Module Capacity (cf):
| 210

Required Number of Modules:
| 4

Module Designation:
| SC1 0-2

SITE DESIGN

System Invert Elevation (ft):
| 100.00

Top of Module Elevation (ft):
| 102.60

Maximum Rim Elevation (ft):
| 103.10

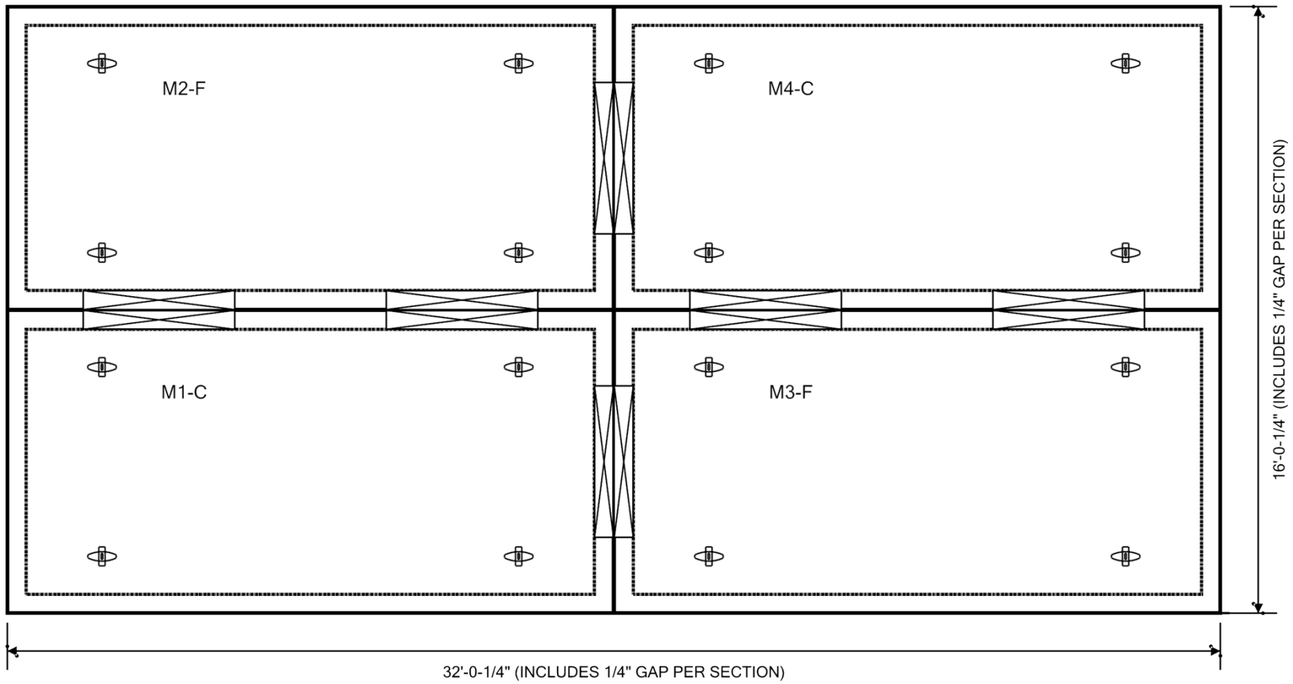
Depth of Cover (ft):
| 0.50

Minimum Inlet Elevation (ft):
| 0.00

Maximum Inlet Elevation (ft):
| 0.00

Minimum Outlet Elevation (ft):
| 0.00

Maximum Outlet Elevation (ft):
| 0.00



PLAN VIEW
SCALE: 1/4" = 1'-0"

MODULE NOTES		
TYPE	QUANTITY	HEIGHT
C	2	2
F	2	2
TOTAL	4	
VOLUME	849	CUBIC FEET

PIPE SCHEDULE		
PIPE	SIZE	INVERT

MANHOLE SCHEDULE		
MANHOLE	TYPE	RIM

DESIGN NOTES:
1. DESIGN LOADINGS:
   A. AASHTO HS-20-44 W/ IMPACT.
   B. DEPTH OF COVER = 6" - 5'-0" (120 PCF ASSUMED).
   C. ASSUMED WATER TABLE = BELOW BOTTOM OF PRECAST.
   D. DRY LATERAL EARTH PRESSURE (EFP) = 45 PCF.
   E. LATERAL LIVE LOAD SURCHARGE = 80 PSF (APPLIED TO 8' BELOW GRADE).
   F. NO LATERAL SURCHARGE FROM ADJACENT BUILDINGS, WALL PIERS, OR FOUNDATIONS.
2. CONCRETE 28 DAY COMPRESSIVE STRENGTH SHALL BE 6,000 PSI.
3. STEEL REINFORCEMENT: REBAR, ASTM A-615 OR A-706, GRADE 60.
4. MESH REINFORCEMENT: ASTM A-1064, S1.2, GRADE 80.
5. CEMENT: ASTM C-150 SPECIFICATION.
6. STORMCAPTURE MODULE TYPE = DETENTION
7. REQUIRED BASE LAYER DEPTH = 2" SAND BEDDING LAYER.
8. REQUIRED NATIVE ALLOWABLE SOIL BEARING PRESSURE = 2,500 PSF. NATIVE SOIL SHOULD BE LEVEL/SCREEDED AND COMPACTED ADEQUATELY TO ALLOW FOR REQUIRED BEARING CAPACITY.
9. REFERENCE STANDARDS:
   A. ASTM C 890
   B. ASTM C 891
   C. ASTM C 913
10. CONSTRUCTION EQUIPMENT EXCEEDING DESIGN LOADING SHALL NOT BE ALLOWED ON STRUCTURE. ANY DESIGN CONSTRAINT DIFFERENT FROM ABOVE REQUIRES CUSTOM STRUCTURAL DESIGN AND MAY REQUIRE THICKER SUBGRADE AND REVISED PRICING.

NOTES TO REVIEWING ENGINEER:
1. THIS SYSTEM IS DESIGNED TO THE PARAMETERS NOTED. PLEASE VERIFY THAT THESE PARAMETERS MEET PROJECT REQUIREMENTS (I.E. LIVE LOAD AND FILL RANGE). IF DESIGN PARAMETERS ARE INCORRECT NOTIFY OLDCASTLE
2. ENGINEER OF RECORD TO CONFIRM ALL PIPE PENETRATION LOCATIONS, SIZES, AND INVERTS.
3. ENGINEER OF RECORD TO CONFIRM ALL MANWAY ACCESS LOCATIONS AND RIM ELEVATIONS.
4. UNLESS OTHERWISE NOTED, ALL PIPE SUPPLIED AND INSTALLED BY OTHERS.
5. THIS SYSTEM IS DESIGNED FOR A GROUNDWATER TABLE BELOW SYSTEM INVERT. ENGINEER OF RECORD TO VERIFY THAT THE DESIGN GROUNDWATER TABLE IS BELOW INVERT OF PRECAST. IF DESIGN PARAMETERS ARE INCORRECT NOTIFY OLDCASTLE IMMEDIATELY FOR REDESIGN AND REVISED PRICING.
6. THIS SYSTEM IS DESIGNED WITH A CONTAINMENT MEMBRANE LINER. IF A LINER IS NOT NEEDED PLEASE CONTACT OLDCASTLE TO PROVIDE THIS OPTION IN THE FINAL DESIGN. FOR WATERTIGHT PIPE BOOT CONNECTION TO LINER, CORRUGATED PIPE ADAPTER BY TRELLEBORG (OR EQUAL) REQUIRED FOR CONNECTION TO CORRUGATED HDPE PIPE, SUPPLIED AND INSTALLED BY OTHERS.

Detention/
Infiltration

- PRELIMINARY –
NOT FOR CONSTRUCTION

Oldcastle Infrastructure™
A CRH COMPANY

Ph: 800.579.8819 | www.oldcastleinfrastructure.com/stormwater

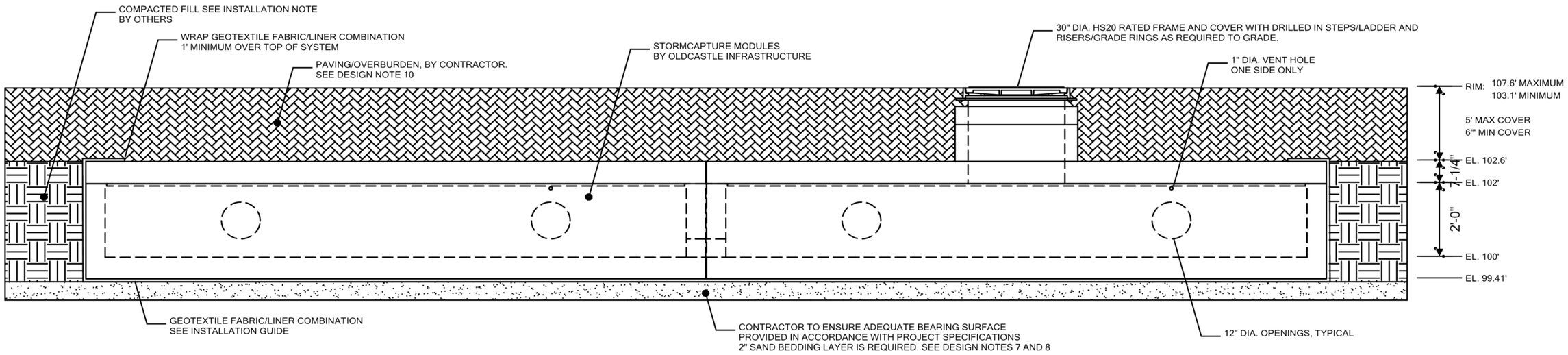
STORMCAPTURE ®

SC1 DETENTION SYSTEM

CUSTOMER:

JOB NAME & LOCATION:
- ,AL

DRAWING NUMBER	REVISION	SHEET
WSCDD-745-0_SC1_DT	-	1 OF 2
	REV DATE 8/7/20	



TYPICAL ELEVATION
SCALE: 3/8" = 1'-0"

- PRELIMINARY –
NOT FOR CONSTRUCTION

Detention/
Infiltration

Oldcastle Infrastructure™
A CRH COMPANY

Ph: 800.579.8819 | www.oldcastleinfrastructure.com/stormwater

STORMCAPTURE ®

SC1 DETENTION SYSTEM

CUSTOMER:

