APPENDIX P -
POST-CONSTRUCTION STORMWATER MANAGEMENT PLAN

VENTURA COUNTYWIDE STORMWATER QUALITY PROGRAM
POST-CONSTRUCTION STORMWATER MANAGEMENT PLAN (PCSMP)
FOR
Camarillo Springs TTM 6016 (SW #0034)
PARCEL #: 234-004-0-59

Project Name: Camarillo Springs TTM 6016 (SW #0034)

Preparation/Revision Date: **Approved 3/5/2019 (Revised 06/2020)**

Prepared for:

Name of Owner/Developer:	NUWI
Stress Address:	1733 Ocean Ave, Suite #350
City, State, Zip Code:	Santa Monica, CA 90401
Telephone:	310-394-3379

Prepared by:

Name and Title of Preparer:	Daniel Lopez (Associate Engineer)
Company Name:	Encompass Consultant Group, Inc.
Stress Address:	333 N. Lantana St. #287
City, State, Zip Code:	Camarillo, CA 93010
Telephone:	805-586-2979

I hereby certify that the information provided in this Application is correct.

Application Prepared by: Daniel Lopez / Encompass Consultant Group, Inc.
Print Name and Firm

Signed
Signature of Project Engineer in the Firm Named Above

Title: Associate Engineer, Encompass Consultant Group, Inc.

Affix Professional registration stamp of the person named above with signature and expiration date

Project Name: Camarillo Springs TTM 6016 (SW #0034)

STEP 1: DETERMINE PROJECT APPLICABILITY

Instructions:
For new development projects, answer yes, no, or NA to questions (1) - (10) below.
For redevelopment projects , answer yes, no, or NA to questions (11) - (13) below.

NEW DEVELOPMENT PROJECTS	
Does the new development project fall within categories (1) - (10) below?	
Project Type and/or Characteristics	**Y/N/NA**
1) Development projects equal to 1 acre or greater of disturbed area that adds more than 10,000 square feet of impervious surface area **→go to Step 2**	Y
2) Industrial parks with 10,000 square feet or more of total altered surface area **→go to Step 2**	N/A
3) Commercial strip malls with 10,000 square feet or more of impervious surface area **→go to Step 2**	N/A
4) Retail gasoline outlets with 5,000 square feet or more of total altered surface area **→go to Step 2**	N/A
5) Restaurants (Standard Industrial Classification (SIC) of 5812) with 5,000 square feet or more of total altered surface area **→go to Step 2**	N/A
6) Parking lots with 5,000 square feet or more of impervious surface area, or with 25 or more parking spaces **→go to Step 2**	N/A
7) Streets, roads, highways, and freeway construction of 10,000 square feet or more of impervious surface area **→ go to Roadway Projects**	N
8) Automotive service facilities (Standard Industrial Classification (SIC) of 5013, 5014, 5511, 5541, 7532-7534 and 7536-7539) of 5,000 square feet or more of total altered surface area **→go to Step 2**	N/A
9) Projects located in or directly adjacent to, or discharging directly to an Environmentally Sensitive Area (ESA), where the development will: a. Discharge stormwater runoff that is likely to impact a sensitive biological species or habitat; and b. Create 2,500 square feet or more of impervious surface area **→go to Step 2**	N/A
10) Single-family hillside homes (see Section 2 of the TGM for specific requirements) **→go to SF Hillside**	N/A

Project Name: Camarillo Springs TTM 6016 (SW #0034)

PROJECT APPLICABILITY, CONT.

REDEVELOPMENT PROJECTS	
For redevelopment projects that fall within categories (1) through (9) above, and that conduct land-disturbing activities that result in the creation, or addition, or replacement of 5,000 square feet or more of impervious surface area on an already developed site, answer questions 11-13 below.Existing single-family dwelling and accessory structures are exempt from redevelopment projects unless such projects create, add, or replace 10,000 square feet of impervious surface area.	
Project Type and/or Characteristics	**Y/N/NA**
11) Projects where redevelopment results in an alteration to more than fifty percent of impervious surfaces of a previously existing development, and the existing development was not subject to the post development stormwater quality control requirements of Board Order 00-108, these projects must mitigate the entire redevelopment project area **→go to Step 2**	N/A
12) Projects where redevelopment results in an alteration to more than fifty percent of impervious surfaces of a previously existing development, and the existing development was subject to the post development stormwater quality control requirements of Board Order 00-108, the project must mitigate only the altered portion of the redevelopment project area and not the entire project area **→go to Step 2**	N/A
13) Projects where redevelopment results in an alteration of less than fifty percent of impervious surfaces of a previously existing development these projects must mitigate only the altered portion of the redevelopment project area and not the entire project area **→go to Step 2**	N/A

Project Name: Camarillo Springs TTM 6016 (SW #0034)

STEP 2: ASSESS SITE CONDITIONS

Provide an assessment of the project site using the following tables

New Development Project General Characteristics

General Project Characteristics	Area (acres)
Total Project Site Area	182.00
Total Disturbed Area	182.00
Total Existing (Pre-Project) Impervious Area	6.37
Post-Project Impervious Area [1]	27.84
Area of Green Roof (ET-1) [1]	0.00
Area Draining to Hydrologic Source Controls (ET-2) [1]	0.00
Revised Post-Project Impervious Area	27.84
Project Imperviousness (%)	15.30%

Redevelopment Project General Characteristics

General Project Characteristics	Area (acres)
Total Project Site Area	
Total Altered Area [6]	
Total Existing (Pre-Project) Impervious Area	
Was existing (pre-project) impervious area subject to post-development stormwater quality control requirements? [2]	
Amount of Existing Impervious Area Altered [3]	
Amount of Impervious Area Added	
% Alteration of Existing Impervious Area [4]	N/A
Post-Project Impervious Area (Impervious Area to be Mitigated) [1], [4]	0.00
Area of Green Roof (ET-1) [1]	
Area Draining to Hydrologic Source Controls (ET-2) [1]	
Revised Post-Project Impervious Area	0.00
Project Imperviousness (%) [5]	

Project Name: Camarillo Springs TTM 6016 (SW #0034)

Project Description

Briefly describe project:
The project is a 182-acre residential and golf course development. There will be a pond to include storage for stormwater as a detention basin. The housing will include 1/8 acre lots. The development will include housing, neighborhood parks, walking trails, open space, a pond and a maintenance area. The residential component of the development is 34.8 acres, while the remaining acreage will be an active golf course.
Describe current and proposed zoning and land use designation:
The current site is a golf course.
Describe topography of project area. Identify low and high points and the location of steep slopes (provide a range of grades):
The topography is relatively flat. It is the valley that is surrounded by mountains. The project area is currently mapped as a flood hazard.
Describe the site's soil types (A, B, C, D) and geological conditions
The soil has a mixture of soil types B, C and D with shallow ground water. *Attach soil type information*

Project Name: Camarillo Springs TTM 6016 (SW #0034)

Project Description, cont'd

Describe the site's groundwater conditions (e.g. depth to seasonal high groundwater):
The site has high groundwater which makes infiltration options not feasible. Refer to Geolabs infeasibility analysis dated October 19, 2018.

Is there offsite drainage on the site? If so, identify the location(s) and source(s) of offsite drainage and the volume of water running onto the site:
The water coming onto the site will either go into the proposed pond or into an 10'x6' box culvert which conveys the water out of the site. The 10'x6' box and overall flood control is being designed by PACE Engineering. Flows from tributary areas in the mountain ranges surrounding the project will drain toward the 10'x6' box culvert that discharges into Conejo Creek. If the box becomes inundated flows are diverted to an onsite pond for additional storage. The flood waters will not come onto the surface of the project as the pads are elevated above the high-water elevation.
Describe any existing utilities within the project area that would limit the possible locations of certain BMPs:
There are no known existing utilities limiting BMPs.
Describe any environmentally sensitive areas (e.g. riparian areas, wetlands) within the project area:
There are no enviroenmentally sensitive area within the project area.

Geotechnical considerations:	
Does the site contain any of the following characteristics:	**Y/N/NA**
Collapsible Soil	N
Expansion Soil	Y
Potential for seismically-inducted soil liquefaction	N
Additional considerations:	
The groundwater within the project area is high and does not allow for significant infiltration.	
Attach relevant geotechnical information	

Project Name: Camarillo Springs TTM 6016 (SW #0034)

STEP 2: POLLUTANTS OF CONCERN

Pollutants of Concern (See Section 3.3 of TGM)

Activity / Potential Land Uses	Potential Pollutant*								
	Sediment	Nutrients	Metals	Pesticides	Oxygen Demanding Substances	Toxic Organics	Oil & Grease	Bacteria	Trash and Debris
Home Subdivisions	X	X			X			X	X
Parking Lots	X		X		X	X			X
Residential Use	X		X				X		
Other [fill in if necessary]									

*Denote potential pollutant with "x"

Receiving Waterbody Listings (see Section 3.3. of TGM)

Receiving Waterbody (watershed indicated in parentheses)	**Constituent Group [7]**	**Distance to Project (ft)**
Calleguas Creek watershed above Potrero Rd (Calleguas Creek)	Bacteria, Salts, Trash, Metals, Nutrients, Pesticides, PCBs, Sediment	1000.00
Other [fill in if necessary]		

[1] Applicant should enter post-project impervious cover prior to accounting for green roof and hydrologic source control (HSC) credits. Volume reduction provided by green roofs and HSCs are accounted for implicitly in the sizing calcuations for BMPs by assuming the roof area covered by a green roof or the area draining to a HSC is pervious rather than impervious when caluclating the runoff coefficient for the site. Green roofs and HSCs are not required to be considered for all project locations and types. In order to obtain credit, Green Roofs and HSCs must be designed as specified in the TGM. Additional detail on Green Roofs (ET-1) and HSCs (ET-2) can be found in Section 6 of the TGM.

[2] Land-disturbing activity that results in the creation or addition or replacement of less than 5,000 square feet of impervious surface area on an already developed site, or that results in a decrease in impervious area which was subject to the post development stormwater quality control requirements of Board Order 00-108, is not subject to mitigation unless so directed by the local permitting agency

[3] Redevelopment does not include routine maintenance activities that are conducted to maintain the original line and grade, hydraulic capacity, or original purpose of the facility or emergency redevelopment activity required to protect public health and safety. Impervious surface replacement, such as the reconstruction of parking lots and roadways, that does not disturb additional area and maintains the original grade and alignment, is considered a routine maintenance activity. Agencies' flood control, drainage, and wet utilities projects that maintain original line and grade or hydraulic capacity are considered routine maintenance. Redevelopment also does not include the repaving of existing roads to maintain original line and grade.

[4] "% Alteration of Existing Impervious Area" determines the 50% threshold which is key in determining portion of site that must comply with post-construction requirements - see Step 1 redevelopment categories for more detail. The amount of "Post Project Impervious Area" that must adhere to post-construction requirements is dependant on 50% threshold

[5] "Project Imperviousness" is calculated using the "Total Project Area" except when redevelopment projects that must mitigate only the altered portion of the redevelopment project area. In this case, the "Total Disturbed Area" is used to calculate "Project Imperviousness"

[6] For the purposes of this calculation, Total Altered Area shall mean any area that is altered as a result of land disturbance, such as clearing, grading, grubbing, and excavation. This excludes areas used exclusively for temporary stockpiling.

[7] If a waterbody is listed for "toxicity" and the cause and/or contribution to toxicity is known, then the consituent group known to contribute to toxicity are listed here (in lieu of listing "toxicity")

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STEP 3: APPLY SITE DESIGN PRINCIPLES AND TECHNIQUES

Provide a brief description of site design principles and techniques included within the proposed project site.

Site Design Measures [1]	Included? Y/N/NA	Brief Description of the Site Design Measure
Site Planning	Y	The site was planned to include housing, a pond, and a portion of the golf course at the earliest stages of design. The pond is necessary for storage as a detention basin and for flood control.
Protect and Restore Natural Areas	Y	148 acres of the 182 acre project area will remain as golf course use and protected natural areas. The groundwater is high and there is no appicable place for infiltration.
Minimize Land Disturbance	Y	The area of development was minimized through site design.
Minimize Impervious Cover	Y	The site will have a retention pond and a portion of the golf course will remain open.
Apply LID at Various Scales	Y	The site will incorporate catch basin connector pipe screens and low irrigation landscaping.
Implement Integrated Water Resource Management Practices	Y	Low flow irrigation and plumbing will be used for the development.

[1] Refer to Section 4.2 - 4.7 of the TGM for applicable Design Criteria.

Project Name: Camarillo Springs TTM 6016 (SW #0034)

STEP 4: APPLY SOURCE CONTROL MEASURES

Provide a brief description of the source control measures included in the proposed project site.

Site-Specific Source Control Measures[1]	Included? Y/N/NA	Brief Description of the Source Control Measure
S-1: Storm Drain Message and Signage	Y	There will be storm drain signage for all curb inlets.
S-2: Outdoor Material Storage Area Design	Y	There will be a maintenance area on the south east side of the project site where material may be stored outside. This area will drain to a nearby vegetated swale for stormwater treatment.
S-3: Outdoor Trash Storage and Waste Handling Area Design	Y	Trash enclosures will be included for golf clubhouse. The trash enclosures will have an impervious base and a cover. Grading for the trash enclosure areas will not have water drain through the area.
S-4: Outdoor Loading/Unloading Dock Area Design	Y	There is one loading area for the golf clubhouse. The loading area will be covered 3 feet beyond the loading dock and graded to not allow stormwater from surrounding areas to run-on. There will be no storm drain connections.
S-5: Outdoor Repair/Maintenance Bay Design	N	There are no outdoor repair/maintenance bay areas.
S-6: Outdoor Vehicle /Equipment/ Accessory Washing Area Design	Y	There is one vehicle washing area for the golf clubhouse. The wash area will be covered and not allow water in or out of the washing area. The water from washing will ahave a drain that connects to the sewer.
S-7: Fueling Area Design	N	There are no fueling areas.
S-8: Proof of Control Measure Maintenance	Y	Maintenance of the swale and contech treatment will be written into the HOA agreement and the HOA will be responsible for the maintenance of the treatment facility.

[1] Refer to Fact Sheets in Section 5 of the TGM for detailed information and design criteria

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STEP 5: APPLY BMPS TO REDUCE EIA TO <=5%

New development and redevelopment projects (Categories 1-6, 8, and 9) must reduce EIA to <=5%

Step 5a: Calculate Allowable EIA

EIA is defined as impervious area that is hydrologically connected via sheet flow over a hardened conveyance or impervious surface without any intervening medium to mitigate flow volume.

The allowable "EIA" for a project is calculated as:

$$EIA_{allowable} = (A_{project})*(\%_{allowable}) \quad \text{Equation 2-1}$$

Where:

$EIA_{allowable}$ = The maximum impervious area from which runoff can be treated and discharged offsite (and not retained onsite) [acres]

$A_{project}$ = The total project area [acres] [1]

$\%_{allowable}$ = 5 percent

Input:		Units
$A_{project}$ [1]	182.00	Acres
$\%_{allowable}$	5.00%	Percent
$EIA_{allowable}$	**9.10**	Acres

Step 5b: Calculate Impervious Area to be Retained

The impervious area from which runoff must be retained onsite is the total impervious area minus the EIA allowable, which should be calculated as follows:

$$A_{retain} = TIA - EIA_{allowable} = (IMP*A_{project}) - EIA_{allowable} \quad \text{Equation 2-2}$$

Where:

A_{retain} = the drainage area from which runoff must be retained [acres]

TIA = total impervious area [acres]

IMP = imperviousness of project area (%)

Input:		Units
Imperviousness	15.30%	
$A_{project}$ [1]	182.00	Acres
$EIA_{allowable}$	9.10	Acres
A_{retain}	**18.74**	Acres

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BMPS TO REDUCE EIA TO <=5%, CONT.

Step 5c: Calculate the Volume to be Retained (SQDV)

The runoff volume that is to be retained onsite should be calculated using Equation 2-3 below:

$$V_{retain} = C*(0.75/12)*A_{retain}$$ Equation 2-3

Where:

V_{retain} = The stormwater quality design volume (SQDV) that must be retained onsite [ac-ft]

C = runoff coefficient (equals 0.95 for impervious surfaces)

Input:		**Units**
C	0.95	
A_{retain}	18.74	Acres
V_{retain}	1.113	ac-ft
	362,573.0	gallons
	48,468.7	cu.ft.

Continue to Step 5d

Project Name: Camarillo Springs TTM 6016 (SW #0034)

STEP 5d: SELECT RETENTION BMPs

Select and size Retention BMPs to meet the 5% EIA Requirement. Retention BMPs include INF1-6, RWH-1, and ET 1 and 2. See TGM, Section 6 for more information.

Retention BMPs	Included? Y/N	Drainage Area Retained (acres) [2]	Drainage Area Runoff Coefficient	Volume Retained (SQDV) (ac-ft) [1],[2]	If not applicable, state brief reason
Infiltration BMPs					
INF-1: Infiltration Basin			0.95		
INF-2: Infiltration Trench			0.95		
INF-3: Bioretention			0.95		
INF-4: Drywell			0.95		
INF-5: Permeable Pavement			0.95		
INF-6: Proprietary Infiltration			0.95		
INF-7: Bioinfiltration			0.95		
Rainwater Harvesting BMPs					
RWH-1: Rainwater Harvesting			2		
			TOTAL Volume Retained	0.000	ac-ft
				0.0	gallons
				0.0	cu.ft.
			REMAINING Volume to meet 5% EIA requirement	1.1	ac-ft
				362,573	gallons
				48,469	cu.ft.

[1] SQDV Methodology #3 used here.

[2] If a Retention BMP is used more than once on a site (i.e., 2 Infiltration Trenches implemented on one site) then drainage area and volume retained shown here should be additive. A separate BMP sizing worksheet (see Appendix E of the TGM) should be submitted for each BMP.

ADDITIONAL INSTRUCTIONS: Retention BMPs must be used onsite to the maximum extent practicable. If the remaining volume to meet 5% EIA cannot be met, then project applicants must demonstrate technical infeasibilty. Consult Section 3.2 of the 2011 TGM for infeasability criteria. A technical infeasability site-specific analysis must be submitted. Projects that cannot prove technical infeasibility must reduce EIA to <=5% using Retention BMPs.

If onsite Retention BMPs cannot feasibly be used to meet the 5% EIA Requirement, move onto Step 5e; if 5%EIA Requirement is met go to Step 7

	Y/N/NA
A completed copy of the applicable "BMP Sizing Worksheet(s)" for the project's Retention BMPs from Appendix E of the TGM is included as an attachment. BMPs must be sized to meet the SQDV or SQDF (See Section 2 Step 7 of the TGM).	N/A

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STEP 5e: SELECT AND SIZE BIOFILTRATION BMPS TO REDUCE EIA TO <=5%

New development and redevelopment projects that demonstrate technical infeasibility (see Section 3.2 of TGM) for reducing EIA to <= 5% using Retention BMPs are eligible to use Biofiltration BMPs to achieve the 5% EIA Requirement.

	Y/N
Is it technically infeasible for Retention BMPs to meet the 5% EIA Requirement?	Y
If yes, volume-based biofiltration BMPs shall be sized to treat 1.5 times the volume not retained using Retention BMPs.	

ADDITIONAL INSTRUCTIONS: Submit Technical Infeasabillity documentation.