JOB NAME & LOCATION:

- ,AL

DRAWING NUMBER	REVISION	SHEET
WSCDD-745-0_SC1_DT	-	2 OF 2
	REV DATE 8/7/20	

PROJECT INFORMATION

PROJECT NAME:

PROJECT CITY:

PROJECT STATE: AL

COMPANY:

SITE TYPE: Commercial

SYSTEM DESIGN

System Type:
| Detention

Module Construction Type:
| Base with Top Slab

Storage Volume Required (cf):
| 3050

Configured Storage Volume (cf):
| 3218

System Internal Height (ft):
| 3

Nominal Module Capacity (cf):
| 315

Required Number of Modules:
| 10

Module Designation:
| SC1 0-3

SITE DESIGN

System Invert Elevation (ft):
| 100.00

Top of Module Elevation (ft):
| 103.60

Maximum Rim Elevation (ft):
| 104.10

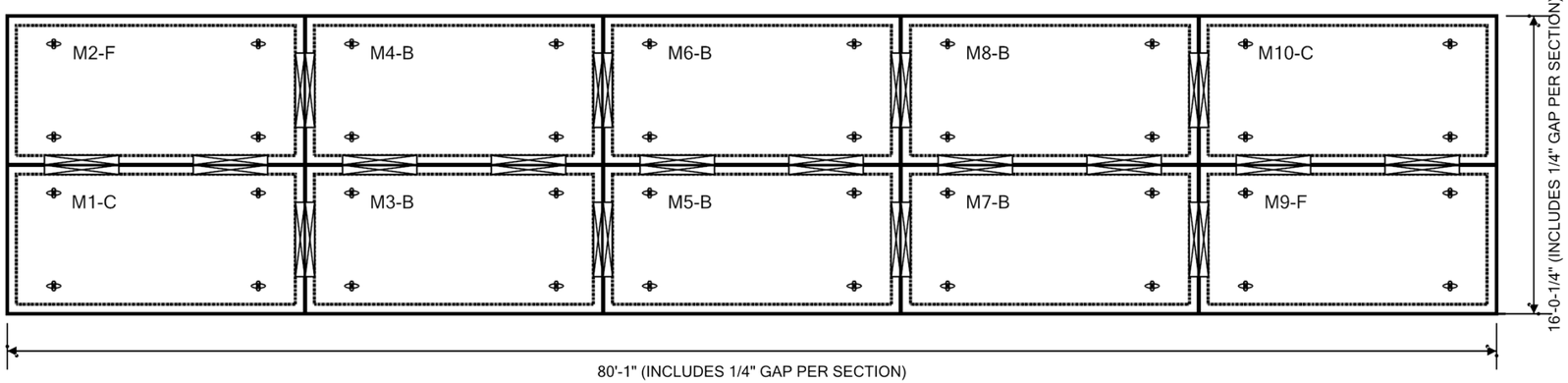
Depth of Cover (ft):
| 0.50

Minimum Inlet Elevation (ft):
| 0.00

Maximum Inlet Elevation (ft):
| 0.00

Minimum Outlet Elevation (ft):
| 0.00

Maximum Outlet Elevation (ft):
| 0.00



PLAN VIEW
SCALE: 1/8" = 1'-0"

MODULE NOTES		
TYPE	QUANTITY	HEIGHT
C	2	3
F	2	3
B	6	3
TOTAL	10	
VOLUME	3218	CUBIC FEET

PIPE SCHEDULE		
PIPE	SIZE	INVERT

MANHOLE SCHEDULE		
MANHOLE	TYPE	RIM

DESIGN NOTES:

1. DESIGN LOADINGS:
   - A. AASHTO HS-20-44 W/ IMPACT.
   - B. DEPTH OF COVER = 6" - 5'-0" (120 PCF ASSUMED).
   - C. ASSUMED WATER TABLE = BELOW BOTTOM OF PRECAST.
   - D. DRY LATERAL EARTH PRESSURE (EFP) = 45 PCF.
   - E. LATERAL LIVE LOAD SURCHARGE = 80 PSF (APPLIED TO 8' BELOW GRADE).
   - F. NO LATERAL SURCHARGE FROM ADJACENT BUILDINGS, WALL PIERS, OR FOUNDATIONS.
2. CONCRETE 28 DAY COMPRESSIVE STRENGTH SHALL BE 6,000 PSI.
3. STEEL REINFORCEMENT: REBAR, ASTM A-615 OR A-706, GRADE 60.
4. MESH REINFORCEMENT: ASTM A-1064, S1.2, GRADE 80.
5. CEMENT: ASTM C-150 SPECIFICATION.
6. STORMCAPTURE MODULE TYPE = DETENTION
7. REQUIRED BASE LAYER DEPTH = 2" SAND BEDDING LAYER.
8. REQUIRED NATIVE ALLOWABLE SOIL BEARING PRESSURE = 2,500 PSF. NATIVE SOIL SHOULD BE LEVEL/SCREEDED AND COMPACTED ADEQUATELY TO ALLOW FOR REQUIRED BEARING CAPACITY.
9. REFERENCE STANDARDS:
   - A. ASTM C 890
   - B. ASTM C 891
   - C. ASTM C 913
10. CONSTRUCTION EQUIPMENT EXCEEDING DESIGN LOADING SHALL NOT BE ALLOWED ON STRUCTURE. ANY DESIGN CONSTRAINT DIFFERENT FROM ABOVE REQUIRES CUSTOM STRUCTURAL DESIGN AND MAY REQUIRE THICKER SUBGRADE AND REVISED PRICING.

NOTES TO REVIEWING ENGINEER:

1. THIS SYSTEM IS DESIGNED TO THE PARAMETERS NOTED. PLEASE VERIFY THAT THESE PARAMETERS MEET PROJECT REQUIREMENTS (I.E. LIVE LOAD AND FILL RANGE). IF DESIGN PARAMETERS ARE INCORRECT NOTIFY OLDCASTLE
2. ENGINEER OF RECORD TO CONFIRM ALL PIPE PENETRATION LOCATIONS, SIZES, AND INVERTS.
3. ENGINEER OF RECORD TO CONFIRM ALL MANWAY ACCESS LOCATIONS AND RIM ELEVATIONS.
4. UNLESS OTHERWISE NOTED, ALL PIPE SUPPLIED AND INSTALLED BY OTHERS.
5. THIS SYSTEM IS DESIGNED FOR A GROUNDWATER TABLE BELOW SYSTEM INVERT. ENGINEER OF RECORD TO VERIFY THAT THE DESIGN GROUNDWATER TABLE IS BELOW INVERT OF PRECAST. IF DESIGN PARAMETERS ARE INCORRECT NOTIFY OLDCASTLE IMMEDIATELY FOR REDESIGN AND REVISED PRICING.
6. THIS SYSTEM IS DESIGNED WITH A CONTAINMENT MEMBRANE LINER. IF A LINER IS NOT NEEDED PLEASE CONTACT OLDCASTLE TO PROVIDE THIS OPTION IN THE FINAL DESIGN. FOR WATERTIGHT PIPE BOOT CONNECTION TO LINER, CORRUGATED PIPE ADAPTER BY TRELLEBORG (OR EQUAL) REQUIRED FOR CONNECTION TO CORRUGATED HDPE PIPE, SUPPLIED AND INSTALLED BY OTHERS.

Detention/
Infiltration

- PRELIMINARY –
NOT FOR CONSTRUCTION

Oldcastle Infrastructure™
A CRH COMPANY

Ph: 800.579.8819 | www.oldcastleinfrastructure.com/stormwater

STORMCAPTURE ®

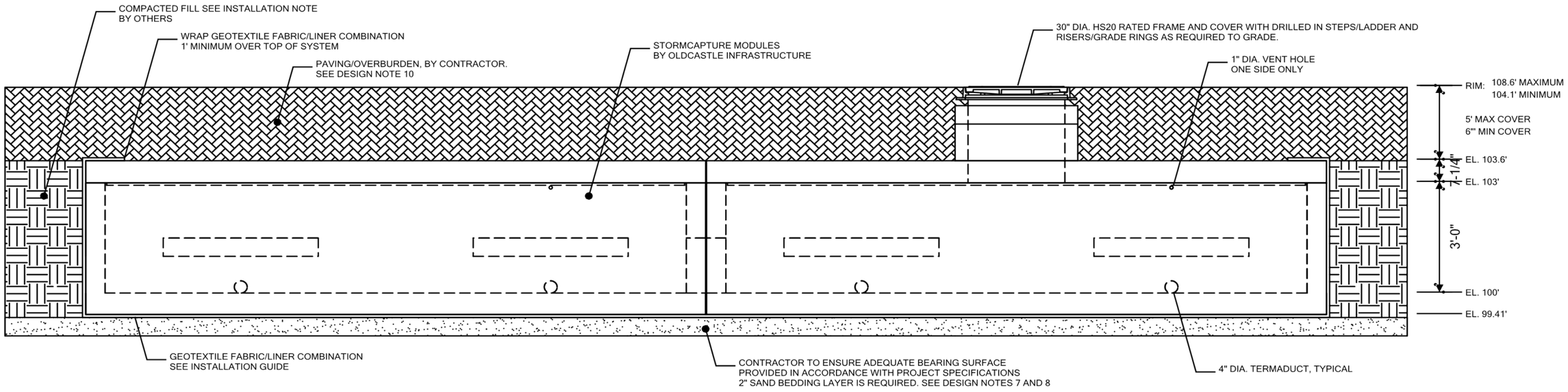
SC1 DETENTION SYSTEM

CUSTOMER:

JOB NAME & LOCATION:

- ,AL

DRAWING NUMBER	REVISION	SHEET
WSCDD-747-0_SC1_DT	-	1 OF 2
	REV DATE 8/7/20	



TYPICAL ELEVATION
SCALE: 3/8" = 1'-0"

NOTE:
TERMADUCT INSERTS TO BE KNOCKED OUT
AT SPECIFIED LOCATIONS ONLY (BY OTHERS)

- PRELIMINARY –
NOT FOR CONSTRUCTION

Detention/
Infiltration

Oldcastle Infrastructure™
A CRH COMPANY

Ph: 800.579.8819 | www.oldcastleinfrastructure.com/stormwater

STORMCAPTURE ®

SC1 DETENTION SYSTEM

CUSTOMER:

JOB NAME & LOCATION:

- ,AL

DRAWING NUMBER	REVISION	SHEET
WSCDD-747-0_SC1_DT	- REV DATE 8/7/20	2 OF 2

STORMCAPTURE®

Installation Manual

Water

Oldcastle Infrastructure™
A CRH COMPANY

INTRODUCTION

StormCapture (shown in **Figure 1**) is a total storm water management system. The highly-configurable module has many solutions for detention, retention, infiltration, treatment and harvesting. Multiple modules can be arranged into endless formations to meet the needs of even the most challenging sites. The rectangular design facilitates rapid and easy installation, plus stress-free maintenance. The precast concrete provides long-term reliability and low lifecycle costs.