The onsite biofiltered volume ($V_{biofilter}$), should be calculated as follows:

$$V_{biofilter} = (V_{retain} - V_{achieved}) * 1.5 \qquad \text{Equation 2-4}$$

Where:

$V_{biofilter}$ = the volume that must be captured and treated in a Biofiltration BMP [ac-ft]

V_{retain} = the stormwater quality design volume (SQDV) that must be retained [ac-ft]

$V_{achieved}$ = the volume retained onsite using Retention BMPs [ac-ft]

Input		**Units**
$V_{achieved}$	0.000	ac-ft
V_{retain}	1.113	ac-ft
$V_{biofilter}$	**1.67**	ac-ft
	543,860	gallons
	72,703	cu.ft.

BIOFILTRATION BMPs, CONT.

Biofiltration BMPs	Included? Y/N	Drainage Area Biofiltered (acres) [3]	Drainage Area Runoff Coefficient	Volume Biofiltered (1.5xSQDV) (ac-ft) [2],[3]	If not applicable, state brief reason
BIO-1: Bioretention with Underdrain	Y	0.14	0.95	0.012	
BIO-2: Planter Box			0.95		
BIO-3: Vegetated Swale [1]	Y	10.90	0.95	0.971	
BIO-4: Vegetated Filter Strip [1]			0.95		
BIO-5: Proprietary Biotreatment [1]		23.40	0.95	2.084	
TOTAL Volume Biofiltered				3.07	ac-ft
				999,494.2	gallons
				133,612.1	cu.ft
REMAINING Volume to be addressed by Alternative Compliance				0.00	ac-ft
				0.0	gallons
				0.0	cu.ft

[1] BIO-3 and BIO-4 are flow-based and should be calculated using SQDF for sizing (see Table 2-1 of the TGM for the applicable design criteria for sizing). The SQDV is shown here for 5% EIA Requirement compliance purposes only.
[2] SQDV Methodology #3 used here.
[3] If a Biofiltration BMP is used more than once on a site (e.g., 2 Planter Boxes implemented on one site) then drainage area and volume biofiltered shown here be additive. A separate BMP sizing worksheet (see Appendix E of the TGM) should be submitted for each BMP.

If onsite Retention BMPs and/or Biofiltration BMPs cannot feasibly be used to meet the 5% EIA standard, move onto Step 6, otherwise, skip Step 6.

	Y/N/NA
A completed a copy of the applicable "BMP Sizing Worksheet(s)" for the project's Biofiltration BMPs from Appendix E of the TGM is included as an attachment.. BMPs must be sized to meet the 1.5 times SQDV or SQDF (see Section 2, Step 7 of the TGM) requirement. Guidance on flow based design for 150% sizing provided in Table 2-1 of the TGM.	Y

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STEP 7: APPLY TREATMENT CONTRL MEASURES

► *Stormwater runoff from EIA and developed pervious surfaces must be mitigated using Retention BMPs, Biofiltration BMPs, or Treatment Control Measures (See Chapter 6 of TGM).*
► *Treatment Control Measures should be selected per the BMP selection process outlined in Section 3.3 of the TGM.*
► *BMPs must be sized to meet the SQDV or SQDF. See Section 2, Step 7 of the for guidance on calculating the SQDV and SQDF.*

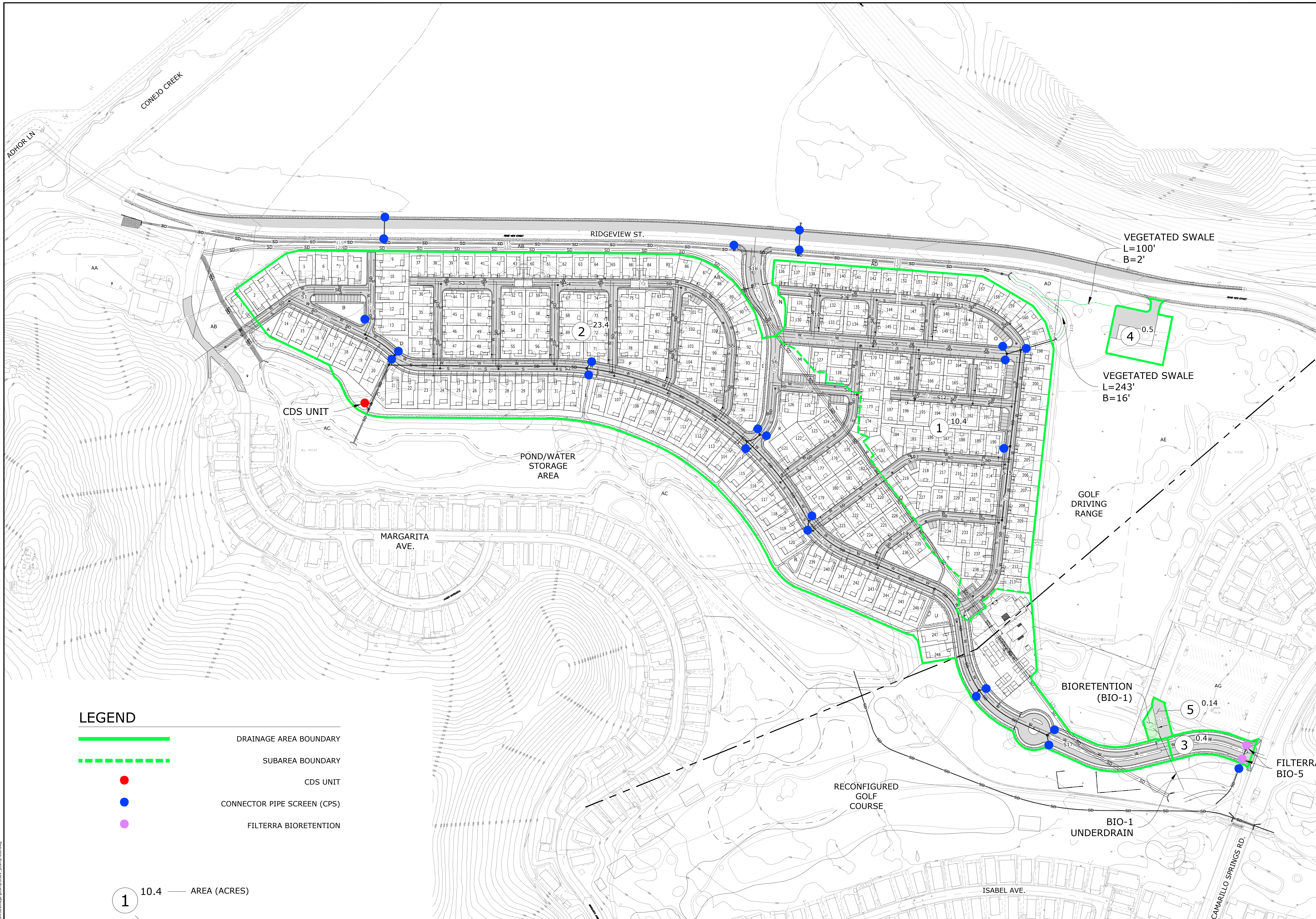
	Y/N
Completed copy of the applicable "BMP Sizing Worksheet(s)" for the project's stormwater BMP(s) from Appendix E of the Technical Guidance Manual is included.	Y

Project Name: Camarillo Springs TTM 6016 (SW #0034)

ADDITIONAL REQUIRED SUBMITTALS

Submit $2,000 fee deposit, and 1 original & 1 copy of PCSMP as well as two electronic copies on 2 CD's with the Excel spreadsheet along with the following submittals to City of Camarillo Public Works Dept.:

Yes	**Site map** that includes: o Property boundary o Major roadways or landmarks o Scale and north arrow o Drainage areas o Surrounding land uses o Presence of Environmentally Sensitive Areas o Open space preservation areas o Impervious areas o Natural hydrologic features o Location of discharge(s) o Existing and planned utilities o Topography (including steep slopes) o Key activities such as outdoor material storage, parking, food preparation, etc. o Potential pollutant areas (e.g., fueling island) o Location of nearby (within 2,000 ft of development project) bus or train station(s) o Location and type of source control measures o Location and type of stormwater BMPs
Yes	**BMP Sizing Worksheet(s) (see Appendix E of TGM); design specifiations and details must also be provided for Green Roofs and Hydrologic Source Controls (ET-1 & 2)**
Yes	Stormwater Treatment Device Access and Maintenance Agreement (Use City of Camarillo Template available at www.cityofcamarillo.org in forms)
Yes	Maintenance Plan (Use City of Camarillo Template available for download at www.cityofcamarillo.org in "forms")
Yes	Technical Infeasibility Analysis – if Retention BMPs cannot be used, the applicant must submit a site-specific analysis showing technical infeasibility as described in Section 3.2 of the TGM. Technical infeasibility may include some (or all) of the components submitted with soil, groundwater and/or geotechnical reports. Technical infeasibility must also account for Rainwater Harvesting. Rainwater Harvesting is not required to be used if the available demands do not meet the volume required for 80% capture using a 72-hour drawndown time (See RWH-1 in Section 6 of the TGM for more detail).
Yes	**Soil Type Information** (may include site specific analyses, available geologic or geotechnical reports and/ or the Ventura Hydrology Manual Soil Map zoomed into site level)
Yes	**Groundwater Information** (may include available groundwater data, site specific redoximorphic analytical/groundwater monitoring results, or known groundwater impacts such as contaminated sites registered with the State Water Board)
Yes	**Geotechnical Reports** (may include site specific analyses with information on collapsible soils, expansive soil, liquefaction, or groundwater mounding analysis)
	Rainwater Harvesting - Include calculations and justification for rainwater harvesting demand. Section 3.2 for guidance of the TGM.



REVISIONS			
MARK	DATE	DESCRIPTION	BY

REVIEWED BY:

DATE

DATE

Encompass Consultant Group
333 N. LANTANA ST, SUITE 287, CAMARILLO, CA 93010
PHONE: 805.322.4443 WEBSITE: WWW.ECGCIVIL.COM

GLEN H. PACE DATE: 05/2020
PROJECT ENGINEER
R.C.E. 61468

TENTATIVE TRACT NO. 6016
CAMARILLO SPRINGS GOLF COURSE
DRAINAGE AREA MAP (DEVELOPED CONDITION)
CAMARILLO, CA

SCALE: HORIZ. 1" = 80' VERT.

WORK ORDER
DRAWN BY: TJS/DL
CHECKED BY: GHP

SHEET NO. 1 OF 1

Sizing Worksheet

AREA 1 - SWALE

Designer: DANIEL LOPEZ Project Proponent: NUWI Date: 10/16/2019 Project: CAMARILLO SPRINGS TTM 6016 Location: CAMARILLO, CA	
Type of Vegetation: (describe)	TBD
Outflow Collection: (Check type used or describe "Other")	____ Grated Inlet ____ Infiltration Trench ____ Underdrain Used X Other HEADWALL AND UNDERGROUND DRAINAGE SYSTEM

Step 1: Determine water quality design flow

1-1. Enter Project area (acres), $A_{project}$ A_{desing}=(Project Total Area)-(Pervious Area)-(5%EIA)=10.4-3.63-0.34	A_{design} = 6.43	acres
1-2. Enter impervious fraction, *Imp* (e.g. 60% = 0.60)	Imp = 1.0	
1-3. Determine pervious runoff coefficient using Table E-1, C_p	C_p = N/A	
1-4. Calculate runoff coefficient, $C = 0.95*imp + C_p\ (1-imp)$ C=0.95 for impervious areas.	C = 0.95	
1-5. Enter design rainfall intensity (in/hr), *i*	i = 0.2	in/hr
1-6. Calculate water quality design flow (cfs), $SQDF = CiA$ =0.95*.2*6.43	SQDF = 1.22	cfs

-1.5*SQDF (SINCE NO RETENTION)	=1.83 CFS
-REMAINING SQDF (PER STEP 7 OF THE TGM, SEE ATTACHMENT)	=0.14 CFS
-TOTAL SQDF TO BE TREATED	**=1.97 CFS**

Step 2: Calculate swale bottom width	
2-1. Enter water quality design flow (cfs), *SQDF*	SQDF = 1.97 cfs
2-2. Enter Manning's roughness coefficient for shallow flow conditions, n_{wq} = *0.2*	n_{wq} = 0.2
2-3. Calculate design flow depth (ft), *y*	y = 0.33 ft
2-4. Enter longitudinal slope (ft/ft) (along direction of flow), *s*	s = 0.019 ft/ft
2-5. Calculate bottom width of swale (ft), $b = (SQDF^{*}n_{wq})/(1.49y^{1.67}s^{0.5})$	(12.22' min.) b = 16' design ft b=16' to convey Q50 runoff
2-6. If *b* is between 2 and 10 feet, go to Step 3	
2-7. If b is less than 2 ft, assume b = 2 ft and recalculate flow depth, $y = ((SQDF^{*}n_{wq})/(2.98\ s^{0.5}))^{0.6}$	y = N/A ft
2-8. If b is greater than 10 ft, one of the following design adjustments must be made (recalculate variables as necessary): • Increase the longitudinal slope to a maximum of 0.06 ft/ft. • Increase the design flow depth to a maximum of 4 in (0.33 ft). • Place a divider lengthwise along the swale bottom (Figure 3-1) at least three-quarters of the swale length (beginning at the inlet). Swale width can be increased to an absolute maximum of 16 feet if a divider is provided.	
Step 3: Determine design flow velocity	
3-1. Enter side slope length per unit height (H:V) (e.g. 3 if side slopes are 3H :1V), *Z*	Z = 4
3-2. Enter bottom width of swale (ft), *b*	b = 16 ft
3-3. Enter design flow depth (ft), *y*	y = 0.33 ft

3-4. Calculate the cross-sectional area of flow at design depth (ft^2), $A_{wq} = by + Zy^2$	A_{wq} = 5.72 ft^2
3-5. Calculate design flow velocity (ft/s), $V_{wq} = SQDF/A_{wq}$	V_{wq} = 0.34 ft/s
3-6. If the design flow velocity exceeds 1 ft/s, go back to Step 2 and change one or more of the design parameters to reduce the design flow velocity. If design flow velocity is less than 1 ft/s, proceed to Step 4.	
Step 4: Calculate swale length	
4-1. Enter hydraulic residence time (minutes, minimum 7 min), t_{hr}	t_{hr} = 7 min
4-2. Calculate swale length (ft), $L = 60 t_{hr} V_{wq}$	L = (143' min.) ft 243' provided
Step 4: Calculate swale length	
4-3. If L is too long for the site, proceed to Step 5 to adjust the swale layout If L is greater than 100 ft and will fit within the constraints of the site, skip to Step 6 If L is less than 100 ft, increase the length to a minimum of 100 ft, leaving the bottom width unchanged, and skip to Step 6	
Step 5: Adjust swale layout to fit within site constraints	:N/A, There is space in the site to fit the swale
5-1. Enter the bottom width calculated in Step 2 (ft), $b_i = b$	b_i = ft
5-2. Enter design flow depth (ft), y	y = ft
5-3. Enter the swale side slope ratio (H:V), Z	Z = ft:ft
5-4. Enter the additional top width above the side slope for the design water depth (ft), $b_{slope} = 2Zy$	b_{slope} = ft
5-5. Enter the initial length calculated in Step 4 (ft), $Li = L$	L_i = ft

5-6. Calculate the top area at the design treatment depth (ft^2), $A_{top} = (b_i + b_{slope}) \times L_i$	A_{top} = 3366.4 ft^2
5-7. Choose a reduced swale length based on site constraints (ft), L_f	L_f = ft
5-8. Calculate the increased bottom width (ft), $b_f = (A_{top}/L_f) - b_{slope}$	b_f = ft
5-9. Recalculate the cross-sectional area of flow at design depth (ft2), $A_{wq,f} = b_f y + Z y^2$	$A_{wq,f}$ = ft^2
5-10. Recalculate design flow velocity (ft/s), $V_{wq} = SQDF / A_{wq}$ Revise design as necessary if design flow velocity exceeds 1 ft/s.	V_{wq} = ft/s
5-11. Recalculate the hydraulic residence time (min), $t_{hr} = L_f/(60 V_{wq})$ Ensure that t_{hr} is greater or equal to 10 minutes.	t_{hr} = min
5-12. When V_{wq} and t_{hr} are recalculated to meet requirements, proceed to Step 6.	

Step 6: Provide conveyance capacity for flows higher than SQDF (if swale is on-line)

6-1. If the swale already includes a high-flow bypass to convey flows higher than the water quality design flow rate, skip this step and verify that all parameters meet design requirements to complete sizing	
6-2. If swale does not include a high-flow bypass, determine that the swale can convey flood control design storm peak flows. Calculate the capital peak flow velocity per Ventura County requirements (ft/s), V_p	V_p = 2.96 ft/s

6-3. If V_p > 3.0 feet per second, return to Step 2 and increase the bottom width or flatten the longitudinal slope as necessary to reduce the flood control design storm peak flow velocity to 3.0 feet per second or less. If the longitudinal slope is flattened, the swale bottom width must be recalculated (Step 2) and must meet all design criteria.	

Area 1 Swale - Remaining SQDF Calculation (Step 7 of the TGM -Method #1)

SQDF $=CIA_{rem.}$

$=0.17*0.2*3.97$

=0.14 cfs

Where:

SQDF = Flow in cubic feet per second (cfs)

C =0.17= runoff coefficient = 0.95*imp+Cp*(1-imp)

Where:

imp = 0.086 = impervious fraction of watershed [(Impervious Area)/(Ar_{em})]

Cp = 0.1 = pervious runoff coefficient, per TGM table below (soil type is 2)

Table 2-3: Ventura Soil Type Pervious Runoff Coefficients

Ventura Soil Type (Soil Number)	C_p value
1	0.15
2	0.10
3	0.10
4	0.05
5	0.05
6	0
7	0

I = 0.2 in/hr = average rainfall intensity (0.2 in/hr for method #1)

$Ar_{em.}$ = 3.97 ac. = tributary drainage area (acres) = (Total Subarea acreage) - (95% of impervious area)

AREA 1 - SWALE
Q50 Conveyance Calculation

Worksheet for Trapezoidal Channel - 1

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data	
Roughness Coefficient	0.040
Channel Slope	0.019 ft/ft
Normal Depth	5.9 in
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	16.00 ft

Results	
Discharge	26.00 cfs
Flow Area	8.8 ft²
Wetted Perimeter	20.0 ft
Hydraulic Radius	5.3 in
Top Width	19.92 ft
Critical Depth	5.0 in
Critical Slope	0.032 ft/ft
Velocity	2.96 ft/s
Velocity Head	0.14 ft
Specific Energy	0.63 ft
Froude Number	0.785
Flow Type	Subcritical

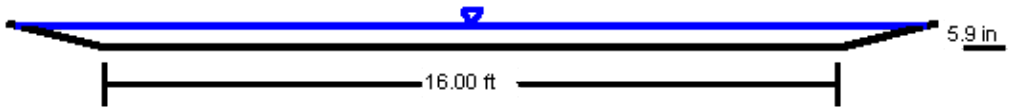
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

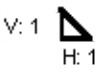
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	(N/A) ft/s
Upstream Velocity	(N/A) ft/s
Normal Depth	5.9 in
Critical Depth	5.0 in
Channel Slope	0.019 ft/ft
Critical Slope	0.032 ft/ft

Cross Section for Trapezoidal Channel - 1

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data	
Roughness Coefficient	0.040
Channel Slope	0.019 ft/ft
Normal Depth	5.9 in
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	16.00 ft
Discharge	26.00 cfs





Sizing Worksheet

AREA 2 - CDS

Designer: DANIEL LOPEZ

Project Proponent: NUWI

Date: 10/16/2019

Project: CAMARILLO SPRINGS TTM 6016

Location: CAMARILLO, CA

Step 1: Determine water quality design flow

1-1. Enter Project area (acres), $A_{project}$ Adesing=(Project Total Area)-(Pervious Area)-(5%EIA)=23-9.33-0.68	A_{design} = 12.99 acres
1-2. Enter impervious fraction, Imp (e.g. 60% = 0.60)	Imp = 1.0
1-3. Determine pervious runoff coefficient using Table E-1, C_p	C_p = N/A
1-4. Calculate runoff coefficient, $C = 0.95*imp + C_p(1-imp)$ C=0.95 for impervious areas.	C = 0.95
1-5. Enter design rainfall intensity (in/hr), i	i = 0.2 in/hr
1-6. Calculate water quality design flow (cfs), $SQDF = CiA = 0.95*0.2*12.99$	SQDF = 2.47 cfs

-1.5*SQDF (SINCE NO RETENTION) =3.71 CFS
-REMAINING SQDF (PER STEP 7 OF THE TGM, SEE ATTACHMENT) =0.32 CFS
-TOTAL SQDF TO BE TREATED =4.03 CFS

Area 2 CDS - Remaining SQDF Calculation (Step 7 of the TGM -Method #1)

SQDF $=CIA_{rem.}$

$=0.16*0.2*10.01$

$=0.32$ cfs

Where:

SQDF = Flow in cubic feet per second (cfs)

C $=0.16=$ runoff coefficient $= 0.95*0.071+0.1*(1-0.071) =0.95*imp+Cp*(1-imp)$

Where:

imp = 0.068 = impervious fraction of watershed [(Impervious Area)/(Ar_{em})]

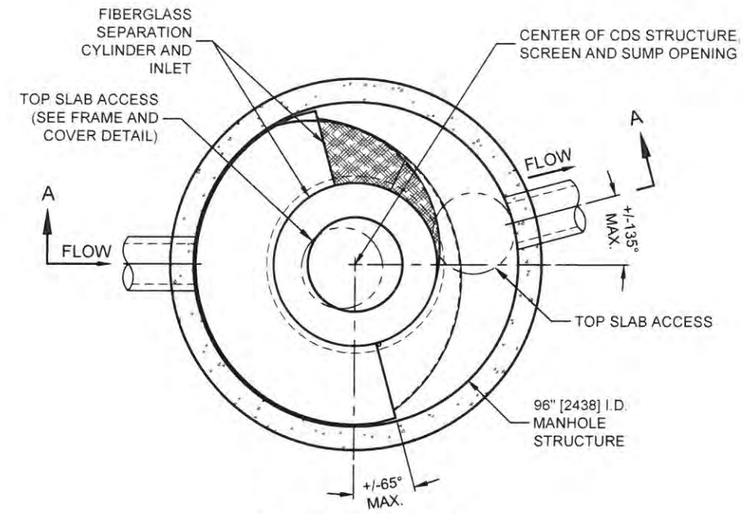
Cp = 0.1 = pervious runoff coefficient, per TGM table below (soil type is 2)

Table 2-3: Ventura Soil Type Pervious Runoff Coefficients

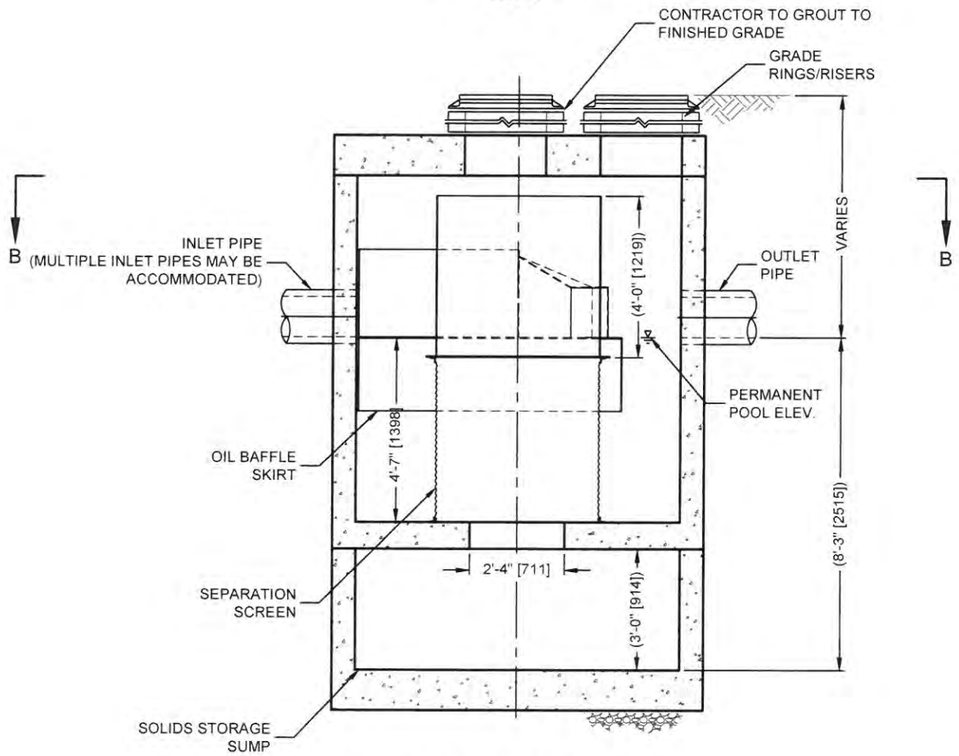
Ventura Soil Type (Soil Number)	C_p value
1	0.15
2	0.10
3	0.10
4	0.05
5	0.05
6	0
7	0

I = 0.2 in/hr = average rainfall intensity (0.2 in/hr for method #1)

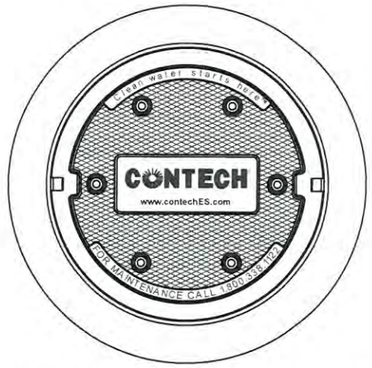
$Ar_{em.}$ = 10.01 ac =tributary drainage area (acres) = (Total Subarea acreage) - (95% of impervious area)



PLAN VIEW B-B
N.T.S.



ELEVATION A-A
N.T.S.



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

CDS4040-8-C DESIGN NOTES

CDS4040-8-C RATED TREATMENT CAPACITY IS 6.0 CFS [169.9 L/s], OR PER LOCAL REGULATIONS. MAXIMUM HYDRAULIC INTERNAL BYPASS CAPACITY IS 30.0 CFS [850 L/s]. IF THE SITE CONDITIONS EXCEED 30.0 CFS [850 L/s], AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

THE STANDARD CDS4040-8-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

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

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	5.05
PEAK FLOW RATE (CFS OR L/s)	OFFLINE
RETURN PERIOD OF PEAK FLOW (YRS)	OFFLINE
SCREEN APERTURE (2400 OR 4700)	4700

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

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

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

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

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

CDS4040-8-C
OFFLINE CDS
CAMARILLO SPRINGS
614161-010

AREA 3 - Filterra

BIO-5: Proprietary Biotreatment

TGM BMP Sizing:

Treatment of 150% SQDF:

Runoff produced from a rainfall event equal to at least 0.2 inches per hour intensity:

- Q_{SQDF} = C x I x A = 0.95 x 0.35 in/hr x (0.29 ac) = 0.10 cfs [Equation 2-15]
  - C = 0.95
  - I =

Table 2-1: Flow-Based Biofiltration BMP Design Intensity for 150% Sizing

Time of Concentration, minutes	Design Intensity for 150% Sizing, in/hr
30	0.24
20	0.25
15	0.28
10	0.31
5	0.35

  - A = 0.3 ac (Impervious) - 0.015 ac ($EIA_{allowable}$) = 0.29 ac

Treatment of $EIA_{allowable}$ and Pervious Area (TGM Step 7):

Runoff produced from a rainfall event equal to at least 0.2 inches per hour intensity:

- Q_{STEP-7} = C x I x A = 0.13 x 0.20 in/hr x (0.115 ac) = 0.003 cfs [Equation 2-15]
  - C = 0.95 * imp + Cp (1-imp) [Equation 2-13]
    - = 0.95 * 0.13+ 0.10 (1-0.13) = 0.21
    - Imp = 0.015 / 0.115 ac = 0.13
  - I = average rainfall intensity (inches/hour) for a duration equal to the time of concentration of the watershed [equal to 0.2 in/hr for method (1)]
  - A = 0.015 ac ($EIA_{allowable}$) + 0.1 ac (Developed Pervious) = 0.115 ac

TOTAL SQDF = 0.10 cfs + 0.003 cfs **= 0.103 cfs** (for two Filterras)

TOTAL SQDF per Filterra = (0.103 cfs)/2 = 0.052 cfs

Proposed Proprietary Biotreatment: Filterra Bioretention Systems (Contech Model FT0404).

- Sizing includes sizing of $EIA_{allowable}$ and Pervious Area
- Treatment capacity for 4' x 4' Filterra Box with 175in/hr media: 0.065cfs > 0.0cfs (0.0505 cfs for 150% SQDF + 0.0087 cfs for TGM Step 7) required above.

Note:

Filterra manufacturer responsible for planting of the system's vegetation and placement of pretreatment mulch layer using mulch certified for use in Filterra systems. Manufacturer also responsible for delivering device with protection in place to resist intrusion of construction related sediment and is responsible for removal of the protection.

AREA 3 - Filterra

Filterra (FT0404) Sizing By Media Infiltration Rates[1]

Media Infiltration Rate	175 in/hr	140 in/hr	100 in/hr
Design Treatment Flowrate[2]	0.052 cfs	0.052 cfs	0.052 cfs
Required Filterra Area	12.84 ft^2	16.05 ft^2	22.47 ft^2

[1]Sizing spreadsheet provided by Contech

[2]Design treatment flowrate per PCSMP attachment, *BIO-5: Proprietary Biotreatment*

Calculations

Filterra Infiltration Rate = 175 (in/hr)

Filterra Flow per Square Foot = 0.00405 ($ft^3/sec/ft^2$)

Filterra Surface Area, Filterra Surface Area = $0.052 ft^3/sec \div 0.00405 ft^3/sec/ft^2$

= 12.84 ft^2

Filterra (FT0404) Surface Area = 16ft^2 (4' x 4') > 12.84ft^2

Sizing Worksheet

AREA 4 - SWALE

Designer: DANIEL LOPEZ Project Proponent: NUWI Date: 02/13/2020 Project: CAMARILLO SPRINGS TTM 6016 Location: CAMARILLO, CA	
Type of Vegetation: (describe)	TBD
Outflow Collection: (Check type used or describe "Other")	____ Grated Inlet ____ Infiltration Trench ____ Underdrain Used X Other Vegetated Swale

Step 1: Determine water quality design flow

1-1. Enter Project area (acres), $A_{project}$ Adesing=(Project Total Area)-(Pervious Area)-(5%EIA)=0.52-0.25-0.01	A_{design} = 0.26	acres
1-2. Enter impervious fraction, *Imp* (e.g. 60% = 0.60)	Imp = 1.0	
1-3. Determine pervious runoff coefficient using Table E-1, C_p	C_p = N/A	
1-4. Calculate runoff coefficient, $C = 0.95*imp + C_p\ (1-imp)$,C=0.95 for impervious areas.	C = 0.95	
1-5. Enter design rainfall intensity (in/hr), *i*	i = 0.2	in/hr
1-6. Calculate water quality design flow (cfs), $SQDF = CiA$ =0.95*0.2*0.26	SQDF = 0.05	cfs

-1.5*SQDF (SINCE NO RETENTION) =0.08 CFS
-REMAINING SQDF (PER STEP 7 OF THE TGM, SEE ATTACHMENT) =0.01 CFS
-TOTAL SQDF TO BE TREATED =0.09 CFS

Step 2: Calculate swale bottom width	
2-1. Enter water quality design flow (cfs), *SQDF*	SQDF = 0.09 cfs
2-2. Enter Manning's roughness coefficient for shallow flow conditions, n_{wq} = *0.2*	n_{wq} = 0.2
2-3. Calculate design flow depth (ft), *y*	y = 0.33 ft
2-4. Enter longitudinal slope (ft/ft) (along direction of flow), *s*	s = 0.02 ft/ft
2-5. Calculate bottom width of swale (ft), $b = (SQDF^{*}n_{wq})/(1.49y^{1.67}s^{0.5})$	(1' min.) 2' design b = ft Swale conveys Q50 flows
2-6. If *b* is between 2 and 10 feet, go to Step 3	
2-7. If b is less than 2 ft, assume b = 2 ft and recalculate flow depth, $y = ((SQDF^{*}n_{wq})/(2.98\ s^{0.5}))^{0.6}$	y = N/A ft
2-8. If b is greater than 10 ft, one of the following design adjustments must be made (recalculate variables as necessary): • Increase the longitudinal slope to a maximum of 0.06 ft/ft. • Increase the design flow depth to a maximum of 4 in (0.33 ft). • Place a divider lengthwise along the swale bottom (Figure 3-1) at least three-quarters of the swale length (beginning at the inlet). Swale width can be increased to an absolute maximum of 16 feet if a divider is provided.	
Step 3: Determine design flow velocity	
3-1. Enter side slope length per unit height (H:V) (e.g. 3 if side slopes are 3H :1V), *Z*	Z = 4
3-2. Enter bottom width of swale (ft), *b*	b = 2 ft
3-3. Enter design flow depth (ft), *y*	y = 0.33 ft

3-4. Calculate the cross-sectional area of flow at design depth (ft^2), $A_{wq} = by + Zy^2$	A_{wq} = 1.1 ft^2
3-5. Calculate design flow velocity (ft/s), $V_{wq} = SQDF/ A_{wq}$	V_{wq} = 0.08 ft/s
3-6. If the design flow velocity exceeds 1 ft/s, go back to Step 2 and change one or more of the design parameters to reduce the design flow velocity. If design flow velocity is less than 1 ft/s, proceed to Step 4.	
Step 4: Calculate swale length	
4-1. Enter hydraulic residence time (minutes, minimum 7 min), t_{hr}	t_{hr} = 7 min
4-2. Calculate swale length (ft), $L = 60 t_{hr} V_{wq}$	L = (34' min.) ft 100' designed
Step 4: Calculate swale length	
4-3. If L is too long for the site, proceed to Step 5 to adjust the swale layout If L is greater than 100 ft and will fit within the constraints of the site, skip to Step 6 If L is less than 100 ft, increase the length to a minimum of 100 ft, leaving the bottom width unchanged, and skip to Step 6	
Step 5: Adjust swale layout to fit within site constraints	:N/A, There is space in the site to fit the swale
5-1. Enter the bottom width calculated in Step 2 (ft), $b_i = b$	b_i = ft
5-2. Enter design flow depth (ft), y	y = ft
5-3. Enter the swale side slope ratio (H:V), Z	Z = ft:ft
5-4. Enter the additional top width above the side slope for the design water depth (ft), $b_{slope} = 2Zy$	b_{slope} = ft
5-5. Enter the initial length calculated in Step 4 (ft), $Li = L$	L_i = ft

5-6. Calculate the top area at the design treatment depth (ft^2), $A_{top} = (b_i + b_{slope}) \times L_i$	A_{top} = 3366.4 ft^2
5-7. Choose a reduced swale length based on site constraints (ft), L_f	L_f = ft
5-8. Calculate the increased bottom width (ft), $b_f = (A_{top}/L_f) - b_{slope}$	b_f = ft
5-9. Recalculate the cross-sectional area of flow at design depth (ft2), $A_{wq,f} = b_f y + Zy^2$	$A_{wq,f}$ = ft^2
5-10. Recalculate design flow velocity (ft/s), $V_{wq} = SQDF / A_{wq}$ Revise design as necessary if design flow velocity exceeds 1 ft/s.	V_{wq} = ft/s
5-11. Recalculate the hydraulic residence time (min), $t_{hr} = L_f/(60V_{wq})$ Ensure that t_{hr} is greater or equal to 10 minutes.	t_{hr} = min
5-12. When V_{wq} and t_{hr} are recalculated to meet requirements, proceed to Step 6.	

Step 6: Provide conveyance capacity for flows higher than SQDF (if swale is on-line)

6-1. If the swale already includes a high-flow bypass to convey flows higher than the water quality design flow rate, skip this step and verify that all parameters meet design requirements to complete sizing	
6-2. If swale does not include a high-flow bypass, determine that the swale can convey flood control design storm peak flows. Calculate the capital peak flow velocity per Ventura County requirements (ft/s), V_p	Swale conveys Q50 flows of V_p = 1.99 ft/s

6-3. If V_p > 3.0 feet per second, return to Step 2 and increase the bottom width or flatten the longitudinal slope as necessary to reduce the flood control design storm peak flow velocity to 3.0 feet per second or less. If the longitudinal slope is flattened, the swale bottom width must be recalculated (Step 2) and must meet all design criteria.	