The engineer of record is responsible for reviewing and approving the system design, storage volume, required depth of cover, vehicular loading, water table elevation, backfill material and soil bearing capacity. Any variations found during construction to those stated on the plans must be reported to the engineer and Oldcastle Infrastructure.

This manual is not intended to be all-inclusive and is a reference guide only.

FIGURE 1

Detention System

Single Module

FIGURE 2

StormCapture System During Installation Process

SITE PREPARATION

TIMING

- Excavation and subgrade shall be completed prior to StormCapture delivery.

EXCAVATION (See **Figures 3 & 4**)

- Depth
  Concrete invert: Depth of fill* + Module outside height + 2" subgrade depth
  Open bottom: Depth of fill* + Module outside height + subgrade depth**
  ** 6" minimum, 5' maximum, unless otherwise noted*
  *** Subgrade depth determined in accordance with StormCapture Tech Note SC-01*
- Excavation shall be large enough to allow access around structure for backfilling and compaction equipment.
- Trench sloping shall follow OSHA requirements.
- To prevent excessive water pressure build up on the outside of the modules, the site must be prepared and graded for proper drainage around the StormCapture system.
- Dewatering is required when water level is above bottom of subgrade.

SUBGRADE (See **Figures 3 & 4**)

1 Native soil shall be level and compacted adequately to allow for required bearing capacity on design documents.

2 Add 2" of sand for leveling purposes.

3 Geotextile fabric and containment membrane liner.

- An 8 oz. non-woven geotextile fabric must be used as a separation layer around the StormCapture system.
- When the project requires a containment membrane liner, a layer of 8 oz. non-woven geotextile fabric must be used on both the inside and outside face of the liner.
- Install containment membrane liner per manufacturer's recommendations.

4 Aggregate bearing layer (See **Figure 3**)

- Open-bottom modules only are required to be placed on a crushed aggregate bearing layer to a depth in accordance with StormCapture Tech Note SC-01. Material shall be clean, durable crushed aggregate compacted as directed by the engineer of record. Oldcastle recommends size 5, 56 or 57 (per ASTM C33).
- Extend aggregate bearing layer a minimum of 1' around the system perimeter.
- Aggregate bearing layer must be level and compacted prior to module placement.
- An 8 oz. non-woven geotextile fabric must be used as a separation layer around the aggregate material and StormCapture system.

Note: *Further investigation by a geotechnical engineer may be required where there are concerns with seasonally high water table, and/or poor soil conditions such as low allowable bearing capacity, permafrost and seasonal freeze/thaw cycles.*

FIGURE 3

- 1-Piece Module - With Liner

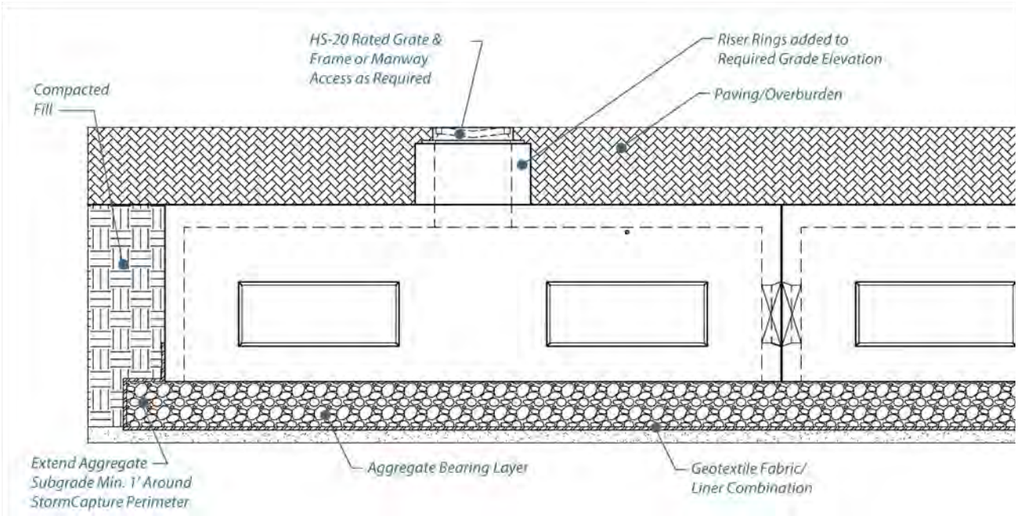
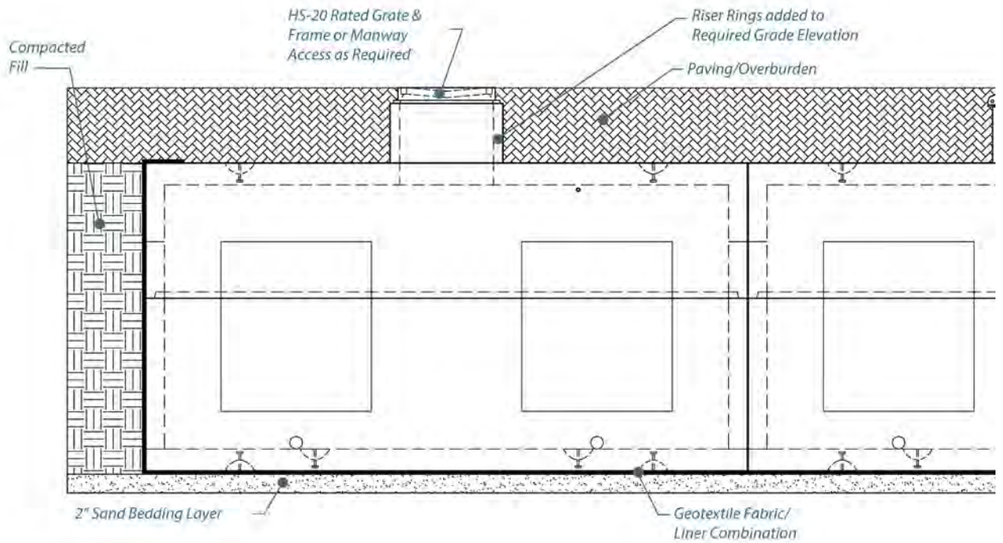


FIGURE 4

- 2-Piece Module - With Liner



DELIVERY & INSTALLATION

StormCapture modules are to be installed in accordance with ASTM C891-90, Installation of Underground Precast Utility Structures. Project plan and specifications must be followed along with any applicable regulations.

TIMING

- Plan for first delivery of StormCapture modules after site preparation is completed.
- Individual pieces can be installed in as little as 10 minutes.

DELIVERY

- Verify that equipment can handle module weights as noted on construction documents prior to delivery.
- StormCapture modules will be delivered on flatbed trucks.

HANDLING

- StormCapture modules are lifted by the designed embedded lifers at points provided by Oldcastle (**Figure 5**).
- Designed embedded lifters must be used. Use proper rigging to assure all lifters are equally engaged with a minimum 60° angle on slings (**Figure 6**).
- Special lifting clutches are required and shall be coordinated with the producing plant.
- Always follow safety protocols for handling StormCapture modules during installation as illustrated on this page.
- Never stand under load (**Figure 7**).
- Never place hands in the lift gear (**Figure 8**).
- Never place hands under load (**Figure 9**).

PLACEMENT

- Use the plan line, grade and elevations shown on the construction documents to install the modules. The sand bedding or aggregate bearing layer must be level.
- Modules must be placed as close together as possible with gaps no greater than 3/4".
- All vertical & top joints shall be covered with an 8" minimum width self-adhesive joint wrap as shown in **Figure 10**.
- Horizontal joints between modules or slabs shall be sealed with Conseal CS-102 butyl rubber sealant as shown in **Figure 11**.
- Seal pipe penetrations to containment membrane liner with pipe boots per liner manufacturer's recommendations.

FIGURE 5

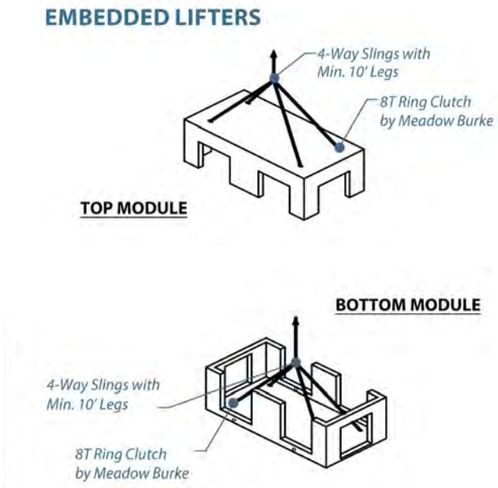


FIGURE 6

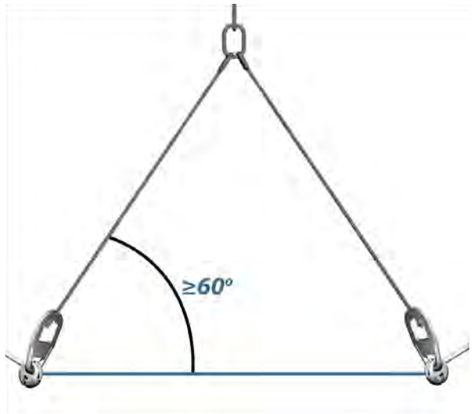


FIGURE 7

FIGURE 8

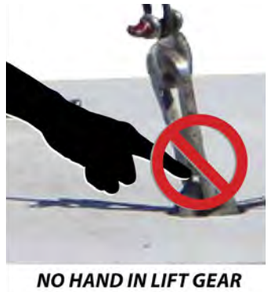


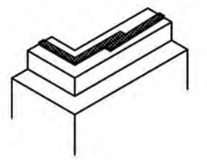
FIGURE 9

FIGURE 10

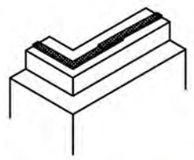
- Sealed Joints Between Modules

FIGURE 11

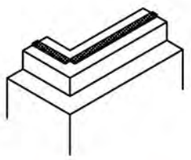
Keyways must be free of dirt, rocks and water. Rocks and dirt prevent the vault sections from seating and sealing properly. Remove all protective paper from rubber sealant material. Splice rubber sealant material with a "side by side" joint, away from corners. Corner splicing will not seal properly.