Area 4 Swale - Remaining SQDF Calculation (Step 7 of the TGM -Method #1)

SQDF $=CIA_{rem.}$

$=0.13*0.2*0.26$

=0.01 cfs

Where:

SQDF = Flow in cubic feet per second (cfs)

C =0.13= runoff coefficient = 0.95*0.04+0.1*(1-0.04) =0.95*imp+Cp*(1-imp)

Where:

imp = 0.04 = impervious fraction of watershed [(Impervious Area)/(Ar_{em})]

Cp = 0.1 = pervious runoff coefficient, per TGM table below (soil type is 2)

Table 2-3: Ventura Soil Type Pervious Runoff Coefficients

Ventura Soil Type (Soil Number)	C_p value
1	0.15
2	0.10
3	0.10
4	0.05
5	0.05
6	0
7	0

I = 0.2 in/hr = average rainfall intensity (0.2 in/hr for method #1)

$Ar_{em.}$ = 0.26 ac =tributary drainage area (acres) = (Total Subarea acreage) - (95% of impervious area)

AREA 4 - SWALE
Q50 Conveyance Calculation

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data	
Roughness Coefficient	0.040
Channel Slope	0.020 ft/ft
Normal Depth	4.0 in
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	2.00 ft

Results	
Discharge	2.22 cfs
Flow Area	1.1 ft²
Wetted Perimeter	4.7 ft
Hydraulic Radius	2.8 in
Top Width	4.67 ft
Critical Depth	3.3 in
Critical Slope	0.040 ft/ft
Velocity	1.99 ft/s
Velocity Head	0.06 ft
Specific Energy	0.40 ft
Froude Number	0.721
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

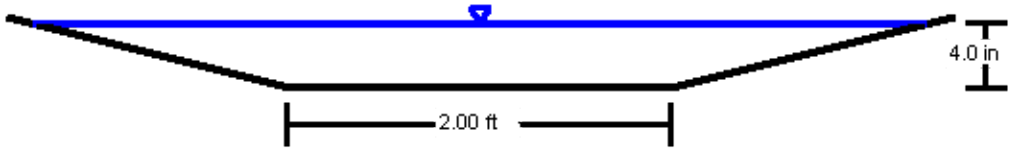
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	(N/A) ft/s
Upstream Velocity	(N/A) ft/s
Normal Depth	4.0 in
Critical Depth	3.3 in
Channel Slope	0.020 ft/ft
Critical Slope	0.040 ft/ft

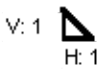
AREA 4 - SWALE
Q50 Conveyance Calculation

Cross Section for Trapezoidal Channel - 1

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data	
Roughness Coefficient	0.040
Channel Slope	0.020 ft/ft
Normal Depth	4.0 in
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	2.00 ft
Discharge	2.22 cfs





Sizing Worksheet

AREA 5 - BIORETENTION

Designer: DANIEL LOPEZ	
Project Proponent: NUWI	
Date: 06/2020	
Project: CAMARILLO SPRINGS TTM 6016	
Location: CAMARILLO, CA	
Type of Vegetation: TBD	
Outflow Collection: DOWNSTREAM CATCH BASIN	
Step 1: Determine water quality design volume	
1-1. Enter Project area (acres), $A_{project}$	$A_{project}$ = 0.14 acres
1-2. Enter the maximum allowable percent of the Project area that may be effective impervious area (refer to permit), ranges from 5-30%, $\%_{allowable}$	$\%_{allowable}$ 5 %
1-3. Determine the maximum allowed effective impervious area (ac), $EIA_{allowable} = (A_{project})*(\%_{allowable})$	$EIA_{allowable}$= 0.007 acres
1-4. Enter Project impervious fraction, *Imp* (e.g. 60% = 0.60)	Imp= 0.62
1-5. Determine the Project Total Impervious area (acres), $TIA=A_{project}*Imp$	TIA= 0.087 acres
1-6. Determine the total area from which runoff must be retained (acres), $A_{retain}=TIA-EIA_{allowable}$	A_{retain} = 0.08 acres
1-7. Determine pervious runoff coefficient using Table E-1, C_p	C_p = N/A
1-8. Calculate runoff coefficient, $C = 0.95*imp + C_p\ (1-imp)$	C = 0.95
1-9. Enter design rainfall depth of the storm (in), P_i	P_i = 0.75 in
1-10. Calculate rainfall depth (ft), $P = P_i/12$	P =0.0625 ft
1-11. Calculate water quality design volume (ft^3),	SQDV= 207 ft^3

-1.5*SQDV = 311 cu. ft.
-Remaining SQDV (TGM Step 7) = 63 cu. ft.

$SQDV=43560 \bullet C^{*}P^{*}A_{retain}$	SQDV Total = **374 cu. ft.**

Step 2: Determine the design percolation rate		
2-1. Enter the design saturated hydraulic conductivity of the amended filter media (2.5 in/hr recommended rate), K_{design}	K_{design} = 2.5	in/hr

Step 3: Calculate Bioretention/Planter Box surface area		
3-1. Enter water quality design volume (ft^3), *SQDV*	SQDV = 374	ft^3
3-2. Enter design saturated hydraulic conductivity (in/hr), K_{design}	K_{design} = 2.5	in/hr
3-3. Enter ponding depth (max 1.5 ft for Bioretention, 1 ft for Planter Box) above area, d_p	d_p = 1	ft
3-4. Calculate the drawdown time for the ponded water to filter through media (hours), $t_{ponding} = (d_p/K_{design}) \times 12$	$t_{ponding}$= 4.8	hrs
3-5. Enter the storm duration for routing calculations (use 3 hours unless there is rationale for an alternative), $T_{routing}$	$T_{routing}$ = 3	hrs
3-6. Calculate depth of water (ft) filtered by using the following two equations: $d_{filtered,1} = (K_{design} \times T_{routing})/12$ $d_{filteret,2} = d_p /2$	$d_{filtered,1}$ = 0.625 $d_{filtered,2}$ = 0.5	ft ft
3.7 Enter the resultant depth (ft) (the lesser of the two calculated above), $d_{filtered}$	$d_{filtered}$ = 0.5	ft
3-8. Calculate the infiltrating surface area as follows (ft^2): $A_{req} = SQDV/(d_p + d_{filtered})$	A_{req} = 250	ft^2

Step 4: Calculate Bioretention Area Total Footprint	
4-1. Calculate total footprint required by including a buffer for side slopes and freeboard (ft^2) [A_{req} is measured at the as the filter bottom area (toe of side slopes)], A_{tot}	A_{tot} = 770 ft^2 Note: 4:1 side slopes and 6" freeboard
Step 5: Calculate Underdrain System Capacity	
To calculate the underdrain system capacity, continue through steps 5-1 to 5-7.	
Step 5: Calculate Underdrain System Capacity	
5-1. Calculated filtered flow rate to be conveyed by the longitudinal drain pipe, $Q_f = K_{design} A_{req}/43{,}200$	Q_f = 0.014 cfs
5-2. Enter minimum slope for energy gradient, S_e	S_e = 0.005
5-3. Enter Hazen-Williams coefficient for plastic, C_{HW}	C_{HW} = 150
5-4. Enter pipe diameter (min 6 inches), D	D = 6 in
5-5. Calculate pipe hydraulic radius (ft), $R_h = D/48$	R_h = 0.125 ft
5-6. Calculate velocity at the outlet of the pipe (ft/s), $V_p = 1.318 C_{HW} R_h^{0.63} S_e^{0.54}$	V_p = 3.05 ft/s
5-7. Calculate pipe capacity (cfs), $Q_{cap} = 0.25\pi (D/12)^2 V_p$	Q_{cap} = 0.6 cfs

Remaining SQDV (Step 7 of the TGM):

SQDV = C*(0.75/12) * 43560*Atreat (Equation 2-15)
= (0.23) * (0.75/12) * 43560 * 0.067 acres
=42 cu. ft.
=1.5*42 cu. ft. **= 63 cu.ft.**

Where:

- SQDV = the stormwater quality design volume runoff (cu. ft.)
- Atreat = drainage area in acres (5% allowed EIA and developed pervious area)
  = **0.067 AC**
- 0.75 = depth (in) [based on sizing method (3)]
- C = Runoff coefficient per
  = 0.95*imp + Cp (1-imp)
  = 0.95*0.10 + 0.15 (1-0.10)
  = 0.23
  - Imp = (5%EIA)/(5%EIA+Pervious Area)
    - 5%EIA = 0.007 acres
    - Perv. Area = 0.06 acres

    Imp = (0.007)/(0.007+0.06)
    = **0.10**
  - Cp = pervious runoff coefficient, based on soil type. Use 0.15 for soil no. 1.

NOTE: The SQDV generated form the pervious area and 5% EIA will be treated together with the SQDV generated from the impervious area in a BIO-1 bmp (shown in the site map). The total SQDV is shown in the BIO-1 sizing worksheet.

RECORDED AT THE REQUEST OF
AND WHEN RECORDED MAIL TO:

City Clerk
City of Camarillo
601 Carmen Drive
Camarillo, California 93010

Recorded for the benefit of City of Camarillo.
No fee required (Government Code §27383)

Covenant and Deed Restriction

Assessor Parcel No(s): 234-0-040-595

STORMWATER TREATMENT DEVICE ACCESS AND MAINTENANCE AGREEMENT FOR PROJECT NO. _____

OWNER: New Urban West, Inc.

PROPERTY ADDRESS: 791 Camarillo Springs Road

THIS AGREEMENT is made and entered into this ____ day of _____, ____, by and between _____ ("Owner") and the City of Camarillo, a general law city and municipal corporation ("City").

1. **RECITALS**. This Agreement is entered into with reference to the following:

   A. Owner owns real property ("Property") in City's jurisdiction, more specifically described in attached Exhibit "A" and shown on the map in Exhibit "B", each of which is incorporated by this reference.

   B. At the time of initial approval of development project known as Camarillo Springs Tentative Tract 6016 on the Property, City required the project to employ on-site control measures to minimize pollutants in urban runoff.

   C. Owner intends to install the following device(s)
(1) Contech CDS 4040-8-C, (2) Bio-3, (24) Catch Basin Connector Pipe Screens, (2) Filterra Bio-5, (1) Bio-1
("Device") as the on-site control measure(s) to minimize pollutants in urban runoff (as shown in the attached Exhibit "C", which is incorporated by this reference, and on the Stormwater Pollution Control or Prevention Plan No. _____.

D. The Device must be installed in accordance with approved plans and specifications shown on City Drawings Nos. C- through C- on file with City Engineer, and incorporated by this reference.

E. The Device, installed on private property and draining only private property, is a private facility and all maintenance or replacement of the Device is the sole responsibility of Owner in accordance with the terms of this Agreement.

F. Owner is aware that periodic and continuous maintenance, including, without limitation, filter material replacement and sediment removal, is required to assure peak performance of the Device, and that such maintenance activity will require compliance with all local, state, or federal laws and regulations, including those pertaining to confined space and waste disposal methods in effect at the time such maintenance occurs.

2. **ACCESS**. Owner grants a license to City's designee for complete access, of any duration, to the Device and its immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by City's Director of Public Works ("Director"), no advance notice, for the purpose of inspection, sampling, testing of the Device, and, in case of emergency, to undertake all necessary repairs or other preventative measures at Owner's expense as provided below. City will make every effort at all times to minimize and avoid interference with Owner's use of the Property.

3. **MAINTENANCE.** Owner will use its best efforts to diligently maintain the Device in a manner assuring peak performance at all times. Refer to the Stormwater Pollution Control/Prevention Plan for further maintenance instructions and the attached Exhibit "C". All reasonable precautions will be exercised by Owner and Owner's representative or contractor in the removal and extraction of material(s) from the Device and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. In October of each year, Owner will provide City with documentation identifying the date of inspection, type and quantity of material(s) removed and disposal destination, and other maintenance performed.

4. **DEFAULT.** Should Owner, or its successors or assigns, fail to accomplish the necessary maintenance contemplated by this Agreement within ten (10) days after being given written notice by City, City is authorized to take any maintenance action needed and charge the entire cost and expense to Owner or Owner's successors or assigns, including administrative costs, attorneys' fees and interest at the maximum rate authorized by law from the date of notice of any expenses incurred by City until paid in full.

5. **SECURITY.** City may require Owner to post security in form and for a time period satisfactory to City to guarantee the performance of this Agreement. Should Owner fail to perform the obligations under this Agreement, City may, in the case of a cash bond, act for Owner using the proceeds from it, or in the case of a surety bond, require the surety to perform the obligations of the Agreement. As an additional remedy, Director may cause the withdrawal of any previous stormwater related approval with respect to the property on which a Device has been installed until such time as Owner repays to City its reasonable costs.

6. **RECORDATION**. This Agreement will be recorded in the Ventura County Recorder's Office at Owner's expense and will constitute notice to all successors and assigns of title to the Property of Owner's obligations, and also a lien in such amount as will fully reimburse City, including interest, subject to foreclosure in event of default in payment.

7. **ENFORCEMENT.** In the event City initiates legal action occasioned by any default or action of Owner, or its successors or assigns, then Owner and its successors or assigns agree to pay all costs incurred by City in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same may become a lien against the Property.

8. **RUNS WITH PROPERTY.** The burdens and benefits in this Agreement constitute covenants that run with the Property and constitute a lien upon the Property.

9. **SUCCESSORS.** This Agreement is binding upon the heirs, successors, executors, administrators and assigns of the parties. The term "Owner" includes not only the present Owner, but also its heirs, successors, executors, administrators, and assigns. Owner will notify any successor to title of all or part of the Property about the existence of this Agreement. Owner will provide this notice before such successor obtains an interest in all or part of the Property. Owner will provide a copy of such notice to City at the same time such notice is provided to the successor.

10. **TIME IS OF ESSENCE**. Time is of essence in the performance of this Agreement.

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

IF TO CITY:

Public Works Department - Stormwater Program
601 Carmen Drive
Camarillo, California 93010

IF TO OWNER:

Chameleon Springs, LLC
PO Box 11480
Beverly Hills, CA 90213
Telephone # 310-556-1001

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

CITY OF CAMARILLO:

City Manager

ATTEST:

City Clerk

APPROVED AS TO FORM BY:
Don Davis, Assistant City Attorney
November 15, 2006

OWNER:

(If a legal entity such as a corporation, partnership, limited liability company, or trust, please print the entity's name and name and title of signer above signature line and then sign. If individual, please print name of signer above signature line.)

Ronald Richards

NOTARIES ON FOLLOWING PAGE

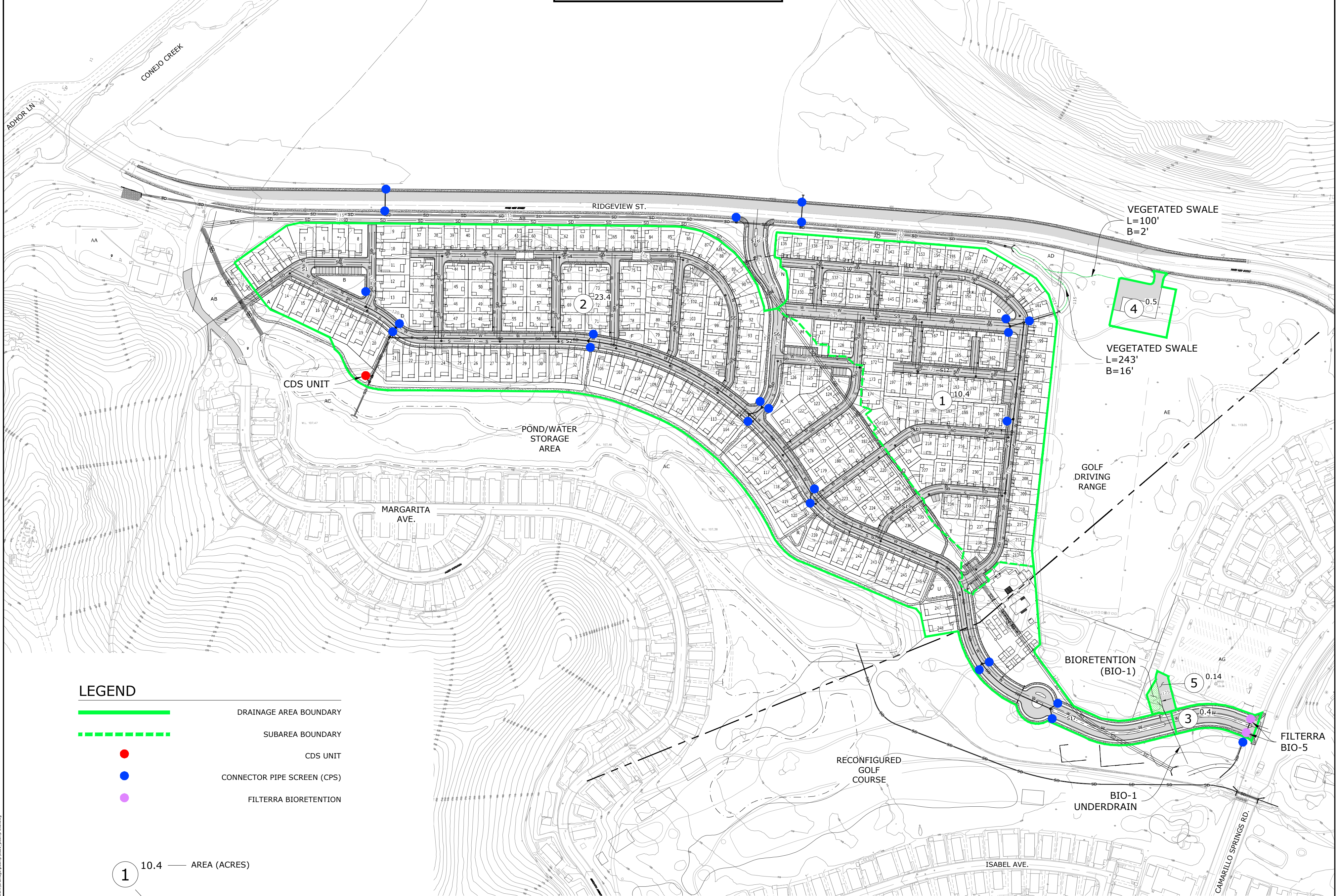
c: Public Works Department (2)
Public Works Stormwater
City GIS Dept.
Owner

EXHIBIT A
(Legal Description)

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE CITY OF CAMARILLO, IN THE COUNTY OF VENTURA, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:
PARCEL 1, IN THE CITY OF CAMARILLO, COUNTY OF VENTURA, STATE OF CALIFORNIA, AS SHOWN ON THAT CERTAIN MAP FILED IN BOOK 32, PAGE 20 OF PARCEL MAPS, IN THE OFFICE OF THE VENTURA COUNTY RECORDER.

APN: 234-0-040-595

Exhibit B



REVISIONS			
MARK	DATE	DESCRIPTION	BY

REVIEWED BY:

DATE

DATE

Encompass Consultant Group
333 N. LANTANA ST, SUITE 287, CAMARILLO, CA 93010
PHONE: 805.322.4443 WEBSITE: WWW.ECGCIVIL.COM

GLEN H. PACE DATE: 05/2020
PROJECT ENGINEER
R.C.E. 61468

TENTATIVE TRACT NO. 6016
CAMARILLO SPRINGS GOLF COURSE
DRAINAGE AREA MAP (DEVELOPED CONDITION)
CAMARILLO, CA

SCALE: HORIZ. 1" = 80' VERT. ______

WORK ORDER
DRAWN BY: TJS/DL
CHECKED BY: GHP
SHEET NO. 1 OF 1

EXHIBIT C
Minimum Maintenance Requirements For Post-Construction Treatment Devices

Maintenance logs will be required by the City of Camarillo in October of each year for all post-construction devices listed below. At a minimum, the maintenance log should include documentation identifying the device, its location, date of inspection, inspector's name and signature, type and quantity of material(s) removed, disposal destination, and other maintenance performed. The California Stormwater BMP Handbooks referred to below can be obtained at www.cabmphandbooks.com and the Ventura County Technical Guidance Manual for Stormwater Quality Control Measures (TGM) can be obtained at www.vcstormwater.org. . If device does not apply, write N/A.

Treatment Device	Minimum Maintenance Requirements/Schedule
Onsite trash enclosures constructed with solid roof that protects against stormwater entering refuse bins.	Inspect yearly prior to October 1 for leaks. Remove solids, stains and/or residue from floor and walls of trash enclosure with dry methods when possible. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer (check with local Sanitation Department before discharging to sewer). Do not hose down area to a storm drain. Refer also to Calif. Stormwater Municipal BMP Handbook – SC-34.
Onsite storm drains & catch basins	All onsite catch basins to be inspected and cleaned at least twice a year. Once immediately prior to October 1 and once in January. Additional cleanings may be required if more than 40% full.
Parking lots & sidewalks	Sidewalks and parking lots to be swept regularly to prevent accumulation of litter and debris. Litter, debris and any cleaning agents will be trapped and collected and disposed of properly to prevent entry into storm drain system. Refer also to Calif. Stormwater Municipal BMP Handbook – SC-43 & SC-71.
TCM-1 Detention Basin *See Ventura County Technical Guidance Manual (5/29/15) for further maint. guidelines* N/A	Inspect basin semiannually, after each significant storm, or more frequently, if needed. Check/correct as required: differential settlement, cracking; erosion, leakage or tree growth on embankment; the condition of the riprap in the inlet, outlet and pilot channels; sediment accumulation in the basin; and the vigor and density of the grass turf on the basin side slopes and floor. Remove litter and debris from banks and basin bottom as required. Repair erosion to banks and bottom as required. Remove sediment when accumulation reaches 25% of original design depth, or if resuspension is observed. Clean in early Spring so vegetation damaged during cleaning has time to reestablish. Inspect outlet for clogging a minimum of twice a year, before and after the rainy season, after large storms, and more frequently if needed. Correct observed problems as necessary. Clean fore bay frequently to reduce frequency of main basin cleaning. Control mosquitoes, as necessary.
BIO-3, 4 Biofilters (Swales Grass Strip Filters) (2 PROPOSED SWALES) *See Ventura County Technical Guidance Manual (5/29/15) for further maint. guidelines*	Check annually for signs of erosion, vegetation loss, and channelization of the flow. The grass should be mowed when it reaches a height of 6 inches. Allowing the grass to grow taller may cause it to thin and become less effective. The clippings should be removed.