CORRECT - Install rubber sealant material at the outer edge of the keyway. Rubber sealant should be continuous around corners.



INCORRECT - Do not overlap the rubber sealant material at splice.



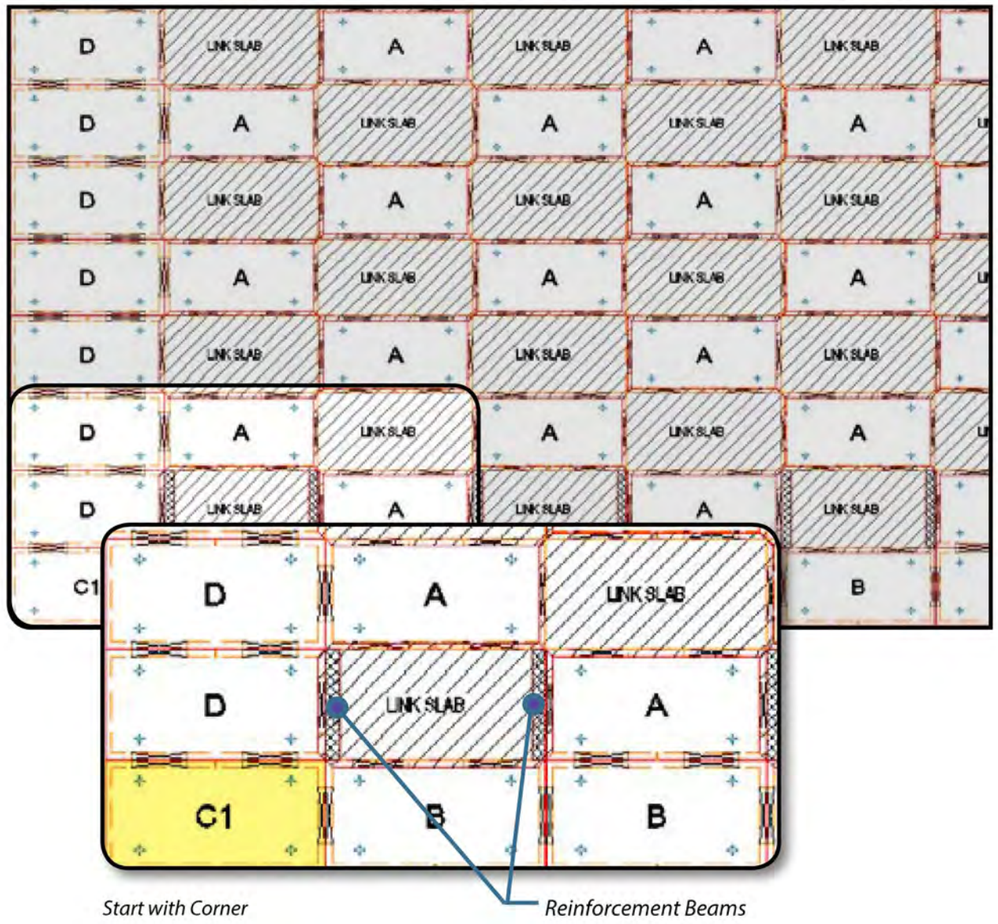
INCORRECT - Do not overlap the rubber sealant material at a corner. Rubber sealant should be continuous around corners.

LINKSLAB® PROCEDURE

These procedures reference the diagram below. This diagram is not indicative of all site layouts. Refer to the site plan for the project specific configuration.

FIGURE 12

| Example Layout



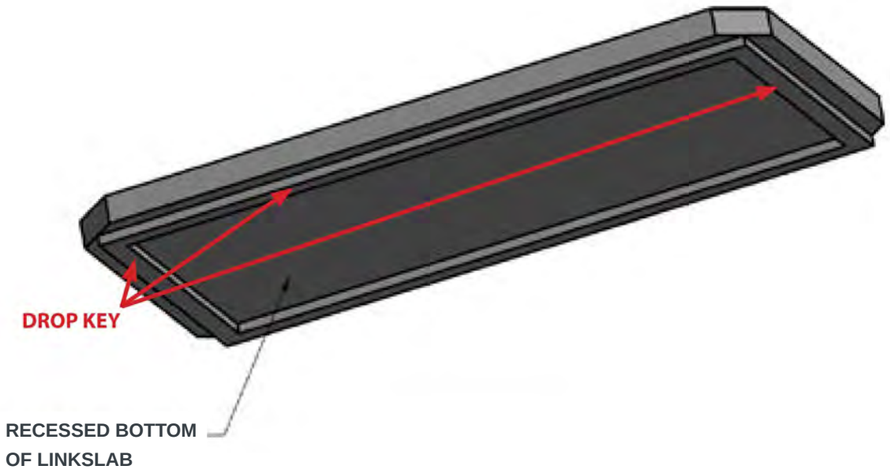
LINKSLAB PROCEDURE

Maintaining proper line and grade is critical to installation. A qualified surveyor on the site with proper equipment is recommended to ensure a square, level and straight layout. Subgrade must be compacted.

1 Start in the corner of the layout and place the first bottom module C1.
2 Place adjacent bottom modules B, B, D, D. Be sure to set the corners square and straight (from C1 up with D modules, and from C1 right with B modules).
3 Where called out on plans, place reinforcement beams between the modules where the LinkSlab will sit (between B and A). Reinforcement beams may not be required at all locations, so refer to the project specific configuration.
4 Place interior modules A, A.
| Check the distance between pieces when there is a gap for a LinkSlab. Both bottom corners should be between 8' and 8'-1 ¼".
5 Place Conseal CS-102 at the horizontal joints.
6 Place top modules (C1, B, B, D, D, A, A).
| Check the distance between pieces when there is a gap for a LinkSlab. Both top corners should be 8' and 8'-1 ¼".
7 Place Conseal CS-102 for the horizontal LinkSlab joints at D, A, A and B.
8 Place the LinkSlab. Ensure that it fits tightly between all adjacent modules. The drop key should fit inside the adjacent modules. Do not allow the LinkSlab to rest on the drop key.
| Ensure surface contact with the bottom of the LinkSlab and the top of the adjacent modules. Reset adjacent modules as necessary to correct the problem.
9 Continue placing adjacent modules and LinkSlabs.
| Oldcastle Precast recommends placing each LinkSlab as soon as the supporting modules are in place to ensure proper fit.
10 Continue installation procedure as recommended in the StormCapture Installation Manual.

FIGURE 13

| LinkSlab Isometric View



BACKFILL

Once all modules are in place with joints sealed and geotextile fabric wrapped, the StormCapture system shall be inspected by the engineer of record or an accepted representative. Upon approval, backfilling can begin.

- Do not compact within 6" of module to avoid damaging the system. Care shall be taken during placement of backfill not to displace modules, joint wrap, containment membrane liner or geotextile fabric.
- Backfilling shall be in 1' lifts with proper compaction between lifts. Typical backfill shall be compacted to 95% standard proctor density or as specified.
- Expansive soil material shall not be used as backfill around the structure.
- Compaction shall be adequate to support expected loads on top of the system and surrounding area. Consult with geotechnical engineer for the project.
- Once installed, StormCapture modules are ready for paving or overburden material (**Figure 14**).
- Finished grading, paving and landscaping shall be per construction documents.
- Construction equipment exceeding design loading shall not be allowed on structure. Consult Oldcastle Infrastructure if unsure.
- Contact Oldcastle Infrastructure and the engineer of record if the live loads are greater than HS-20.
- Track vehicles including D-4 type dozers or lighter are permitted.

INSTALLATION IS NOW COMPLETE

Project specific conditions may apply. Please refer to design documents for any special circumstances regarding installation or infiltration. ***Oldcastle Infrastructure is not liable for installation.***

FIGURE 14

- Backfill

PRECONSTRUCTION MEETING CHECKLIST

Project Name: _____ Date: _____ Time: _____

Installer Name: _____ Address: _____

Oldcastle Rep: _____ _____

- ☐ Cover the installation manual
- ☐ Installer has the **approved** drawings
- ☐ Crane sizing and proper rigging
- ☐ Coordinate with installer to borrow lifting clutches for installation
  - ☐ Recommend $1,600 deposit (paid to plant from contractor), with money to be repaid upon return of undamaged clutches.
- ☐ Hole sizing
  - ☐ Extra space for liner weld if needed
- ☐ Hole prep (base prep)
- ☐ Liner (if applicable)
  - ☐ Extra hands for unrolling liner needed
- ☐ Project date of install: _____
- ☐ Delivery truck access to the site
  - ☐ Will a truck with a sleeper cab fit?
  - ☐ Do construction site items need to be moved for access?
- ☐ Timing of trucks
  - ☐ Splash pads first
  - ☐ Order of modules to install with ease
  - ☐ Assume 10-15 minutes per piece
- ☐ Installing of modules
- ☐ Joint Wrap
- ☐ Other: _____

SIGNATURES:

Project Superintendent: _____ Other: _____

Project Foreman: _____ Other: _____

OUR MARKETS

Building Structures

Communications

Water

Energy

Transportation

Oldcastle Infrastructure™
A CRH COMPANY

Attachment I

Master Covenant and Agreement and Maintenance & Operation Plan

Operations and Maintenance (O&M) Plan

Water Quality Management Plan
for

The Residences at 4400 Von Karman

5000 Birch Street

Newport Beach, CA 92660

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 owner shall prepare a training manual along with the Operations and Maintenance Manual for all existing and future employees. The manual shall include information regarding proper practices that contribute to the protection of the stormwater quality. Training shall be provided upon hire of new associates. A copy of the training manual shall remain in the building at all times for employees to use as needed. The manual shall include all Educational Materials. Additional education material may be found in the following website : http://www.ocwatershed.com/PublicEd/resources/business-brochures.html	Ongoing	Owner
Yes	**N2. Activity Restrictions** The property owner shall ensure that the rules and guidelines as determined on the project conditions of approval or other policies are followed at all times once the project is operations. Prohibited activities for the project that promoted water quality includes: 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 dumpster lids closed at all times. Prohibit vehicle washing, maintenance, or repair on the premises or restrict those activities to designated areas.	Ongoing	Owner
Yes	**N3. Common Area Landscape Management** Ongoing maintenance is conducted to minimize erosion and over-irrigation, conserve water and reduce pesticide and fertilizer applications.	Weekly	Owner
Yes	**N4. BMP Maintenance** All proposed BMP's shall be regularly maintained.	Ongoing	Owner
No	**N5. Title 22 CCR Compliance**	Every time	Owner