Treatment Device	Minimum Maintenance Requirements/Schedule
Media Filter, Clarifier, Wet Vault, Vortex Separator, Hydrodynamic Systems Device Name: CDS Model#: 4040-8-C Mfr.(Name & Address): _____ _____	Follow manufacturer's recommended maintenance specifications. Inspect unit twice during first wet season of operation, setting the cleaning frequency accordingly. Annually inspect for floating debris, sediment buildup, and accumulated petroleum products. Remove accumulated sediment in vault after construction in the drainage area is complete. Recommended frequency of cleaning ranges from one to two years – confirm with manufacturer. Maintenance consists of removal of accumulated material with an educator truck. It may be necessary to remove and dispose of the floatables separately due to the presence of petroleum product. Control mosquitoes, as necessary. Annual maintenance is typical. Refer also to Calif. Stormwater Municipal BMP Handbook – MP-50 & MP-51.
Drain Insert N/A Mfr.(Name & Address): _____ Model: _____	Follow manufacturer's recommended maintenance specifications. At the beginning of the wet season and after significant storms, inspect for proper functioning and remove sediment buildup. After construction, verify that stormwater enters the unit and does not leak around the perimeter. Refer also to Calif. Stormwater Municipal BMP Handbook – MP-52.
Drain Insert – **Connector Pipe Screen (CPS)** **MODEL**: **StormTek ST-3G** (removable half-moon CPS) Mfr.: Advanced Solutions 714-457-3283 www.stormtekCPS.com **Or** **MODEL: Flexstorm CPS (24)** (removable half-moon) Mfr: ADS/Flexstorm 805-904-9923; 866-287-8655 www.ads-pipe.com	Follow manufacturer's recommended maintenance specifications. Inspect quarterly and before and after significant rain events. Clean device and catch basin if 25% or more full of trash and debris. CPS screen may need to be pressured washed; block outlet pipe and vacuum wastewater; do not allow wastewater to exit outlet pipe. May require use of industrial vacuum or vactor truck. Dispose of debris properly.
INF-5 Permeable Pavement *See Ventura County Technical Guidance Manual (5/29/15) for further maint. guidelines* N/A	1. Regularly Inspect pavement or pavers for pools of standing water after rain events, this could indicate clogging. 2. Actively (3-4 times per year) vacuum sweep the pavement to reduce the risk of clogging by frequently removing fine sediments before they can clog the pavement and subsurface layers. 3. Inspect for vegetation growth on pavement and remove when present. 4. Inspect for missing sand/gravel in spaces between pavers and replace as needed. 5. Activities that lead to ruts or depressions on the surface should be prevented or the integrity of the pavement should be restored by patching or repaving. 6. Spot clogging of porous concrete may be remedied by drilling 0.5 inch holes every few feet in the concrete. 7. Interlocking pavers that are damaged should be replaced. 8. Maintain landscaped areas and reseed bare areas.

Treatment Device	Minimum Maintenance Requirements/Schedule
INF-3 or BIO-1 Bioretention with or without Underdrain *See Ventura County Technical Guidance Manual (5/29/15) for further maint. guidelines* **(1 PROPOSED BIO-1)**	1. Repair small eroded areas 2. Remove trash and debris and rake surface soils 3. Remove accumulated fine sediments, dead leaves, and trash 4. Remove weeds and prune back excess plant growth. Replace dead plants. 5. Remove sediment and debris accumulation near inlet and outlet structures. 6. Periodically observe function under wet weather conditions 7. Replace or add mulch as needed to maintain a 2-3" **depth at least** once every two years. *8.* If sediment is deposited in the bioretention area, immediately determine the source within the contributing area, stabilize, and remove excess surface deposits. 9. Via observation well inspect underdrain for standing water/proper dewatering.
INF-1, 2 Infiltration Basin or Trench *See Ventura County Technical Guidance Manual (5/29/15) for further maint. guidelines.* N/A	1. Remove trash, debris, and sediment at inlet and outlets 2. Wet weather inspection to ensure drain time. Basin or trench should drain within 72 hours of storm. If clogging occurs refer to VC TGM for further guidance. 3. Remove weeds 4. Inspect for mosquito breeding 5. Remove sediment when 6 inches has accumulated and replace vegetation that was removed during sediment removal process. 6. Regularly inspect pretreatment sediment removal device for nec. maint.
INF-6 Proprietary Infiltration Basin or Trench Model: _____ N/A Mfr.: _____ Phone: _____	*Follow manufacturer guidelines.* *Minimum Maintenance:* 1. Remove trash, debris, and sediment at inlet and outlets 2. Wet weather inspection to ensure drain time. Basin or trench should drain within 72 hours of storm. 3. Inspect for mosquito breeding 4. Regularly inspect pretreatment sediment removal device for necessary maintenance
Other Device: **Filterra Bio - 5 (2 units)** **Contech Model FT0404** **Contech Engineered Solutions LLC** **9025 Centre Pointe Dr.,** **Suite 400** **West Chester, OH 45069** **Phone: 1-800-338-1122**	**1. Inspection of Filterra and surrounding area.** **2. Removal of tree grate and erosion control stones.** **3. Removal of debris, trash and mulch.** **4. Mulch replacement.** **5. Clean area around Filterrra.** **6. Complete paperwork and record plant height and width.** **See Manufacturer Maintenance Instructions for further maintenance requirements.**

1/10/2018 ver.

Stormwater Treatment/Mitigation Device Operations & Maintenance Plan

Address: 791 Camarillo Springs Road, Camarillo CA 93012
APN: 234-0-040-595

Project No.: _____

Date: 06/2020

Prepared for:

New Urban West, Inc.
1733 Ocean Avenue, Suite 260
Santa Monica, CA 90401
925-708-3638

Prepared by:

Name: Daniel Lopez, PE

Company: Encompass Consultant Group, Inc.

Mailing Address: 333 N. Lantana St. #287 Camarillo, CA 93010

Phone No.: 805-586-2979

STORMWATER TREATMENT OPERATIONS & MAINTENANCE PLAN

791 Camarillo Springs Road, Camarillo CA 93012
APN: 234-0-040-595

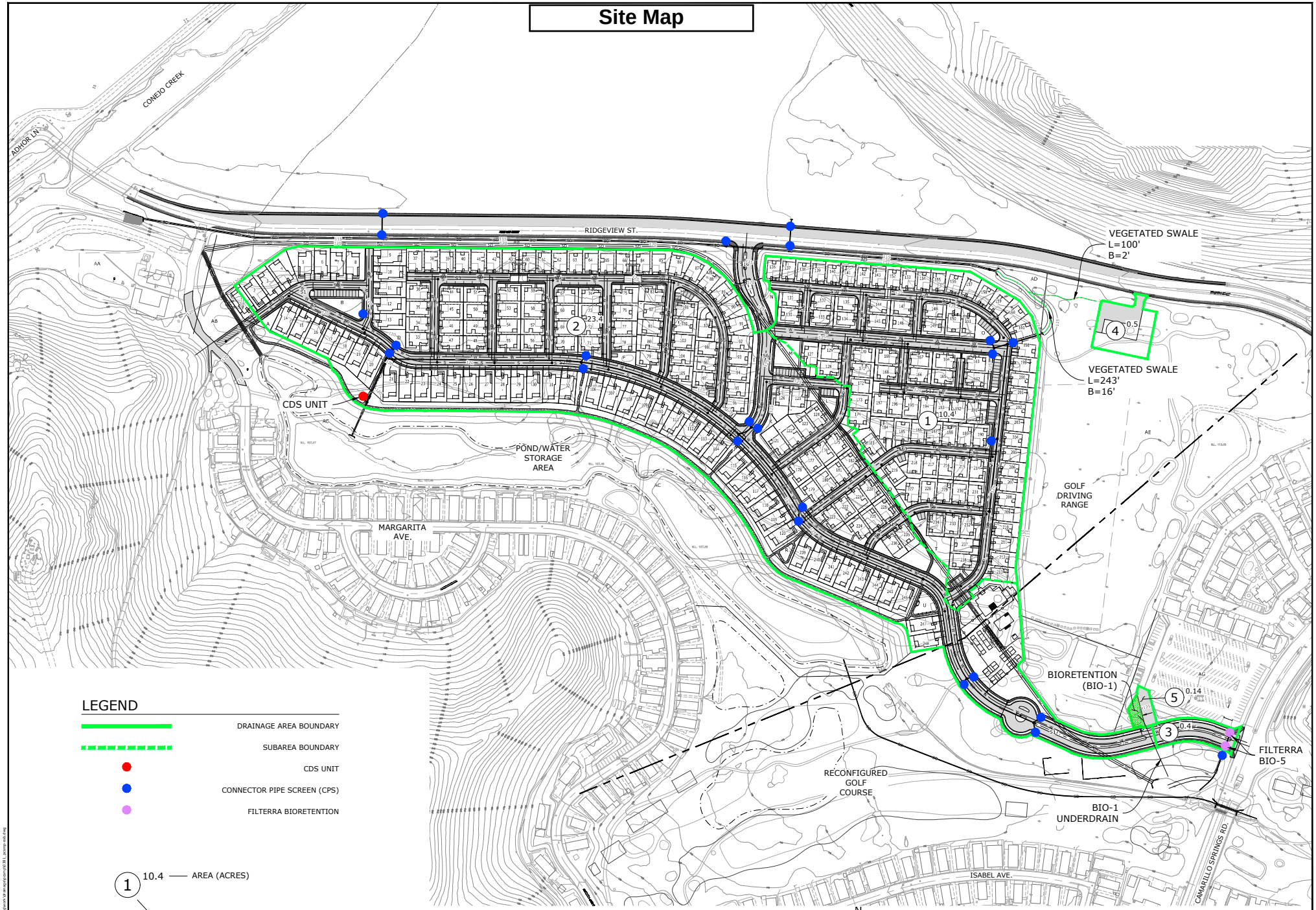
Project Address & No.

INTRODUCTION

This Stomwater Treatment Operations and Maintenance Plan (O&M) has been prepared for the developments located at the above address in Camarillo, California.

This O&M has been prepared in conformance with the guidelines set forth in Appendix I (*Maintenance Plan Guidelines & Checklists)* of the *Technical Guidance Manual for Storm Water Quality Control Measures.*

Site Map



LEGEND

- DRAINAGE AREA BOUNDARY
- SUBAREA BOUNDARY
- CDS UNIT
- CONNECTOR PIPE SCREEN (CPS)
- FILTERRA BIORETENTION

1 — 10.4 — AREA (ACRES)

WATERSHED/TRIBUTARY DESIGNATION

N
W
E
S
SCALE: 1"=80'
0 80 160 240

REVISIONS

GLEN H. PACE
PROJECT ENGINEER
R.C.E. 61468
DATE: 05/2020

TENTATIVE TRACT NO. 6016
CAMARILLO SPRINGS GOLF COURSE
DRAINAGE AREA MAP (DEVELOPED CONDITION)
CAMARILLO, CA

SCALE: HORIZ. 1" = 80' VERT.
WORK ORDER
DRAWN BY: TJS/DL
CHECKED BY: GHP
SHEET NO. 1 OF 1

2. Baseline Descriptions

The proposed development known as Camarillo Springs is to be located within the existing Camarillo Springs golf course in the City of Camarillo. The site is approximately 35.3 acres, and is currently and active Golf Course. Improvements will include grading and infrastructure to support residential condominiums.

2.1 O&M Implementation Responsibility

Table 2-1 O&M Implementation Responsibility

Company	Contact and Telephone Number	Responsibility
New Urban West	Jonathan P. Frankel 925-708-3638	Owner's Agent

2.2 Financing Mechanism

Owner will be responsible for financing of operation, inspection, routine maintenance and upkeep of stormwater control measures.

2.3 Permanent Stormwater Control Measures

This facility is equipped with the following permanent stormwater control measures.

- Bio-3 Vegetated Swale
- CDS Unit
- Catch Basin Inserts, ADS Flexstorm CPS unit

- Bio-1 Bioretention w/ underdrain
- Bio-5 Filterra Bioretention

2.4 Inspection and Maintenance Procedures

BIO-3 Vegetated Swale (2)

a. Maintenance and Cleaning Activities:

Swales must be vegetated in order to provide adequate treatment of runoff via filtration. In general, vegetated swale maintenance requirements are typical landscape care procedures; at a minimum the following activities must occur to properly maintain the proposed vegetated swale areas:

I. Inspect vegetated swales for erosion or damage to vegetation after every storm greater than 0.75 inches for on-line swales and at least twice annually for off-line swales, preferably at the end of the wet season to schedule summer maintenance and in the fall to ensure readiness for winter. Additional inspection after periods of heavy runoff is recommended. Each swale should

be checked for debris and litter and areas of sediment accumulation (see Appendix I for a vegetated swale inspection and maintenance checklist).

II. Swale inlets (curb cuts or pipes) should maintain a calm flow of water entering the swale. Remove sediment as needed at the inlet, if vegetation growth is inhibited in greater than 10% of the swale or if the sediment is blocking even distribution and entry of the water. Following sediment removal activities, replanting and/or reseeding of vegetation may be required for reestablishment.

III. Flow spreaders should provide even dispersion of flows across the swale. Sediments and debris should be removed from the flow spreader if blocking flows. Splash pads should be repaired if needed to prevent erosion. Spreader level should be checked and releveled if necessary.

IV. Side slopes should be maintained to prevent erosion that introduces sediment into the swale. Slopes should be stabilized and planted using appropriate erosion control measures when native soil is exposed or erosion channels are formed.

V. Swales should drain within 48 hours of the end of a storm. Till the swale if compaction or clogging occurs and revegetate. If a perforated underdrain pipe is present, it should be cleaned if necessary.

VI. Vegetation should be healthy and dense enough to provide filtering, while protecting underlying soils from erosion:

a. Mulch should be replenished as needed to ensure survival of vegetation.

b. Vegetation, large shrubs or trees that interfere with landscape swale operation should be pruned.

c. Fallen leaves and debris from deciduous plant foliage should be removed.

d. Grassy swales should be mowed to 4 to 6 inches height. Grass clippings should be removed.

e. Invasive vegetation, such as Alligatorweed (*Alternanthera philoxeroides*), Halogeton (*Halogeton glomeratus*), Spotted Knapweed (*Centaurea maculosa*), Giant Reed (*Arundo donax*), Castor Bean (*Ricinus communis*), Perennial Pepperweed (*Lepidium latifolium*), and Yellow Starthistle (*Centaurea solstitalis*) should be removed and replaced with non-invasive species. Invasive species should never contribute more than 10% of the vegetated area. For more information on invasive weeds, including biology and control of listed weeds, look at the encycloweedia located at the California Department of Food and Agriculture website or the California Invasive Plant Council website at www.cal-ipc.org.

f. Dead vegetation should be removed if greater than 10% of area coverage or when swale function is impaired. Vegetation should be replaced and established before the wet season to maintain cover density and control erosion where soils are exposed.

VII. Check dams (if present) should control and distribute flow across the swale. Causes for altered water flow and/or channelization should be identified and obstructions cleared. Check dams and swale should be repaired if damaged.

VIII. The vegetated swale should be well maintained. Trash and debris, sediment, visual contamination (e.g., oils), noxious or nuisance weeds, should all be removed.

The following Inspection and Maintenance Log should be completed during each inspection.

Vegetated Swale Inspection and Maintenance Checklist

Date: _____ Work Order #_____

Type of Inspection: □ post-storm □ annual □ routine
□ post-wet season □ pre- wet season

Facility: _____ Inspector(s): _____

Defect	Conditions When Maintenance Is Needed	Inspection Result (0, 1, or 2)†	Date Maintenance Performed	Comments or Action(s) Taken to Resolve Issue
Appearance	Untidy			
Trash and Debris Accumulation	Trash and debris accumulated on surface			
Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation start to take over.			
Excessive Shading	Vegetation growth is poor because sunlight does not reach swale. Evaluate vegetation suitability.			
Poor Vegetation Coverage	When vegetation is sparse or bare or eroded patches occur in more than 10% of the bottom. Evaluate vegetation suitability.			
Sediment Accumulation	Sediment depth exceeds 2 inches or covers more than 10% of design area.			
Standing Water	When water stands in the swale between storms and does not drain freely			

Maintenance and Inspection Procedures for Additional BMPs:

An authorized representative from New Urban West, Inc. is responsible for inspections, maintenance and cleanup of illicit discharges from the facility. Inspections shall be performed as shown below and retain proof of inspection for at least three years.

Pollution Source	Frequency	Maintenance/Inspection
Landscape Maintenance	As needed	Procedure: Landscape maintenance contractor will maintain all landscape areas. A careful handling and disposal activities for herbicide and pesticide/fertilizer (if use) will be performed on site. Inspection: Observe and log on inspection list as necessary.
Catch Basin Signage	Quarterly	Procedure: Make sure placard is properly/securely installed. Replace as needed. Inspection: Observe and log on inspection list as necessary.

Flow Spreader or check dams	Flow spreader or check dams uneven or clogged so that flows are not uniformly distributed through entire swale width			
Constant Baseflow	When small quantities of water continually flow through the sale even when it has been dry for weeks and an eroded muddy channel has formed in the swale bottom.			
Inlet/outlet	Inlet/outlet areas clogged with sediment and or debris.			
Erosion/scouring	Eroded or scoured swale bottom due to flow channelization or higher flows. Eroded or rilled side slopes. Eroded or undercut inlet/outlet structres.			

Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#.
Enter 2 if maintenance was performed same day.

3. Flexstorm (24)

Follow manufacturer's recommended maintenance specifications. Inspect quarterly and before and after significant rain events. Clean device and catch basin if 25% or more full of trash and debris. CPS screen may need to be pressured washed; block outlet pipe and vacuum wastewater; do not allow wastewater to exit outlet pipe. May require use of industrial vacuum or vactor truck. Dispose of debris.

4. Contech CDS Hydrodynamic Separator (1)

See attached Manufacturer's Maintenance Manual

5. Bio-5 Filterra Bioretention (2)

It has been found that in regions which receive between 30-50 inches of annual rainfall, (2) two visits are generally required; regions with less rainfall often only require (1) one visit per annum. Varying land uses can affect maintenance frequency. Follow manufacture's recommended maintenance specifications. The Filterra Owner's Manual can be found in the attachments.

6. Bio-1 Bioretention with Underdrain (1)

Bioretention areas require annual plant, soil, and mulch layer maintenance to ensure optimum infiltration, storage, and pollutant removal capabilities. In general, bioretention maintenance requirements are typical landscape care procedures and include: watering, erosion control, occasional pruning and removal of dead plant material, mulch replacement, and analyzing soil for fertility and pollutant levels.

Maintenance and Inspection Procedures for Additional BMPs:

An authorized representative from New Urban West, Inc. is responsible for inspections, maintenance and cleanup of illicit discharges from the facility. Inspections shall be performed as shown below and retain proof of inspection for at least three years.

Pollution Source	Frequency	Maintenance/Inspection
Landscape Maintenance	As needed	Procedure: Landscape maintenance contractor will maintain all landscape areas. A careful handling and disposal activities for herbicide and pesticide/fertilizer (if use) will be performed on site. Inspection: Observe and log on inspection list as necessary.
Catch Basin Signage	Quarterly	Procedure: Make sure placard is properly/securely installed. Replace as needed. Inspection: Observe and log on inspection list as necessary.

Catch Basin Maintenance	3 to 4 times per year, prior to start of rainy season and after all rain events.	Procedure: Remove sediment and trash from all catch basins as needed. Inspection: Inspect at least 3 to 4 times per year, prior to start of rainy season and after rain events. Log all observations on inspection form. May required confined space certification and use of vacuum truck.
Streets	Monthly and before the start of the rainy season (October) or as needed	Procedure: Street surfaces will be swept and residue will be removed with absorbents/cleaners. Inspection: Observed and log on inspection list; inspect street areas for evidence of residues or potential illicit discharges.
Covered Trash Enclosure	Daily	Procedure: No debris shall be washed to storm drain. Enclosures shall remain closed and no trash shall be allowed to overflow. Inspection: Inspection shall be done daily but a thorough observation shall be logged monthly. If there is excessive loading to enclosures/trash receptacles, more frequent trash pickups shall be scheduled.

5. Housekeeping Procedures

Good housekeeping practices will be followed at the site. House keeping control contamination of storm water runoff includes:

- Maintaining the site in a clean an orderly manner to minimize the potential for materials to impact stormwater.
- Avoid over watering landscape
- Storing hazardous materials in leek proof containers in designated indoor storage areas.
- If hazardous materials are stored outside, storing them in a manner to minimize contact with stormwater.
- Properly containing and disposing of sweepings and sediments.
- Promptly cleaning up spills and removing contaminated materials.
- Handling materials to minimize the potential for release.
- Sweep paved areas periodically to remove excess dust and dirt.

6. Spill Plan

If there has been a release of hazardous material, follow the notification procedures presented below.

A. <u>On-Site Spills</u>

Immediately contact the O&M coordinator.

If the O&M Coordinator is unavailable, immediately notify the following agencies. If the O&M Coordinator is available, he should make these notifications.

Local Emergency Response	911
Ventura County Spill Hotline	(805) 320-6244
City of Camarillo	(805) 388-5338
State Office of Emergency Services (OES)	(800) 852-7550
Ventura County Environmental Health Department	(805) 654-2813 (during business hours 911 (After hours)
State Regional Water Quality Control Board	(213) 576-6600

If waste oil is spilled, contact the Department of Toxic Substance Control (DTSC)
(800) 260-3972 (during business hours)
(800) 852-7550 (after hours)

B. Spills Running Off-Site

- Follow sequence action noted above.
- Notify the National Response Center at (800) 424-8802

C. Spills Threaten Navigable Waters

- Follow sequence action noted above
- Notify United States Coast Guard at (562) 980-4444

D. Information to Include in Oral Notification

When reporting to government agencies is required, notification should be made as soon as possible. Below are possible questions that the agency may ask.

Document all reports to regulatory agencies. Ask the name and position of person you have contacted and note the agency and the time of your call. Write this information down. Follow the steps below:

- Give the facility name, address and phone number as well as your name and position.
- Date and time of the spill:
  - Time or estimated time spill began.
  - Duration of spill or if it is continuing.
  - Location of spill
- Spill information:
  - Materials spilled.
  - Volume or estimated volume spilled.
  - Has spill entered storm drain or navigable waters? If so, how much?
  - The source of the discharge.
  - A description of all affected media (water and/or soil).
  - The cause of discharge.
  - Damages or injuries caused by the discharge.
- Response Measure taken:
  - For containment.
  - For clean up
  - Has the source been stopped?
  - Will an evacuation be required?
  - Name of individual and organization who have been contacted.
- Weather:
  - Raining?
  - Air Temperature?
  - Wind speed direction

Do not wait until all information is known to contact agencies
Do not hang up until all questions are answered.

E. Spill Response

The following spill response procedures provide guidelines for use by those on duty to respond to releases. They are not meant to supplant the use of common sense and good judgment during emergencies. Do not contact any spilled material unless wearing proper personal protective equipment per the MSDS.

1. Notify Home Owners Association/Owner as soon as it is safe to do so.
   - If the spill involves fire, the supervisor will call 911 immediately.
   - The supervisor will notify the Plan Coordinator and take charge until the Plan Coordinator or Alternate Plan Coordinator arrives.
   - The Plan Coordinator or Alternate Plan Coordinator will take charge of the situation on arrival.

2. Evacuate the site immediately.

3. Aid any persons that have been injured or contaminated or are in danger of being injured or contaminated. Do not put yourself in danger trying to save someone else. If someone is contaminated with material, avoid contacting that person. Do not attempt to move anyone who may have a back injury.

4. Stop flow it is safe to do so. Stop the source of the spill and contain the material that has already been spilled. Do this only if it can be accomplished safely without endangering life or property. Minimizing the amount of material spilled reduces the potential for discharge and the amount of clean up necessary.

5. Alert others in the area to stay clear.

6. Eliminate ignition sources in the area.

7. Contain Spill if it has or is about to enter storm drains. Place absorbent material into position to contain spill. Care should be used to prevent the spill from leaving the site or entering sewers or storm drains.

8. Clean up spilled material with absorbent materials, dikes, etc. Contact contractors (see below) for assistance if necessary.

F. O&M Coordinator Responsibilities

- In charge of overall incident response.
- Calling emergency numbers
- Notify people in the area and advising them to stay away from the spill.

- Coordinate with outside emergency response and providing technical information.
- Reporting emergency incidents to appropriate agencies.
- Authorizing non-emergency cleanup measures.
- Ensuring compliance with applicable federal, state and local rules and regulations.

G. Response Equipment – External Response Equipment

Property owner may be contacted to provide the following spill response equipment:

- Bins and equipment for used absorbent removal.
- Vacuum truck to collect and remove material.

H. Spill Response, Containment, and Cleanup Materials

Cleanup Material/Equipment	Location	Response Time
Spill kits and/or absorbent material	Onsite	Immediate
Brooms	Onsite	Immediate

Contractor	Location	Response Time
		Less than 1 hour

I. Spill Cleanup Procedure

Materials generated during spill response activities must be disposed of in accordance with applicable federal, state and local regulations.

There may be various types of waste generated during response activities. Below is a list of common materials and disposal requirement.

- Free product: if there is a large amount of this material, a vacuum truck should be contracted to collect and haul it to a licensed treatment, storage,

and disposal facility for recycling or disposal. Small spills may be cleaned up using absorbent material.

- Soiled ragas, brooms, and absorbent material should be drummed up and sent to a licensed treatment, storage, and disposal facility for disposal.

J. Sampling Plan

During a spill it may be possible for contaminated material to enter the storm drain system. If contaminated material enters the storm drain system, it may be prudent to take samples to document the amount of material released.

If sampling is performed, samples should be taken at the storm drain inlet where contaminated material is entering.

The samples must be sent to a State Certified laboratory for analysis. The following procedures will be used for taking the samples:

- Collect samples in sampling containers. Ensure that the sample is free of excess debris (leaves, paper fragments, etc.). Fill the container to the top.
- The closed sample container may be sealed with custody tape, which can be obtained from the test laboratory with the sample bottles. Do not seal the bottles with other types of tapes (scotch, duct, cellophane, etc.) as organic material from the tape may contaminate the sample.
- Label samples with the following information:

Company Name	Date Sampled
Time Sampled	Collection Point
Sampled Description	Preservative
Analysis Required	Special Requirements

- The laboratory should be instructed to analyze for the constituents that may have been discharged. In the event of oil spill, the sample should be analyzed for "Oil & Grease".
- Complete a chain of custody form recording pertinent information including the information listed above and the signature of the person taking the sample. The test laboratory will provide the chain of custody forms.
- If possible, chill the samples to 4°C (40°F) until the samples are delivered to the laboratory. Do not freeze samples
- Send the samples to a State Certified laboratory, or call the laboratory to have the sample picked up. A State Certified Laboratory may be selected from the list of Certified laboratories found at the following link:

http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx

7. Facility Changes

A complete review of this O&M Plan will occur prior to any facility changes which could significantly affect the character or quantity of pollutants discharging into the stormwater control measures.

This O&M will be amended:

- When there is a change in operations which may significantly affect the character or quantity of pollutants discharging into the on-site storm drain system; or
- When deemed necessary by the Owner.

Minor administrative changes to the O&M (changes in names, phone numbers, etc.) may be made by the O&M Coordinator.

Amendments to the O&M will be noted in the following Amendment log.

Amendment Log

Storm Water Treatment Operations and Maintenance Plan

Amendment No.	Date	Brief Description of Amendment	Prepared by

8. Training

The following personnel will be trained in the requirements of this O&M:

Title	Responsibilities
O&M Coordinator	O&M Implementation. Verification and documentation that O&M training is performed (See training forms attached)
Designated Employees	Inspection and maintenance of catch basins, catch basin signage, bio-retention facilities, stormwater outlets, drain inlet inserts and trash enclosures

Employee Training

Purpose: To ensure that affected employees are aware of the Storm Water Treatment Operations and Maintenance Plan and its requirements.

Applicability: This training is required for personnel responsible for implementing the O&M.

Review the following items during the training to ensure that employees are aware of O&M requirements:

_____ Review the housekeeping procedures presented in Section VI.

_____ Review the maintenance procedures presented in Sections VI and X

_____ Review the inspection procedures presented in Sections VI and X

_____ Review the spill response, and notification, and clean up procedures in Section VII

_____ Alert personnel that they should follow safety practices when maintaining devices (Sections VI and X) and cleaning spills (Section VII)

_____ Ask if employees have questions about the O&M or their responsibilities.

_____ Complete the Training Verification Form (next page). Maintain completed training forms on file for five years.

Employee Training Verification Form

I hereby certify that I have conducted Storm water Treatment Operations and Maintenance Plan Training with the undersigned employees.

Instructor's Name (Please Print)	Signature	Date

I hereby certify that I have received Storm Water Treatment Device Maintenance O&M Training.
I am familiar with the O&M and my responsibilities.

Employee Name	Signature	Date

9. REVISIONS OF POLLUTION MITIGATION MEASURES

If future correction or modification of past stormwater management control measures or procedures is required, the owner shall obtain approval from the City of Camarillo, Land Development Engineering Division prior to commencing any work. Corrective measures or modifications shall not cause discharges to bypass or otherwise impede existing stormwater control measures.

If corrective measures or modifications need to be made to the stormwater control measures or procedures, approval must be obtained from the City of Camarillo, Land Development Engineering Division prior to commencing any work.

Any corrective measures or modifications shall not cause stormwater discharges to bypass or otherwise impede existing stormwater control measures.

Minor administrative changes to the O&M (changes in names, phone numbers, etc.) do not need to be submitted to the City.

10. MONITORING & REPORTING PROGRAM

The governing stormwater agency may require a Monitoring & Reporting Program to assure the stormwater management control measures approved for the site are performing according to design. If required by local permitting agency, the Maintenance Plan shall include performance testing and reporting protocols.

Contech CDS Hydrodynamic Separator Maintenance Manual

CONTECH®
ENGINEERED SOLUTIONS

CDS Guide
Operation, Design, Performance and Maintenance

CDS®

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

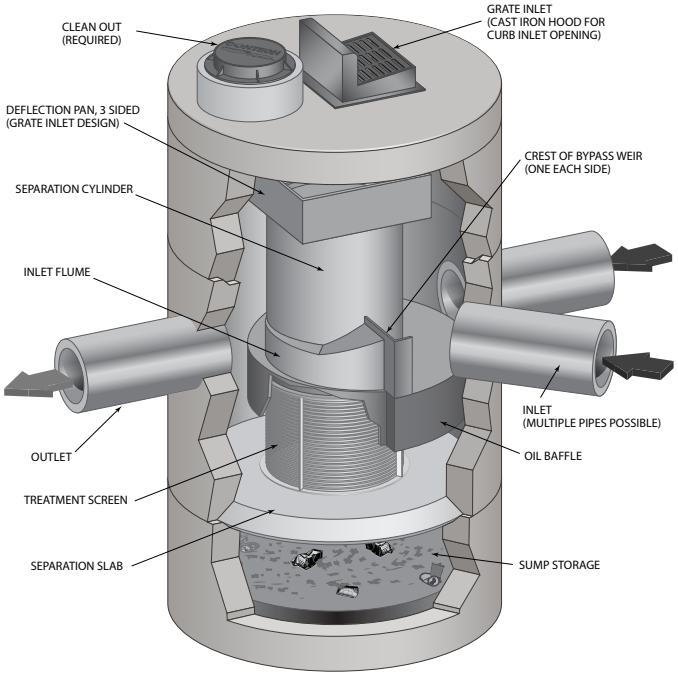
Operation Overview

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

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

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

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



Design Basics

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

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

Water Quality Flow Rate Method

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

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

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

Rational Rainfall Method™

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

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

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

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

Probabilistic Rational Method

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

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

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

Treatment Flow Rate

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

Hydraulic Capacity

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

Performance

Full-Scale Laboratory Test Results

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

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

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

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

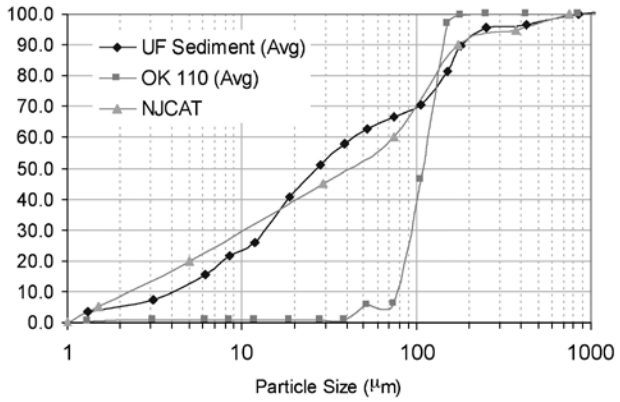


Figure 1. Particle size distributions

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

Results and Modeling

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

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

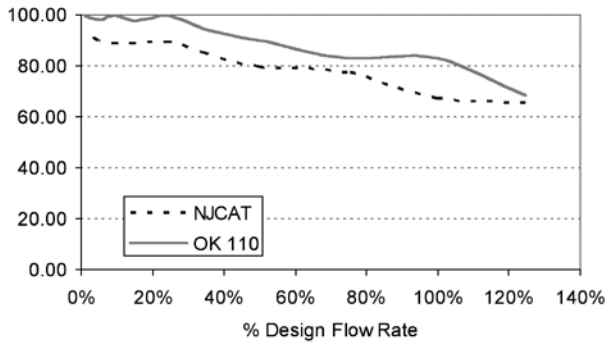


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

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

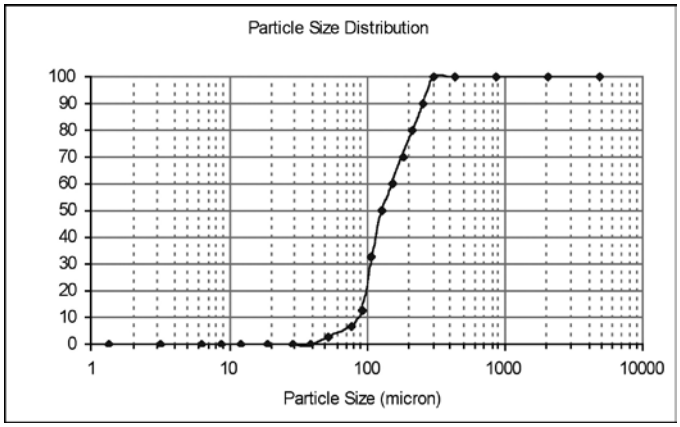


Figure 3. WASDOE PSD

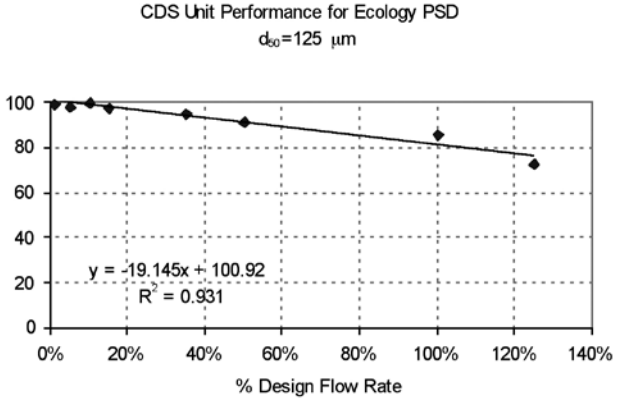


Figure 4. Modeled performance for WASDOE PSD.

Maintenance

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

Inspection

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

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

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

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

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

Cleaning

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

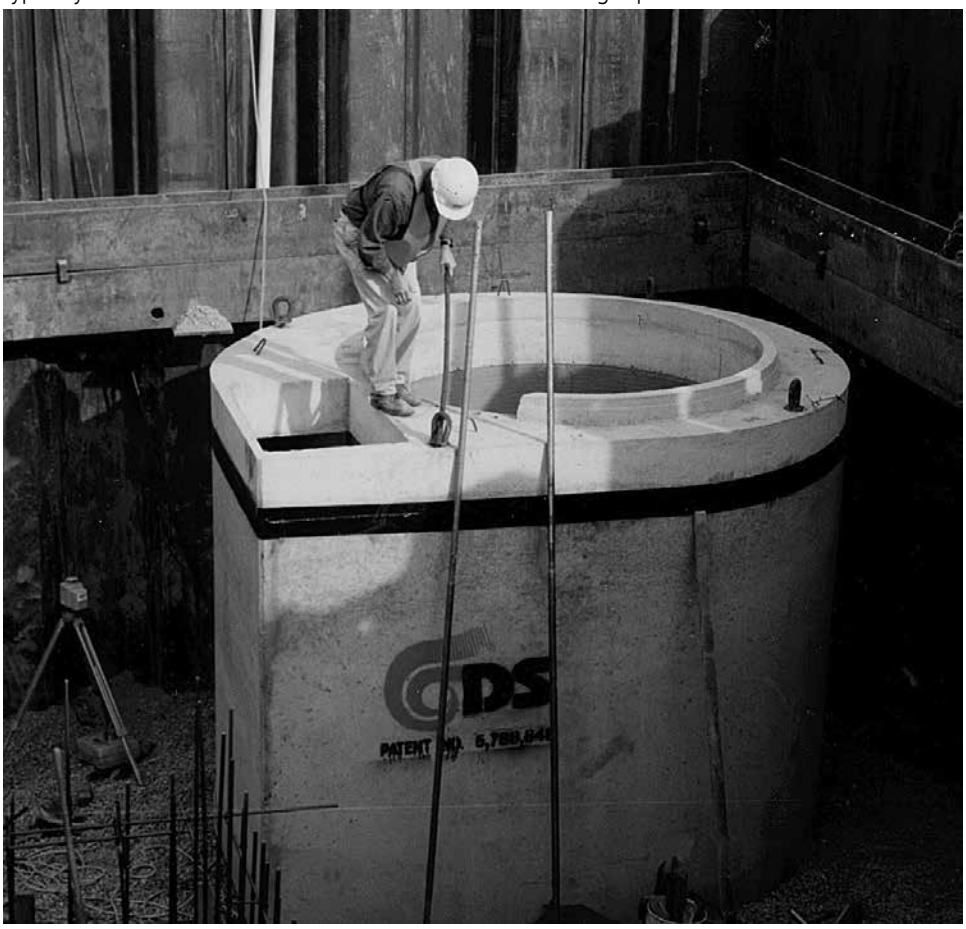
In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should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

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

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

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



CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

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

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

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

SUPPORT

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

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

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

cds_manual 3/17 PDF

ADS – FLEXSTORM CONNECTOR PIPE SCREEN (CPS) MAINTENANCE GUIDELINES

FLEXSTORM suggests that its Connector Pipe Screens (CPS) be maintained per this modified set of conditions from the LA County CPS Standards. FLEXSTORM advises that catch basins be cleaned out at least 2 times per year and/or if debris has filled above a 40% level inside of the catch basin. Sites with large amounts of foliage, high sediment loads, or smaller CPS devices might need to be cleaned more frequently.