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
No	**N6. Local Water Quality Permit Compliance**		
No	**N7. Spill Contingency Plan**		
No	**N8. Underground Storage Tank Compliance**		
No	**N9. Hazardous Materials Disclosure Compliance**		
No	**N10. Uniform Fire Code Implementation**	Procedures shall be established prior to building occupancy.	Owner
Yes	**N11. Common Area Litter Control** The Owner will be required to implement trash management and litter control procedures in the common areas aimed at reducing pllution of drainage water. The Owner may contract with their landscape maintenace firm to provide this service with regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposal violations and reporting the violations to the Owner for investigation	Ongoing	Owner

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	**N12. Employee Training** The owner shall prepare a training manual for all existing and future employees. The manual shall include information regarding proper practices that contribute to the protection of the stormwater quality. Training shall be provided upon hire of new associates. A copy of the training manual shall remain in the building at all times for employees to use as needed. The manual shall include all Educational Materials. Additional education material may be found in the following website : http://www.ocwatershed.com/PublicEd/resources/business-brochures.html	Quarterly. Training shall be provided upon hire and regular intervals thereafter.	Owner
No	**N13. Housekeeping of Loading Docks**		
Yes	**N14. Common Area Catch Basin Inspection** The owner must ensure that the on-site inlet and drain pipe will be periodically inspected visually. Cleaning should take place in the late summer/early fall prior to the start of the rainy season. If necessary, clean, repair, or replace any drainage facility prior to the start of each rainy season (no later than October 15 of each year).	Monthly -Before and after predicted storm events	Owner
Yes	**N15. Street Sweeping Private Streets and Parking Lots** The Owner must sweep outdoor lots regularyly (minimum monthly), or as needed to maintain parking lot surface without trash, debris, or other removable solids, and prior to the storm season (no later than October 15 each year). Sweeping shall be done with a vacuum-type sweeper. Under no circumstances are outdoor areas/lots to be rinsed or washed with water unless said rinse/wash water is collected and disposed of properly (i.e. into the sewer).	Monthly	Owner
Structural Source Control BMPs			

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	**S1. Provide Storm Drain System Stenciling and Signage** All catch basins/inlets/outlets/parkway drains on site must be marked using the City's "No Dumping – Drains to Ocean" curb marker or stenciled using an approved stencil to paint this message on the top of curb directly above the inlet, and on one side of the curb face. Labeling for catch basins & parkway drains is to be inspected regularly and maintained so as to be reasonably legible at all times. The inspection and maintenance is to be performed by the Owner. This stencil is to alert the public/employees to the destination of pollutants discharged into the storm water.	Annually	Owner
No	**S2. Design Outdoor Hazardous Material Storage Areas to Reduce Pollutant Introduction**		
Yes	**S3. Design Trash Enclosures to Reduce Pollutant Introduction** The owner shall post signs on trash enclosure gates that state "Keep Dumpster Lids Closed." The Owner will monitor dumpster usage such that dumpsters are not overfilled and the dumpster lids can close completely. The Owner shall increase the trash pickup schedule as necessary to prevent dumpsters from overfilling. The Owner will observe and damage to the trash enclosure wall and any discharge from the trash storage area.	Ongoing	Owner
Yes	**S4. Use Efficient Irrigation Systems and Landscape Design** All irrigation systems will be inspected to ensure that the systems are functioning properly and that the programmable timers are set correctly. See CASQA Stormwater Handbook BMP Fact Sheet SD-12 for additional information S4. Use Efficient Irrigation Systems and Landscape Design implementation/maintenance activities.	Monthly	Owner
No	**S5. Protect Slopes and Channels**		

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
No	**S6. Loading Dock Areas**		
No	**S7. Maintenance Bays and Docks**		
Yes	**S8. Vehicle Wash Areas** Visual Inspection for trash, debris, and pet waste accumulation and proper dispose of any trash, debris, and pet waste. Vehicle wash out of pet fecal matter, urine or animal fluids shall only be undertaken in areas with sewer drain. Washout of pet fecal material, urine and animal fluids shall not be made where water flows to public storm drain line. 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.		
No	**S9. Outdoor Processing Areas**		
No	**S10. Equipment Wash Areas**		
No	**S11. Fueling Areas**		
No	**S12. Site Design and Landscape Planning**		
No	**S13. Wash Water Controls for Food Preparation Areas**		
No	**S14. Community Car Wash Racks**		
Yes	**Modular Wetland Systems** Visual Inspection for trash and debris accumulation and dispose of any trash and debris accumulation. Inspect for standing water, and vegetation condition per the specifications included in the manual. In addition to the items listed above, refer to the following pages for Bioretention Operations and Maintenance General Requirements.	Per maintenance manual provided.	Owner

Exhibit B, Operations and Maintenance Plan

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	**Underground Infiltration System (Cudo Cubes)** See the following pages for manufacturer's maintenance and inspection procedures.	See the following pages for manufacturers inspection frequency and schedule	Owner

Exhibit B, Operations and Maintenance Plan

Required Permits

This section must list any permits required for the implementation, operation, and maintenance of the BMPs. Possible examples are:

- Permits for connection to sanitary sewer
- Permits from California Department of Fish and Game
- Encroachment permits

If no permits are required, a statement to that effect should be made.

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.

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

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. The hose of the vacuum truck will not damage the screening device.
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.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

Maintenance Procedure Illustration

Screening Device

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

Separation Chamber

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

Cartridge Filters

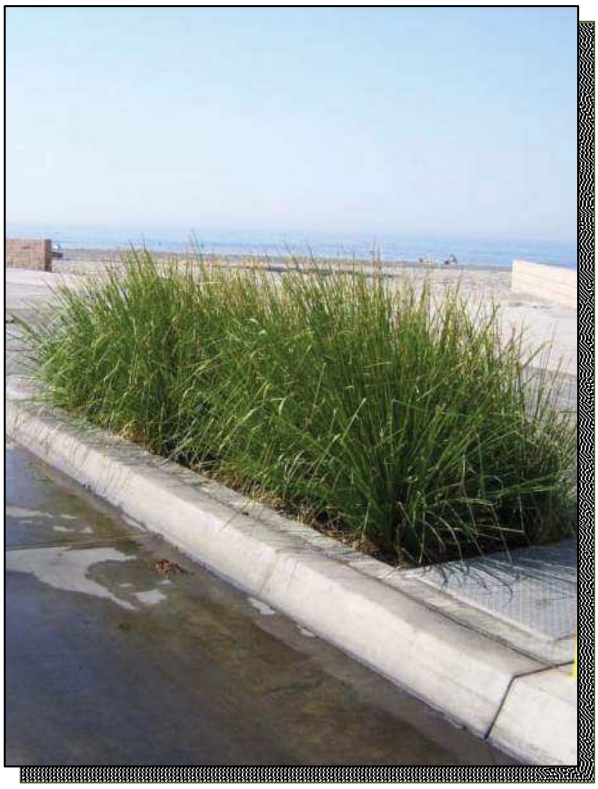
The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.

Drain Down Filter

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

Trim Vegetation

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



Inspection Form

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Inspection Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

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

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

Weather Condition _____ Additional Notes _____

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

Inspection Checklist

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

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

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

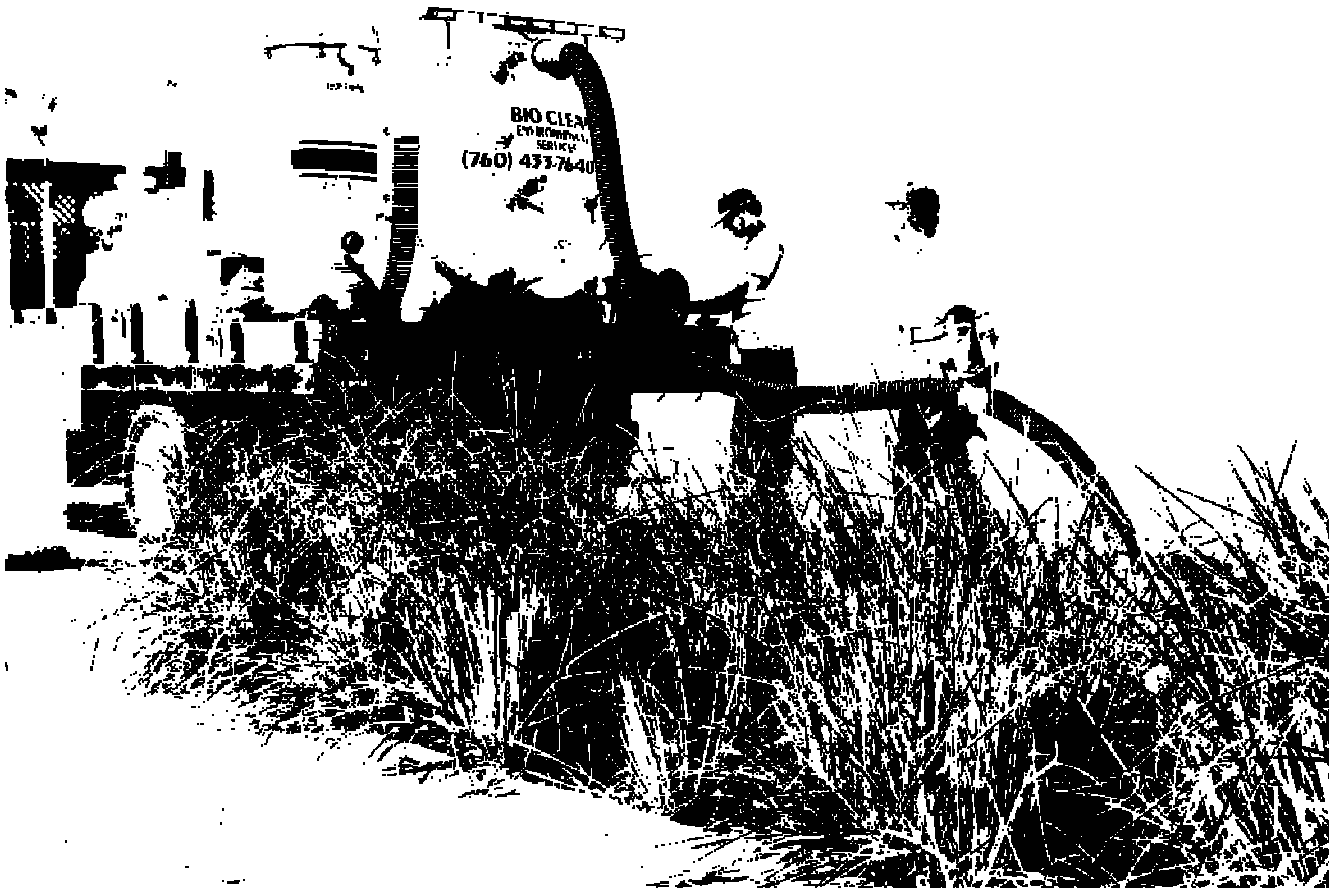
Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: _____