Maintenance Conditions and Maintenance Standards: The Following are deficiencies in maintenance conditions and their corresponding maintenance standards which shall apply to the Connector Pipe Screen. The cleanout of each CB shall meet the maintenance standards listed as follows:

	Description of Maintenance Actions
1	Clear trash and debris located immediately in front of curb opening or side opening of CB, and on top or between metal grates of grated CB.
2	Remove Vegetation growing across and/or blocking the basin opening.
3	Remove all Trash and debris and vegetation from inside the Catch Basin.
4	Remove Trash and debris in the connector pipe opening, upstream or downstream.
5	Knock off/Remove all Debris that covers the perforated openings of the connector pipe screen
6	Ensure there is no Standing Water inside of catch basin (indicates the device is not properly draining)

Trash and debris shall include, but is not limited to, mud, vegetation, and garbage.

Upon completion of a cleanout operation at a CB and before leaving it, the Contractor shall sweep the top surface of the CB and the area 2 feet around the CB, and shall remove any trash and debris resulting from the cleanout operations. No debris is to be left at a CB for future pick-up.

Method of Removal: All trash and debris required to be removed from the CBs shall be removed in a manner to be determined by the Contractor. This can be done by hand or with a truck mounted vacuum. If entering the catch basin ensure that local confined space entry procedures are followed. The Contractor shall not allow any trash or debris to enter the connector pipe or main line as a result of the cleanout operations.

Debris Disposal: All trash and debris removed under this Contract shall become the property of the Contractor and shall be legally disposed of away from the CB sites. The Contractor is responsible for proper disposal of the trash and debris, including obtaining approvals from all jurisdictional agencies, as applicable. The contractor shall be responsible for contacting and coordinating with local Animal Care and Control for pickup and disposal of dead animals. However, the Contractor shall be responsible for removing any dead animal from inside a CB.

Filterra Owner's Manual

filterra®

Bioretention Systems

CONTECH®

ENGINEERED SOLUTIONS

Table of Contents

Enclosed

Local Area Filterra Plant List

Introduction

Thank you for your purchase of the Filterra® Bioretention System. Filterra is a specially engineered stormwater treatment system incorporating high performance biofiltration media to remove pollutants from stormwater runoff. The system's biota (vegetation and soil microorganisms) then further breakdown and absorb captured pollutants. All components of the system work together to provide a sustainable long-term solution for treating stormwater runoff.

The Filterra system has been delivered to you with protection in place to resist intrusion of construction related sediment which can contaminate the biofiltration media and result in inadequate system performance. These protection devices are intended as a best practice and cannot fully prevent contamination. It is the purchaser's responsibility to provide adequate measures to prevent construction related runoff from entering the Filterra system.

Included with your purchase is Activation of the Filterra system by the manufacturer as well as a 1-year warranty from delivery of the system and 1-year of routine maintenance (mulch replacement, debris removal, and pruning of vegetation) up to twice during the first year after activation.

Design and Installation

Each project presents different scopes for the use of Filterra systems. Information and help may be provided to the design engineer during the planning process. Correct Filterra box sizing (by rainfall region) is essential to predict pollutant removal rates for a given area. The engineer shall submit calculations for approval by the local jurisdiction. The contractor is responsible for the correct installation of Filterra units as shown in approved plans. A comprehensive installation manual is available at www.ContechES.com.

Activation Overview

Activation of the Filterra system is a procedure completed by the manufacturer to place the system into working condition. This involves the following items:

- Removal of construction runoff protection devices
- Planting of the system's vegetation
- Placement of pretreatment mulch layer using mulch certified for use in Filterra systems.

Activation MUST be provided by the manufacturer to ensure proper site conditions are met for Activation, proper installation of the vegetation, and use of pretreatment mulch certified for use in Filterra systems.

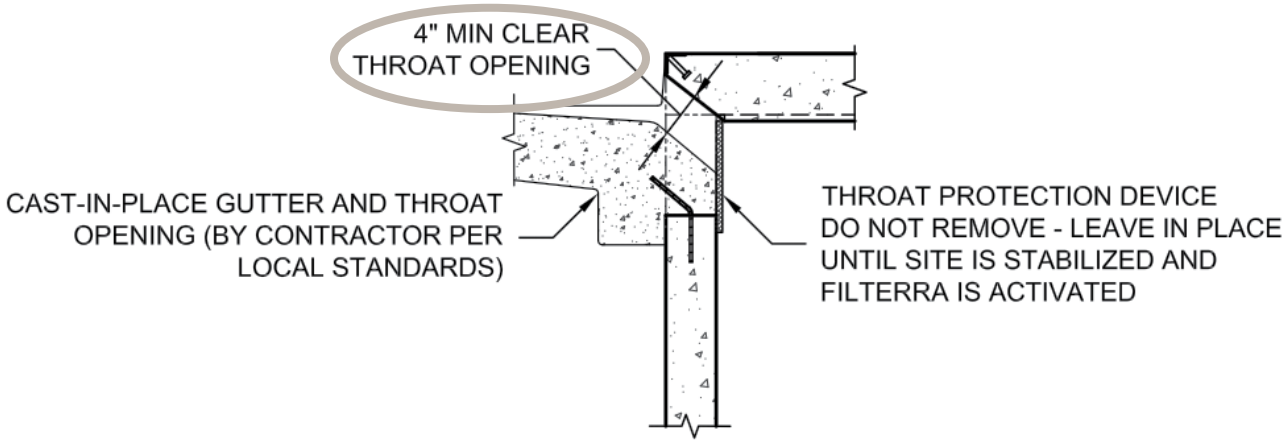
Minimum Requirements

The minimum requirements for Filterra Activation are as follows:

1. The site landscaping must be fully stabilized, i.e. full landscaping installed and some grass cover (not just straw and seed) is required to reduce sediment transport. Construction debris and materials should be removed from surrounding area.

2. Final paving must be completed. Final paving ensures that paving materials will not enter and contaminate the Filterra system during the paving process, and that the plant will receive runoff from the drainage area, assisting with plant survival for the Filterra system.

3. Filterra throat opening should be at least 4" in order to ensure adequate capacity for inflow and debris.



An Activation Checklist is included on page 12 to ensure proper conditions are met for Contech to perform the Activation services. A charge of $500.00 will be invoiced for each Activation visit requested by Customer where Contech determines that the site does not meet the conditions required for Activation.

Filterra Plant Selection Overview

A Plant List has been enclosed with this packet highlighting recommended plants for Filterra systems in your area. Keep in mind that plants are subject to availability due to seasonality and required minimum size for the Filterra system. Plants installed in the Filterra system are container plants (max 15 gallon) from nursery stock and will be immature in height and spread at Activation.

It is the responsibility of the owner to provide adequate irrigation when necessary to the plant of the Filterra system.

The "Planting Requirements for Filterra Systems" document is included as an appendix and discusses proper selection and care of the plants within Filterra systems.

Warranty Overview

Refer to the Contech Engineered Solutions LLC Stormwater Treatment System LIMITED WARRANTY for further information. The following conditions may void the Filterra system's warranty and waive the manufacturer provided Activation and Maintenance services:

- Unauthorized activation or performance of any of the items listed in the activation overview
- Any tampering, modifications or damage to the Filterra system or runoff protection devices
- Removal of any Filterra system components
- Failure to prevent construction related runoff from entering the Filterra system
- Failure to properly store and protect any Filterra components (including media and underdrain stone) that may be shipped separately from the vault

Routine Maintenance Guidelines

With proper routine maintenance, the biofiltration media within the Filterra system should last as long as traditional bioretention media. Routine maintenance is included by the manufacturer on all Filterra systems for the first year after activation. This includes a maximum of 2 visits to remove debris, replace pretreatment mulch, and prune the vegetation. More information is provided in the Operations and Maintenance Guidelines. Some Filterra systems also contain pretreatment or outlet bays. Depending on site pollutant loading, these bays may require periodic removal of debris, however this is not included in the first year of maintenance, and would likely not be required within the first year of operation.

These services, as well as routine maintenance outside of the included first year, can be provided by certified maintenance providers listed on the Contech website. Training can also be provided to other stormwater maintenance or landscape providers.

Why Maintain?

All stormwater treatment systems require maintenance for effective operation. This necessity is often incorporated in your property's permitting process as a legally binding BMP maintenance agreement. Other reasons to maintain are:

- Avoiding legal challenges from your jurisdiction's maintenance enforcement program.
- Prolonging the expected lifespan of your Filterra media.
- Avoiding more costly media replacement.
- Helping reduce pollutant loads leaving your property.

Simple maintenance of the Filterra is required to continue effective pollutant removal from stormwater runoff before discharge into downstream waters. This procedure will also extend the longevity of the living biofilter system. The unit will recycle and accumulate pollutants within the biomass, but is also subjected to other materials entering the inlet. This may include trash, silt and leaves etc. which will be contained above the mulch layer. Too much silt may inhibit the Filterra's flow rate, which is the reason for site stabilization before activation. Regular replacement of the mulch stops accumulation of such sediment.

When to Maintain?

Contech includes a 1-year maintenance plan with each system purchase. Annual included maintenance consists of a maximum of two (2) scheduled visits. Additional maintenance may be necessary depending on sediment and trash loading (by Owner or at additional cost). The start of the maintenance plan begins when the system is activated.

Maintenance visits are scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands while the fall visit helps the system by removing excessive leaf litter.

It has been found that in regions which receive between 30-50 inches of annual rainfall, (2) two visits are generally required; regions with less rainfall often only require (1) one visit per annum. Varying land uses can affect maintenance frequency; e.g. some fast food restaurants require more frequent trash removal. Contributing drainage areas which are subject to new development wherein the recommended erosion and sediment control measures have not been implemented may require additional maintenance visits.

Some sites may be subjected to extreme sediment or trash loads, requiring more frequent maintenance visits. This is the reason for detailed notes of maintenance actions per unit, helping the Supplier and Owner predict future maintenance frequencies, reflecting individual site conditions.

Owners must promptly notify the (maintenance) Supplier of any damage to the plant(s), which constitute(s) an integral part of the bioretention technology. Owners should also advise other landscape or maintenance contractors to leave all maintenance to the Supplier (i.e. no pruning or fertilizing) during the first year.

Exclusion of Services

Clean up due to major contamination such as oils, chemicals, toxic spills, etc. will result in additional costs and are not covered under the Supplier maintenance contract. Should a major contamination event occur the Owner must block off the outlet pipe of the Filterra (where the cleaned runoff drains to, such as drop inlet) and block off the throat of the Filterra. The Supplier should be informed immediately.

Maintenance Visit Summary

Each maintenance visit consists of the following simple tasks (detailed instructions below).

1. Inspection of Filterra and surrounding area
2. Removal of tree grate and erosion control stones
3. Removal of debris, trash and mulch
4. Mulch replacement
5. Plant health evaluation and pruning or replacement as necessary
6. Clean area around Filterra
7. Complete paperwork

Maintenance Tools, Safety Equipment and Supplies

Ideal tools include: camera, bucket, shovel, broom, pruners, hoe/rake, and tape measure. Appropriate Personal Protective Equipment (PPE) should be used in accordance with local or company procedures. This may include impervious gloves where the type of trash is unknown, high visibility clothing and barricades when working in close proximity to traffic and also safety hats and shoes. A T-Bar or crowbar should be used for moving the tree grates (up to 170 lbs ea.). Most visits require minor trash removal and a full replacement of mulch. See below for actual number of bagged mulch that is required in each media bay size. Mulch should be a double shredded, hardwood variety. Some visits may require additional Filterra engineered soil media available from the Supplier.

Box Length	Box Width	Filter Surface Area (ft^2)	Volume at 3" (ft^3)	# of 2 ft^3 Mulch Bags
4	4	4	4	2
6	4	6	6	3
8	4	8	8	4
6	6	9	9	5
8	6	12	12	6
10	6	15	15	8
12	6	18	18	9
13	7	23	23	12

Maintenance Visit Procedure

Keep sufficient documentation of maintenance actions to predict location specific maintenance frequencies and needs. An example Maintenance Report is included in this manual.

1. Inspection of Filterra and surrounding area

- Record individual unit before maintenance with photograph (numbered). Record on Maintenance Report (see example in this document) the following:

Record on Maintenance Report the following:

Standing Water	yes | no
Damage to Box Structure	yes | no
Damage to Grate	yes | no
Is Bypass Clear	yes | no

If yes answered to any of these observations, record with close-up photograph (numbered).

2. Removal of tree grate and erosion control stones

- Remove cast iron grates for access into Filterra box.
- Dig out silt (if any) and mulch and remove trash & foreign items.

3. Removal of debris, trash and mulch

Record on Maintenance Report the following:

Silt/Clay	yes | no
Cups/ Bags	yes | no
Leaves	yes | no
Buckets Removed	_____

- After removal of mulch and debris, measure distance from the top of the Filterra engineered media soil to the top of the top slab. Compare the measured distance to the distance shown on the approved Contract Drawings for the system. Add Filterra media (not top soil or other) to bring media up as needed to distance indicated on drawings.

Record on Maintenance Report the following:

Distance to Top of Top Slab (inches)	_____
Inches of Media Added	_____

4. Mulch replacement

- Add double shredded mulch evenly across the entire unit to a depth of 3".
- Refer to Filterra Mulch Specifications for information on acceptable sources.
- Ensure correct repositioning of erosion control stones by the Filterra inlet to allow for entry of trash during a storm event.
- Replace Filterra grates correctly using appropriate lifting or moving tools, taking care not to damage the plant.

5. Plant health evaluation and pruning or replacement as necessary

- Examine the plant's health and replace if necessary.
- Prune as necessary to encourage growth in the correct directions

Record on Maintenance Report the following:

Height above Grate	_____ (ft)
Width at Widest Point	_____ (ft)
Health	healthy | unhealthy
Damage to Plant	yes | no
Plant Replaced	yes | no

6. Clean area around Filterra

- Clean area around unit and remove all refuse to be disposed of appropriately.

7. Complete paperwork

- Deliver Maintenance Report and photographs to appropriate location (normally Contech during maintenance contract period).
- Some jurisdictions may require submission of maintenance reports in accordance with approvals. It is the responsibility of the Owner to comply with local regulations.

Maintenance Checklist

Drainage System Failure	Problem	Conditions to Check	Condition that Should Exist	Actions
Inlet	Excessive sediment or trash accumulation.	Accumulated sediments or trash impair free flow of water into Filterra.	Inlet should be free of obstructions allowing free distributed flow of water into Filterra.	Sediments and/or trash should be removed.
Mulch Cover	Trash and floatable debris accumulation.	Excessive trash and/or debris accumulation.	Minimal trash or other debris on mulch cover.	Trash and debris should be removed and mulch cover raked level. Ensure bark nugget mulch is not used.
Mulch Cover	"Ponding" of water on mulch cover.	"Ponding" in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils.	Stormwater should drain freely and evenly through mulch cover.	Recommend contact manufacturer and replace mulch as a minimum.
Vegetation	Plants not growing or in poor condition.	Soil/mulch too wet, evidence of spill. Incorrect plant selection. Pest infestation. Vandalism to plants.	Plants should be healthy and pest free.	Contact manufacturer for advice.
Vegetation	Plant growth excessive.	Plants should be appropriate to the species and location of Filterra.		Trim/prune plants in accordance with typical landscaping and safety needs.
Structure	Structure has visible cracks.	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through the cracks.		Vault should be repaired.
Maintenance is ideally to be performed twice annually.				

Filterra Inspection & Maintenance Log

Filterra System Size/Model:_____ **Location:** _____

Date	Mulch & Debris Removed	Depth of Mulch Added	Mulch Brand	Height of Vegetation Above Grate	Vegetation Species	Issues with System	Comments
1/1/17	*5 – 5 gal Buckets*	*3″*	*Lowe's Premium Brown Mulch*	*4′*	*Galaxy Magnolia*	*- Standing water in downstream structure*	*- Removed blockage in downstream structure*

Appendix 1 – Filterra® Activation Checklist

CONTECH ENGINEERED SOLUTIONS

Project Name: ______________________ Company: ______________________

Site Contact Name: ______________________ Site Contact Phone/Email: ______________________

Site Owner/End User Name: ______________________ Site Owner/End User Phone/Email: ______________________

Preferred Activation Date: ______________________ (provide 2 weeks minimum from date this form is submitted)

Site Designation	System Size	Final Pavement / Top Coat Complete	Landscaping Complete / Grass Emerging	Construction materials / Piles / Debris Removed	Throat Opening Measures 4" Min. Height	Plant Species Requested
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	

Attach additional sheets as necessary.

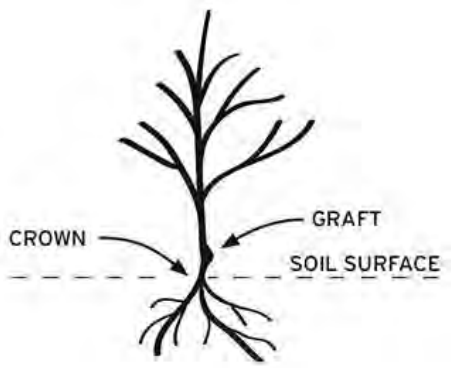
NOTE: A charge of $500.00 will be invoiced for each Activation visit requested by Customer where Contech determines that the site does not meet the conditions required for Activation. ONLY Contech authorized representatives can perform Activation of Filterra systems; unauthorized Activations will void the system warranty and waive manufacturer supplied Activation and 1st Year Maintenance.

______________________ ______________________

Signature Date

Appendix 2 – Planting Requirements for Filterra® Systems

Plant Material Selection



- Select plant(s) as specified in the engineering plans and specifications.
- Select plant(s) with full root development but not to the point where root bound.
- Use local nursery container plants only. Ball and burlapped plants are not permitted.
- For precast Filterra systems with a tree grate, plant(s) must not have scaffold limbs at least 14 inches from the crown due to spacing between the top of the mulch and the tree grate. Lower branches can be pruned away provided there are sufficient scaffold branches for tree or shrub development.
- For precast Filterra systems with a tree grate, at the time of installation, it is required that plant(s) must be at least 6" above the tree grate opening at installation for all Filterra configurations. This DOES NOT apply to Full Grate Cover designs.
- Plant(s) shall not have a mature height greater than 25 feet.
- For standard 21" media depth, a 7 – 15 gallon container size shall be used. Media less than 21" (Filterra boxes only) will require smaller container plants.
- For precast Filterra systems, plant(s) should have a single trunk at installation, and pruning may be necessary at activation and maintenance for some of the faster growing species, or species known to produce basal sprouts.