2972 San Luis Rey Road, Oceanside, CA 92058 P (760) 433-7640 F (760) 433-3176

Maintenance Report



Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

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

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

Weather Condition _____ Additional Notes _____

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

Site Map #	GPS Coordinates of Insert	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:

2972 San Luis Rey Road, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

Oldcastle Precast®

CUDO® CUBES

Operations and Maintenance Manual

(Underground Retention / Detention / Infiltration / Water Reuse Systems)

Stormwater

CUDO® Stormwater Cube - Modular Stormwater Systems

Description / Basic Function

CUDO is a modular stormwater system comprised of a grouping of modular polypropylene or concrete cubes that when constructed form an underground storage area for stormwater. This system can be used for infiltration, retention, detention or water reuse. CUDO can help achieve runoff detainment and storage to help attenuate the peak flow to pre-construction levels and can help conform to current Low Impact Development requirements.

Infiltration

The purpose of a CUDO infiltration system is to capture stormwater runoff, store the runoff, and then allow it to percolate into the ground via the open space area of the cubes and perforations in the side wall. The system is backfilled with a Class I material defined by ASTM D2321 as a cleaned open graded rock or a Class II permeable sand. The rock or sand provide additional storage capacity but also allow for a percolation interface with the native material. The ground water is "recharged" with this type of system.

Detention

The purpose of a CUDO detention system is to capture stormwater runoff, store the runoff, and then allow it to be released at a controlled rate through an appropriately sized orifice control. A detention system helps attenuate the peak flow from the site assuring that pre-development runoff flows are not exceeded as a result of the development. A CUDO detention requires the cubes to be encapsulated with an impermeable liner for the polypropylene system or the seams of the concrete system to be sealed with a water proof mastic.

Retention

A CUDO retention system is a hybrid system. It is a combination of a detention system and an infiltration system. A retention system is utilized to attenuate peak flow as well as promote groundwater re-charge. A retention system is outfitted with an overflow pipe at the top of the system which allows the system to fill for infiltration but also outlet if the ground is saturated.

Water Reuse

The purpose of a water-reuse CUDO system is to capture and store water for future use. The system is constructed in a similar fashion to a detention system but instead of a controlled outlet the system is constructed with an emergency overflow. A water reuse system is a Low-Impact Development (LID) device that helps attenuate peak flows as well as conserve water. Water may be reused through an active pump system or passive irrigation.

Inspection/Cleanout Ports

Inspection and cleanout ports are 18-inch diameter vertical risers connected to the uppermost polypropylene CUDO cubes or up to 30-inch manhole access connected to the concrete CUDO. They are used for entrance into the system, or for access to place vacuum truck hoses or water-jetting devices or CCTV equipment. Ports are strategically located near inlet and outlet pipes and in other areas or probable deposition in the system. It is recommended to keep surface level access lids sealed and bolted at all times when the system is in service.

Inlet Bay

Some systems are configured so that pretreatment of the stormwater occurs within the CUDO system. In this case, the CUDO system will house an inlet bay. The inlet bay is separated from the rest of the CUDO system by sidewall plugs and is intended to separate gross pollutants, trash and debris and floatables from the CUDO system and pre-treatment device. The bay contains its own sump area and unique access ports.

Maintenance Overview for CUDO

State and Local regulations require that stormwater storage systems be maintained and serviced on a recurring basis. The purpose of maintaining a clean and obstruction free CUDO system is to ensure the system performs the intended function of the primary design. Trash and debris, floatables, gross pollutants and sediment can build up in the CUDO leading to clogging of the native soil interface or blockage of the inlet or outlet pipes. This can cause the system to function improperly by limiting storage volume, limiting the design percolation rates or impeding flow in and out of the system. Downstream and upstream, areas could run the risk of flooding and deleterious environmental impact.

Recommended Frequency of Service

It is recommended that the CUDO stormwater systems be serviced on a regularly occurring basis. Ultimately the frequency depends on the amount of runoff, pollutant loading, and interference from trash, debris and gross pollutants as well as proper maintenance of upstream pretreatment devices. However, it is recommended that each installation be inspected at least two times per year to assess service needs.

Recommended Timing of Service

Guidelines for the timing of service are as follows:

1. For areas with a definite rainy season the system should be serviced prior to and following the rainy season.
2. For areas subject to year-round rainfall service should occur on a regularly occurring basis. (A minimum of two times per year.)
3. For areas with winter snow and summer rain the system should be serviced prior to and after the snow season.
4. For installed devices that are subject to dry weather flows only (i.e. wash racks, parking garages, etc...) the unit should be serviced on a regularly occurring basis. (A minimum of two times per year.)

Inspection

An inspection should be performed when the system is new. This allows the owner to establish a baseline condition for comparison to future inspections. Sediment build up can typically be monitored without entering the system. (No confined space entry.) Initial and subsequent inspection data should be recorded and filed for reference. Some regulatory agencies require that the results of the inspections be documented and reported. Inspection reports should comply with regulatory requirements and be submitted as required.

Inspection Procedures

5. Locate the inspection, cleanout and access ports. Inspection and cleanout ports are typically 18-inch diameter. Access ports are typically 24-inch or 30-inch diameter. Pictures should be taken to document the location or a site map should be generated to detail the as-built locations of the ports.
6. Unbolt and remove the access port lids.
7. Insert a measuring device into the opening making note of a point of reference to determine the quantity of sediment and other accumulated material. If access is required to measure, ensure only certified confined space entry personnel having appropriate equipment are allowed to enter the system.
8. In addition, for accessible concrete CUDO systems personnel should utilize appropriate confined space entry procedures to enter the system and photograph its condition.
9. Inspect inlet and outlet locations for obstructions. Obstructions should be removed at this time.
10. Inspect the structural components of the system.
11. Fill in the CUDO Inspection/Maintenance Data Sheet and send a copy to the regulatory agency if necessary.

Disinfection of Water Reuse System

Periodic disinfection of water held for reuse may be required to abate bacteria and algae growth. This may be done using calcium hypochlorite tablets or by the addition of an ozone generator in a small recirculation system.

Maintenance

Cleanout of the CUDO system should be considered if there is sediment buildup of two or more inches at over 50% of the inspection ports. Cleaning shall be performed if sediment buildup is two inches or more over 75% of the system floor. In the event of a spill of a foreign substance, cleanout of the system should be considered.

Maintenance Procedures

1. Locate the inspection, cleanout and access ports. Inspection and cleanout ports are typically 18-inch diameter. Access ports are typically 24-inch or 30-inch diameter. Pictures should be taken to document the location or a site map should be generated to detail the as-built locations of the ports.
2. Unbolt and remove the access port lids.
3. Measure the sediment buildup at each port. If access is required to measure ensure only certified confined space entry personnel having appropriate equipment are allowed to enter the system.
4. A thorough cleaning of the system (inlets, outlets, ports, and inlet bays) shall be performed by either a vacuum truck or by manual methods.
5. Inspect inlet and outlet locations for obstructions. Obstructions should be removed at this time.
6. Inspect the structural components of the system.
7. Fill in the CUDO Inspection/Maintenance Data Sheet and send a copy to the regulatory agency if necessary.

Inspection / Maintenance Requirements

Below are some recommendations for equipment and training of personnel to inspect and maintain a CUDO system.

Personnel: OSHA Confined Space Entry Training is a prerequisite for entrance into a system. In the state of California personnel should be CalOSHA certified.

Equipment:
Record Taking (pen, paper, voice recorder)
Proper Clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
Flashlight
Tape Measure
Measuring Stick
Pry Bar
Traffic Control (flagging, barricades, signage, cones, etc.)
First Aid Materials
Debris and Contaminant Containers
Vacuum Truck

Disposal of Gross Pollutants, Hydrocarbons, and Sediment

The collected gross pollutants, hydrocarbons, and sediment shall be offloaded from the vacuum truck into DOT approved containers for disposal. Once in the container the maintenance contractor has possession and is responsible for disposal in accordance with local, state and federal agency requirements.

Note: As the generator, the landowner is ultimately responsible for the proper disposal of the collected materials. Because the material likely contains petroleum hydrocarbons, heavy metals, and other harmful pollutants, the materials must be treated as EPA class 2 Hazardous Waste. Proper disposal is required.

DESIGN COMPUTATIONS FOR:

CUDO® WATER STORAGE SYSTEM

PREPARED FOR:

Oldcastle Precast - Stormwater
7921 Southpark Plaza, #200
Littleton, Colorado 80120

PREPARED BY:

Terrain Engineering, Inc.
3609 Maidu Place
Davis, California 95618
Voice: (916) 952-0704
Fax: (530) 792-1008
email: cwgilley@sbcglobal.net

OBJECTIVE:

Determine the distributed load acting on the CUDO Water Storage Cube per AASHTO LRFD for live loads and earth loads and recommended minimum and maximum cover heights.

OVERVIEW:

The CUDO Water Storage Cube is manufactured from polypropylene by an injection molding process. The cubes consist of two halves that join together at the spring line of the circular opening of the cube, as well as a top and bottom grate. The cubes will be assembled and installed in rows and columns with no spacing between units.

Our evaluation included review of third party compressive test data, live and earth load calculations, and finite element analysis of the expected cube performance when subjected to live loads in a minimum cover scenario. Structural performance of the cube was assessed using current AASHTO procedures for design of thermoplastic culverts.

LABORATORY TESTING:

CUDO Stormwater Products, Inc. retained Testing Engineers, Inc. of San Leandro, California to perform a compressive test on three 24-in X 24-in x 24-in CUDO cubes. The testing was performed in general conformance with ASTM D2412, Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading. (A copy of this test report is included for reference.) It should be noted at the time this testing was completed there was/is no ASTM test uniquely tailored for modular filtration systems such as the CUDO and it was determined that this test is the most appropriate available test procedure.

The average ultimate load was determined to be 14,036.7lbs (14.0 K) for the 24-in x 24-in x 24-in CUDO cube. The load reference for this laboratory test is approximately 3,500lbs/sq-ft (3.5K/sq-ft).

LIVE LOAD AND EARTH LOAD CALCULATIONS:

Reference AASHTO Section 12-2006 Assumptions:

Load Factors:	Earth Load (EL) – 1.0 Live Load (LL) – 1.75 or As Required
Cover Height:	H = Total Cover Height H_S = Surface Treatment Cover Height H_F = Fill Cover Height
Soil Weight:	Surface = 145pcf Fill = 120pcf
Impact Factor:	IM = 1.3(1-0.125H) where H is cover height in feet
Earth Load:	ELS = H_S X 145pcf ELf = H_f X 120pcf
Live Load (HS20-44):	LL = 16,000 lbs
Wheel Contact Area:	Length (l) = 20-inches Width (w) = 10-inches
Live Load Distribution Factor:	= 1.75
Geogrid Distribution Factor:	= 2.60
Earth Load:	= (SF_{DL}) X (Unit Weight Surface) X (H_S) + (SF_{DL}) X (Unit Weight Fill) X (H_F)
Live Load:	= (IM) X (SF_{LL}) X (Live Load) / Distributed Load Area
Total Load:	= EL + LL

LIVE LOAD AND EARTH LOAD CALCULATIONS (CONTINUED):

The ultimate loading was calculated and then compared to the laboratory test results for ultimate loading of the cubes. The calculations for loading include both live load and earth loads. Although the earth load at minimum cover heights is very minimal in comparison to the live load, the earth loads have been included. The live load and earth load use assumptions as listed above and are in general conformance with AASHTO LRFD. In these calculations, it was assumed that the HS20-44 live load is a point load at surface with no wheel contact area. The load is distributed downward and outward with a distribution factor of 1.75. This is a conservative approach and considers that surface loads are not distributed over the footprint of the wheel contact area. Results of the calculations are found in Table 1.

Cover Height (H) in (in)	Impact Factor (IM)	Live Load Distribution (1.75) sq-in	H20 Live Load Transferred to cube (psi)	Earth Load Transferred to cube (psi)	Total Load Transferred to cube (psi)	Factor of Safety*
0	1.33	0	21280.0	0.0	21280.0	0.00
6	1.31	110	190.0	0.5	190.05	0.13
12	1.29	441	46.8	1.0	47.8	0.51
18	1.27	992	20.4	1.5	22.0	1.11
24	1.25	1764	11.3	2.0	13.3	1.82
30	1.23	2756	7.1	2.5	9.6	2.52
36	1.21	3969	4.9	3.0	7.9	3.08
42	1.19	5402	3.5	3.5	7.0	3.45
48	1.17	7056	2.6	4.0	6.7	3.64
54	1.14	8930	2.1	4.5	6.6	3.69
60	1.12	11025	1.6	5.0	6.7	3.65
66	1.10	13340	1.3	5.5	6.9	3.54
72	1.08	15876	1.1	6.0	7.1	3.41
78	1.06	18632	0.9	6.5	7.5	3.26
84	1.04	21609	0.8	7.0	7.8	3.11
90	1.02	24806	0.7	7.6	8.2	2.96
96	1.00	28224	0.6	8.1	8.6	2.82

*For design situations exceeding 60-inches of cover, please contact the manufacturer for additional analysis.

Table 1

LIVE LOAD AND EARTH LOAD CALCULATIONS (CONTINUED):

Additional analysis was performed to determine the benefit of utilizing a geo-grid layer between the live load and the cubes. Using a program called Spectra Pave3 Version 1.0 developed by Tensar International Corporation it was found that when based on poor quality soil material (CBR 1 or R factor 5+/-) the spread factor is 2.60. This result is based on using Tensar geo-grid BX1200 or equal. The new load distribution factor was incorporated into the calculations and the results can be found in Table 2.

Cover Height (H) in (in)	Impact Factor (IM)	Live Load Distribution (2.6) sq-in	H20 Live Load Transferred to cube (psi)	Earth Load Transferred to cube (psi)	Total Load Transferred to cube (psi)	Factor of Safety*
0	1.33	0	21280.0	0.0	21280.0	0.00
6	1.31	243	86.1	0.5	86.6	0.28
12	1.29	973	21.2	1.0	22.2	1.10
18	1.27	2190	9.3	1.5	10.8	2.26
24	1.25	3894	5.1	2.0	7.1	3.40
30	1.23	6084	3.2	2.5	5.7	4.23
36	1.21	8761	2.2	3.0	5.2	4.65
42	1.19	11925	1.6	3.5	5.1	4.75
48	1.17	15575	1.2	4.0	5.2	4.65
54	1.14	19712	0.9	4.5	5.5	4.45
60	1.12	24336	0.7	5.0	5.8	4.21
66	1.10	29447	0.6	5.5	6.1	3.96
72	1.08	35044	0.5	6.0	6.5	3.72
78	1.06	41128	0.4	6.5	7.0	3.49
84	1.04	47699	0.3	7.0	7.4	3.28
90	1.02	54756	0.3	7.6	7.9	3.10
96	1.00	62300	0.3	8.1	8.3	2.92

*For design situations exceeding 60-inches of cover, please contact the manufacturer for additional analysis.

Table 2

FINITE ELEMENT ANALYSIS:

A finite element analysis for the CUDO cube was performed using a finite element program, Visual Analysis 5.5, by Integrated Engineering Software (www.iesweb.com). The model is 3-D with 2-D plate elements incorporating material stiffness with HS20-44 truck live loading, earth load, dead load and soil lateral loading.

For this analysis, the following loadings and assumptions were utilized:

Live Load (LL) is H20-44 impacted for 2 ft cover, but applied at 3 ft cover

Earth Load (ELV) is applied vertically at 130pcf for cover weight

Earth Load (ELL) is applied laterally at 120pcf using an active lateral earth pressure coefficient (ka) = 0.33

Dead Load (DL) is the weight of the CUDO cube itself. This number is relatively small in comparison to the earth load and live load and is left at zero for this analysis.

Material Stiffness = 75 ksi

Tensile Strength = 3.5 ksi

Material Thickness = 0.170 inch

The results of the analysis indicate that the greatest tensile stress for the 3 ft cover to finished grade is 1.25 ksi located near the point of joining the top and bottom half cubes. This allows for a Safety factor of 2.8 when compared to industry reported tensile strength of 3.5 ksi. The greatest tensile stress for 5 ft of cover to finished grade is 1.51 ksi. This results in a Safety Factor of 2.3 when compared to the industry reported tensile strength of 3.5 ksi.

CONCLUSION:

The CUDO cube can be installed with a minimum of 2ft of cover measured from the finished grade to the top of the cube with a geo-grid, Tensar BX1200 or equivalent, placed in the cover in accordance with the manufacturer's recommendations. Calculations indicate that the addition of the geo-grid helps to reduce point loads and live loads on the cube allowing for a safety factor of 3.4 at this depth. The analysis additionally supports the installation of the CUDO cube to a depth of 5ft measured from the top of the cube to finished grade. Backfill material shall be constructed per project geotechnical engineer requirements. Backfill construction equipment shall not apply loading greater than the design loading of 0.97K/sq-ft. For desired installation depths shallower or in excess of these recommendations the manufacturer should be contacted.

CUDO® CUBES

OUR MARKETS

BUILDING STRUCTURES

COMMUNICATIONS

WATER

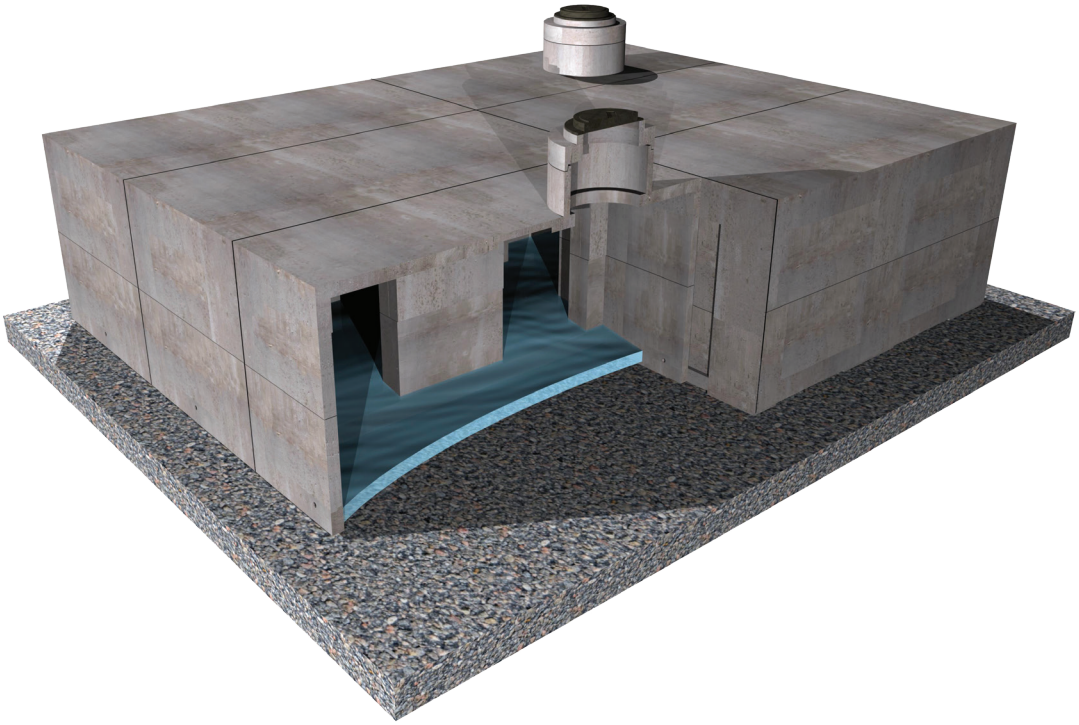
ENERGY

TRANSPORTATION

Oldcastle Infrastructure™
A CRH COMPANY

STORMCAPTURE®

Inspection and Maintenance Guide



Water

Description

The StormCapture® system is an underground, modular, structural precast concrete storage system for stormwater detention, retention, infiltration, harvesting and reuse, and water quality volume storage. The system's modular design utilizes multiple standard precast concrete units with inside dimensions of 7 feet by 15 feet (outside dimensions of 8 feet by 16 feet) to form an underground storage system. The inside height of the StormCapture system can range from 2 feet to 14 feet. This modular design provides limitless configuration options for site-specific layouts.

StormCapture components can be provided as either open-bottom modules to promote infiltration or closed-bottom modules for detention. In some cases, StormCapture modules can be placed in a checkerboard configuration for an even more efficient design. A Link Slab, with a footprint of 9 feet by 17 feet, is then used to bridge each space without a module.

The standard StormCapture design incorporates lateral and longitudinal passageways between modules to accommodate internal stormwater conveyance throughout the system. These passageways may be classified as either a "window configuration" with standard 12-inch tall sediment baffles extending up from the floor of the module to the bottom of the window, or a "doorway configuration" without the sediment baffles. The function and drainage rate of a StormCapture system depends on site-specific conditions and requirements.

Stormwater typically enters the StormCapture system through an inlet pipe. Grated inlets can also be used for direct discharge into the system. The StormCapture system is rated for H-20 traffic loading with limited cover. Higher load requirements can also be accommodated. In addition, StormCapture systems are typically equipped with a limited number of maintenance modules that provide access to the system for ongoing inspection and maintenance.

Function

The StormCapture system is primarily used to manage water quantity by temporarily storing stormwater runoff from impervious surfaces to prevent flooding, slow down the rate at which stormwater leaves the site, and reduce receiving stream erosion. In addition, the StormCapture system can be used to capture stormwater runoff for water quality treatment. Regardless of how the StormCapture system is used, some sedimentation may occur in the modules during the time water is stored.

Configurations

The configuration of the StormCapture systems may vary, depending on the water quality and/or quantity requirements of the site. StormCapture configurations for detention, retention/infiltration, and retention/harvesting are described below.

Detention

StormCapture Detention systems are designed with a closed bottom to detain stormwater runoff for controlled discharge from the site. This design may incorporate a dead storage sump and a permanent pool of water if the outlet pipe is higher than the floor elevation. Discharge from the system is typically controlled by an outlet orifice and/or outlet weir to regulate the rate of stormwater leaving the system. StormCapture Detention systems are typically designed with silt-tight joints, however when conditions exist that require a StormCapture system to be watertight, the system may be wrapped in a continuous, impermeable geomembrane liner. If the StormCapture Detention system includes Link Slabs, a liner must be used to detain water since the chambers under each Link Slab have no floor slab. In this case, care must be taken by maintenance personnel not to damage the exposed liner beneath each Link Slab.

Retention/Infiltration

StormCapture Retention/Infiltration systems are designed with an open bottom to allow for the retention of stormwater onsite through infiltration into the base rock and surrounding soils. For infiltration systems, the configuration of the base of the StormCapture system may vary, depending on the needs of the site and the height of the system. Some systems may use modules that have fully open bottoms with no concrete floor, while other systems may use modules that incorporate floor openings in the base of each module. These are typically 24-inch by 24-inch openings. For open-bottom systems, concrete splash pads may be installed below inlet grate openings and pipe inlets to prevent erosion of base rock. A StormCapture Infiltration system may have an elevated discharge pipe for peak overflow.

Retention/Harvesting

StormCapture Retention/Harvesting systems are similar to detention systems using closed-bottom modules, but stormwater is typically retained onsite for an extended period of time and later reused for non-potable applications or irrigation. For rainwater harvesting systems, an impermeable geomembrane liner is typically installed around the modules to provide a water-tight system.

Inspection and Maintenance Overview

State and local regulations typically require all stormwater management systems to be inspected on a regular basis and maintained as necessary to ensure performance and protect downstream receiving waters. Inspections should be used to evaluate the conditions of the system. Based on these inspections, maintenance needs can be determined. Maintenance needs vary by site and system. Using this Inspection & Maintenance Guide, qualified maintenance personnel should be able to provide a recommendation for maintenance needs. Requirements may range from minor activities such as removing trash, debris or pipe blockages to more substantial activities such as vacuuming and removal of sediment and/or non-draining water. Long-term maintenance is important to the operation of the system since it prevents excessive pollutant buildup that may limit system performance by reducing the operating capacity and increasing the potential for scouring of pollutants during periods of high flow.

Only authorized personnel shall inspect and/or enter a StormCapture system. Personnel must be properly trained and equipped before entering any underground or confined space structure. Training includes familiarity with and adherence to any and all local, state and federal regulations governing confined space access and the operation, inspection, and maintenance of underground structures.

Inspection and Maintenance Frequency

The StormCapture system should be inspected on a regular basis, typically twice per year, and maintained as required. The maintenance frequency will be driven by the amount of runoff and pollutant loading encountered by a given system. Local jurisdictions may also dictate inspection and maintenance frequencies.

Inspection Equipment

The following equipment is helpful when conducting StormCapture inspections:

- Recording device (pen and paper form, voice recorder, iPad, etc.)
- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Confined space entry equipment, if needed
- Flashlight
- Tape measure
- Measuring stick or sludge sampler
- Long-handled net (optional)

Inspection Procedures

A typical StormCapture system provides strategically placed access points that may be used for inspection. StormCapture inspections are usually conducted visually from the ground surface, without entering the unit. This typically limits inspection to the assessment of sediment depth, water drain down, and general condition of the modules and components, but a more detailed assessment of structural condition may be conducted during a maintenance event.

To complete an inspection, safety measures including traffic control should be deployed before the access covers are removed. Once the covers have been removed, the following items should be inspected and recorded (see form provided at the end of this document) to determine whether maintenance is required:

- Observe inlet and outlet pipe penetrations for blockage or obstruction.
- If possible, observe internal components like baffles, flow control weirs or orifices, and steps or ladders to determine whether they are broken, missing, or possibly obstructed.
- Observe, quantify, and record the sediment depths within the modules.
- Retrieve as much floating trash as possible with a long-handled net. If a significant amount of trash remains, make a note in the Inspection & Maintenance Log.
- For infiltration systems, local regulations may require monitoring of the system to ensure drain down is occurring within the required permit time period (typically 24 to 72 hours). If this is the case, refer to local regulations for proper inspection procedure.

Maintenance Indicators

Maintenance should be scheduled if any of the following conditions are identified during the inspection:

- Inlet or outlet piping is blocked or obstructed.
- Internal components are broken, missing, or obstructed.
- Accumulation of more than six inches of sediment on the system floor or in the sump, if applicable.
- Significant accumulation of floating trash and debris that cannot be retrieved with a net.
- The system has not drained completely after it hasn't rained for one to three days, or the drain down does not meet permit requirements.
- Any hazardous material is observed or reported.

Maintenance Equipment

The following equipment is helpful when conducting StormCapture maintenance:

- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Confined space entry equipment, if needed
- Flashlight
- Tape measure
- Vacuum truck

Maintenance Procedures

Maintenance should be conducted during dry weather when no flow is entering the system. Confined space entry is usually required to maintain the StormCapture. Only personnel that are OSHA Confined Space Entry trained and certified may enter underground structures. Once safety measures such as traffic control have been deployed, the access covers may be removed and the following activities may be conducted to complete maintenance:

- Remove trash and debris using an extension on the end of the boom hose of the vacuum truck. Continue using the vacuum truck to completely remove accumulated sediment. Some jetting may be necessary to fully evacuate sediment from the system floor or sump. Jetting is acceptable in systems with solid concrete floors or base slabs (referred to as closed-bottom systems). However, jetting is not recommended for open-bottom systems with a gravel foundation since it may cause bedding displacement, undermining of the foundation, or internal disturbance.
- All material removed from the system during maintenance must be disposed of in accordance with local regulations. In most cases, the material may be handled in the same manner as disposal of material removed from sumped catch basins or manholes.
- Inspect inlet and outlet pipe penetrations for cracking and other signs of movement that may cause leakage.
- Inspect the concrete splash pads (applicable for open-bottom systems only) for proper function and placement.
- Inspect the system for movement of modules. There should be less than 3/4-inch spacing between modules.
- Inspect the general interior condition of modules for concrete cracking or deterioration. If the system consists of horizontal joints as part of the modules, inspect those joints for leakage, displacement or deterioration.

Be sure to securely replace all access covers, as appropriate, following inspection and/or maintenance. If the StormCapture modules or any of the system components show significant signs of cracking, spalling, or deterioration or if there is evidence of excessive differential settlement between modules, contact Oldcastle Infrastructure at **800-579-8819.**

StormCapture
Inspection & Maintenance Log

Refer to as-built records for details about system size and location onsite

Location _____

System Configuration:

Inspection Date _____

☐ Detention ☐ Infiltration ☐ Retention/Harvesting

Inlet or Outlet Blockage or Obstruction

Notes:

☐ Yes ☐ No

Condition of Internal Components

Notes:

☐ Good ☐ Damaged ☐ Missing

Sediment Depth Observed

Notes:

☐ Inches of Sediment: _____

Trash and Debris Accumulation

Notes:

☐ Significant ☐ Not Significant

Drain Down Observations

Notes:

☐ Appropriate Time Frame ☐ Inappropriate Time Frame

Maintenance Requirements

☐ **Yes - Schedule Maintenance** ☐ **No - Inspect Again in _____ Months**

STORMCAPTURE®

OUR MARKETS

BUILDING STRUCTURES

COMMUNICATIONS

WATER

ENERGY

TRANSPORTATION