Plant Installation

- During transport protect the plant leaves from wind and excessive jostling.
- Prior to removing the plant(s) from the container, ensure the soil moisture is sufficient to maintain the integrity of the root ball. If needed, pre-wet the container plant.
- Cut away any roots which are growing out of the container drain holes. Plants with excessive root growth from the drain holes should be rejected.
- Plant(s) should be carefully removed from the pot by gently pounding on the sides of the container with the fist to loosen root ball. Then carefully slide out. Do not lift plant(s) by trunk as this can break roots and cause soil to fall off. Extract the root ball in a horizontal position and support it to prevent it from breaking apart. Alternatively the pot can be cut away to minimize root ball disturbance.
- Remove any excess soil from above the root flare after removing plant(s) from container.
- Excavate a hole with a diameter 4" greater than the root ball, gently place the plant(s).
- If plant(s) have any circling roots from being pot bound, gently tease them loose without breaking them.
- If root ball has a root mat on the bottom, it should be shaved off with a knife just above the mat line.
- Plant the tree/shrub/grass with the top of the root ball 1" above surrounding media to allow for settling.
- All plants should have the main stem centered in the tree grate (where applicable) upon completion of installation.
- With all trees/shrubs, remove dead, diseased, crossed/rubbing, sharply crotched branches or branches growing excessively long or in wrong direction compared to majority of branches.
- To prevent transplant shock (especially if planting takes place in the hot season), it may be necessary to prune some of the foliage to compensate for reduced root uptake capacity. This is accomplished by pruning away some of the smaller secondary branches or a main scaffold branch if there are too many. Too much foliage relative to the root ball can dehydrate and damage the plant.
- Plant staking may be required.

Mulch Installation

- Only mulch that has been meeting Contech Engineered Solutions' mulch specifications can be used in the Filterra system.
- Mulch must be applied to a depth of 3" evenly over the surface of the media.

Irrigation Requirements

- Each Filterra system must receive adequate irrigation to ensure survival of the living system during periods of drier weather.
- Irrigation sources include rainfall runoff from downspouts and/or gutter flow, applied water through the tree grate or in some cases from an irrigation system with emitters installed during construction.
- At Activation: Apply about one (cool climates) to two (warm climates) gallons of water per inch of trunk diameter over the root ball.
- During Establishment: In common with all plants, each Filterra plant will require more frequent watering during the establishment period. One inch of applied water per week for the first three months is recommended for cooler climates (2 to 3 inches for warmer climates). If the system is receiving rainfall runoff from the drainage area, then irrigation may not be needed. Inspection of the soil moisture content can be evaluated by gently brushing aside the mulch layer and feeling the soil. Be sure to replace the mulch when the assessment is complete. Irrigate as needed**.
- Established Plants: Established plants have fully developed root systems and can access the entire water column in the media. Therefore irrigation is less frequent but requires more applied water when performed. For a mature system assume 3.5 inches of available water within the media matrix. Irrigation demand can be estimated as 1" of irrigation demand per week. Therefore if dry periods exceed 3 weeks, irrigation may be required. It is also important to recognize that plants which are exposed to windy areas and reflected heat from paved surfaces may need more frequent irrigation. Long term care should develop a history which is more site specific.

** Five gallons per square yard approximates 1 inch of water Therefore for a 6' by 6' Filterra approximately 20-60 gallons of water is needed. To ensure even distribution of water it needs to be evenly sprinkled over the entire surface of the filter bed, with special attention to make sure the root ball is completely wetted. NOTE: if needed, measure the time it takes to fill a five gallon bucket to estimate the applied water flow rate then calculate the time needed to irrigate the Filterra. For example, if the flow rate of the sprinkler is 5 gallons/minute then it would take 12 minutes to irrigate a 6' by 6' filter.

Notes

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I.10 Proprietary Device Inspection and Maintenance Checklist

Date: _____ Work Order # _____

Type of Inspection: □ post-storm □ annual □ routine □ post-wet season □ pre-wet season

Facility: _____ Inspector(s): _____

Defect	Conditions When Maintenance Is Needed	Inspection Result (0,1, or 2) †	Date Maintenance Performed	Comments or Action(s) taken to resolve issue
Refer to the manufacturer's instructions for maintenance/inspection requirements, below are generic guidelines to supplement manufacturer's recommendations.				
Underground Vault				
Sediment Accumulation on Media	Sediment depth exceeds 0.25-inches.			
Sediment Accumulation in Vault	Sediment depth exceeds 6-inches in first chamber.			
Trash/Debris Accumulation	Trash and debris accumulated on compost filter bed.			
Sediment in Drain Pipes or Cleanouts	When drain pipes, clean-outs, become full with sediment and/or debris.			
Damaged Pipes	Any part of the pipes that are crushed or damaged due to corrosion and/or settlement.			
Access Cover Damaged/Not Working	Cover cannot be opened; one person cannot open the cover using normal lifting pressure, corrosion/deformation of cover.			
Vault Structure Includes Cracks in Wall, Bottom, Damage to	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.			

Defect	Conditions When Maintenance Is Needed	Inspection Result (0,1, or 2) †	Date Maintenance Performed	Comments or Action(s) taken to resolve issue
Frame and/or Top Slab	Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.			
Baffles	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.			
Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, or misaligned.			
Below Ground Cartridge Type				
Filter Media	Drawdown of water through the media takes longer than 1 hour and/or overflow occurs frequently.			
Short Circuiting	Flows do not properly enter filter cartridges.			

†Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.

3) Above the design treatment elevation, a typical lawn mix or landscape plants can be used provided they do not shade the swale vegetation.

4) Irrigation is required if the seed is planted in the spring or summer. Use of a permanent irrigation system may help provide maximal water quality performance. Drought-tolerant grasses should be specified to minimize irrigation requirements.

5) Vegetative cover should be at least 4 inches in height, ideally 6 inches. Swale water depth should ideally be 2/3 of the height of the shortest plant species.

6) Locate the swale in an area without excessive shade to avoid poor vegetative growth. For moderately shaded areas, shade tolerant plants should be used.

7) Locate the swale away from large trees that may drop excessive leaves or needles, which may smother the grass or impede the flow through the swale. Landscape planter beds should be designed and located so that soil does not erode from the beds and enter a nearby swale.

Maintenance Access

1) Access to the swale inlet and outlet should be safely provided, with ample room for maintenance and operational activities.

Operations and Maintenance

1) Inspect vegetated swales for erosion or damage to vegetation after every storm greater than 0.75 inches for on-line swales and at least twice annually for off-line swales, preferably at the end of the wet season to schedule summer maintenance and in the fall to ensure readiness for winter. Additional inspection after periods of heavy runoff is recommended. Each swale should be checked for debris and litter and areas of sediment accumulation (see Appendix I for a vegetated swale inspection and maintenance checklist).

2) Swale inlets (curb cuts or pipes) should maintain a calm flow of water entering the swale. Remove sediment as needed at the inlet, if vegetation growth is inhibited in greater than 10% of the swale or if the sediment is blocking even distribution and entry of the water. Following sediment removal activities, replanting and/or reseeding of vegetation may be required for reestablishment.

3) Flow spreaders should provide even dispersion of flows across the swale. Sediments and debris should be removed from the flow spreader if blocking flows. Splash pads should be repaired if needed to prevent erosion. Spreader level should be checked and releveled if necessary.

4) Side slopes should be maintained to prevent erosion that introduces sediment into the swale. Slopes should be stabilized and planted using appropriate erosion control measures when native soil is exposed, or erosion channels are formed.

5) Swales should drain within 48 hours of the end of a storm. Till the swale if compaction or clogging occurs and revegetate. If a perforated underdrain pipe is present, it should be cleaned if necessary.

6) Vegetation should be healthy and dense enough to provide filtering, while protecting underlying soils from erosion:

   - Mulch should be replenished as needed to ensure survival of vegetation.
   - Vegetation, large shrubs or trees that interfere with landscape swale operation should be pruned.
   - Fallen leaves and debris from deciduous plant foliage should be removed.
   - Grassy swales should be mowed to 4 to 6 inches height. Grass clippings should be removed.
   - Invasive vegetation, such as Alligatorweed (*Alternanthera philoxeroides*), Halogeton (*Halogeton glomeratus*), Spotted Knapweed (*Centaurea maculosa*), Giant Reed (*Arundo donax*), Castor Bean (*Ricinus communis*), Perennial Pepperweed (*Lepidium latifolium*), and Yellow Starthistle (*Centaurea solstitalis*) should be removed and replaced with non-invasive species. Invasive species should never contribute more than 10% of the vegetated area. For more information on invasive weeds, including biology and control of listed weeds, look at the encycloweedia located at the California Department of Food and Agriculture website or the California Invasive Plant Council website at www.cal-ipc.org.
   - Dead vegetation should be removed if greater than 10% of area coverage or when swale function is impaired. Vegetation should be replaced and established before the wet season to maintain cover density and control erosion where soils are exposed.

7) Check dams (if present) should control and distribute flow across the swale. Causes for altered water flow and/or channelization should be identified and obstructions cleared. Check dams and swale should be repaired if damaged.

8) The vegetated swale should be well maintained. Trash and debris, sediment, visual contamination (e.g., oils), noxious or nuisance weeds, should all be removed.

I.2 Vegetated Swale Inspection and Maintenance Checklist

Date: _____ Work Order # _____

Type of Inspection: □ post-storm □ annual □ routine □ post-wet season □ pre-wet season

Facility: _____ Inspector(s): _____

Defect	Conditions When Maintenance Is Needed	Inspection Result (0, 1, or 2)†	Date Maintenance Performed	Comments or Action(s) Taken to Resolve Issue
Appearance	Untidy			
Trash and Debris Accumulation	Trash and debris accumulated in the swale.			
Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation start to take over.			
Excessive Shading	Vegetation growth is poor because sunlight does not reach swale. Evaluate vegetation suitability.			
Poor Vegetation Coverage	When vegetation is sparse, or bare or eroded patches occur in more than 10% of the swale bottom. Evaluate vegetation suitability.			
Sediment Accumulation	Sediment depth exceeds 2 inches or covers more than 10% of design area.			
Standing Water	When water stands in the swale between storms and does not drain freely.			
Flow spreader or Check Dams	Flow spreader or check dams uneven or clogged so that flows are not uniformly distributed through entire swale width.			

Defect	Conditions When Maintenance Is Needed	Inspection Result (0, 1, or 2)†	Date Maintenance Performed	Comments or Action(s) Taken to Resolve Issue
Constant Baseflow	When small quantities of water continually flow through the swale, even when it has been dry for weeks and an eroded, muddy channel has formed in the swale bottom.			
Inlet/Outlet	Inlet/outlet areas clogged with sediment and/or debris.			
Erosion/ Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows. Eroded or rilled side slopes.			
	Eroded or undercut inlet/outlet structures			

†Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.

Plants

Plant materials should be tolerant of summer drought, ponding fluctuations, and saturated soil conditions for 48 to 96 hours.

It is recommended that a minimum of three types of tree, shrubs, and/or herbaceous groundcover species be incorporated to protect against facility failure due to disease and insect infestations of a single species.

Native plant species and/or hardy cultivars that are not invasive and do not require chemical inputs should be used to the maximum extent practicable.

Operations and Maintenance

Bioretention areas require annual plant, soil, and mulch layer maintenance to ensure optimum infiltration, storage, and pollutant removal capabilities. In general, bioretention maintenance requirements are typical landscape care procedures and include:

1) Watering: Plants should be selected to be drought-tolerant and not require watering after establishment (2 to 3 years). Watering may be required during prolonged dry periods after plants are established.

2) Erosion control: Inspect flow entrances, ponding area, and surface overflow areas periodically, and replace soil, plant material, and/or mulch layer in areas if erosion has occurred (see Appendix I for a bioretention inspection and maintenance checklist). Properly designed facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems occur, the following should be reassessed: (1) flow velocities and gradients within the cell, and (2) flow dissipation and erosion protection strategies in the pretreatment area and flow entrance. If sediment is deposited in the bioretention area, immediately determine the source within the contributing area, stabilize, and remove excess surface deposits.

3) Plant material: Depending on aesthetic requirements, occasional pruning and removing of dead plant material may be necessary. Replace all dead plants and if specific plants have a high mortality rate, assess the cause and, if necessary, replace with more appropriate species. Periodic weeding is necessary until plants are established. The weeding schedule should become less frequent if the appropriate plant species and planting density have been used and, as a result, undesirable plants have been excluded.

4) Nutrient and pesticides: The soil mix and plants are selected for optimum fertility, plant establishment, and growth. Nutrient and pesticide inputs should not be required and may degrade the pollutant processing capability of the bioretention area, as well as contribute pollutant loads to receiving waters. By design, bioretention facilities are located in areas where phosphorous and nitrogen levels are often elevated, and these should not be limiting nutrients. If in question, have soil analyzed for fertility.

5) Mulch: Replace mulch annually in bioretention facilities where high trash, sediment load, and heavy metal deposition is likely (e.g., heavy metal contributing areas include industrial and auto dealer/repair parking lots and roads). In residential lots or other areas where metal deposition is not a concern, replace or add mulch as needed to maintain a 2 to 3-inch depth at least once every two years.

6) Soil: Soil mixes for bioretention facilities are designed to maintain long-term fertility and pollutant processing capability. Replacing mulch in bioretention facilities where high trash, sediment load, and heavy metal deposition are likely providing an additional level of protection for prolonged performance. Estimates from metal attenuation research suggest that metal accumulation should not present an environmental concern for at least 20 years in bioretention systems. However, the saturated hydraulic conductivity should be assessed at least annually to ensure that the design water quality event is being treated. If in question, have soil analyzed for fertility and pollutant levels.

I.1 Bioretention/Planter Box Inspection and Maintenance Checklist

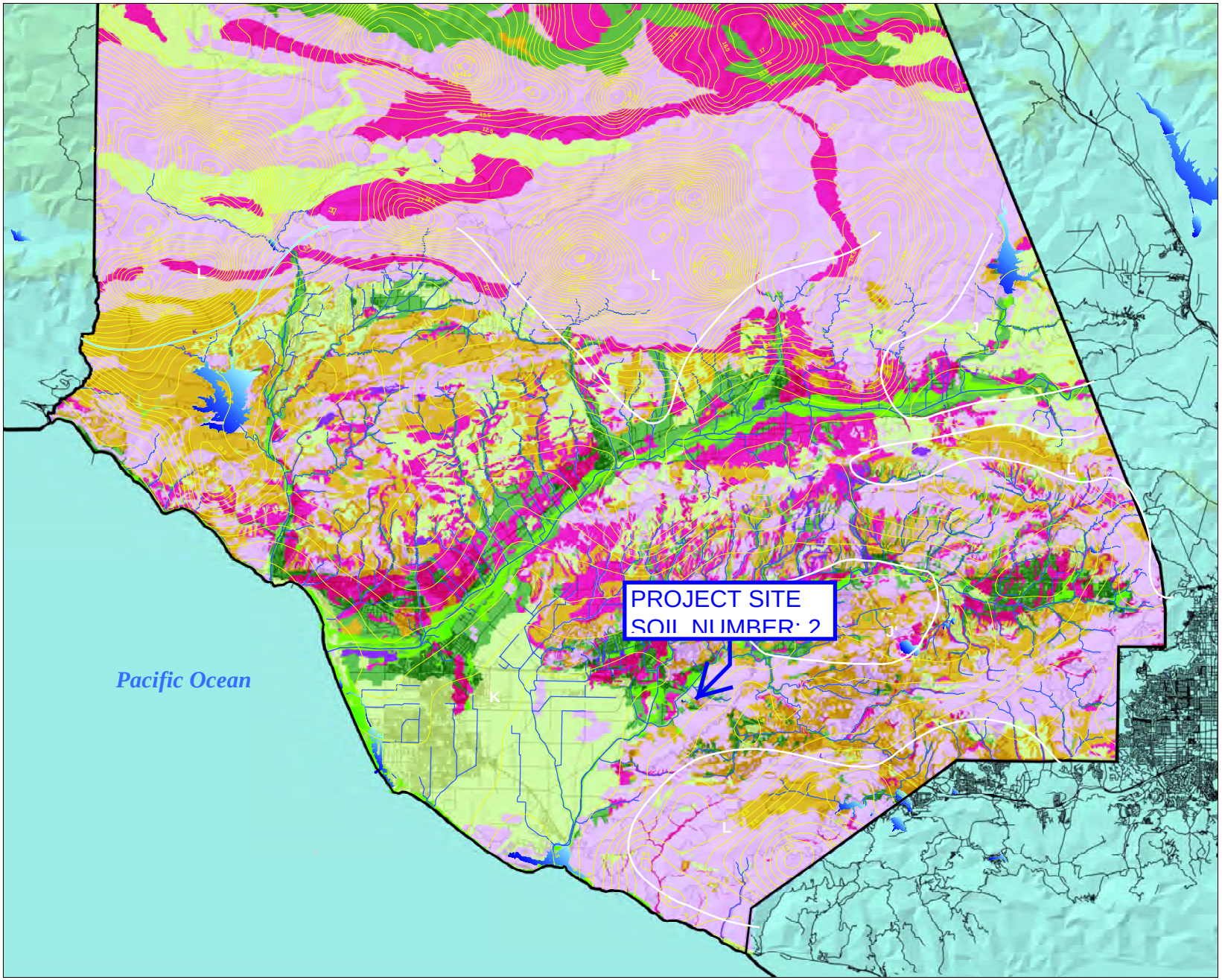
Date: _____ Work Order # _____

Type of Inspection: □ post-storm □ annual □ routine □ post-wet season □ pre-wet season

Facility: _____ Inspector(s): _____

Defect	Conditions When Maintenance Is Needed	Inspection Result (0, 1, or 2)†	Date Maintenance Performed	Comments or Action(s) Taken to Resolve Issue
Appearance	Untidy			
Trash and Debris Accumulation	Trash, plant litter and dead leaves accumulated on surface.			
Vegetation	Unhealthy plants and appearance.			
Irrigation	Functioning incorrectly (if applicable).			
Inlet	Inlet pipe blocked or impeded.			
Splash Blocks	Blocks or pads correctly positioned to prevent erosion.			
Overflow	Overflow pipe blocked or broken.			
Filter media	Infiltration design rate is met (e.g., drains 36-48 hours after moderate - large storm event).			

†Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed and include WO#. Enter 2 if maintenance was performed same day.



100-Year, 1-Day Rainfall Contours for Ventura County

0 0.5 1 2 3 4 5 6 Miles

N
W E
S

Rainfall Zones
Ventura County Boundary
Rainfall Contours (Inches)-100yr
VCWPD Channels
Lakes

Ventura County Soil Numbers

1
2
3
4
5
6
7

Major Streets and Highways

Topography of Ventura County
Elevation (ft.)

7,848 - 8,832
6,864 - 7,848
5,881 - 6,864
4,897 - 5,881
3,914 - 4,897
2,930 - 3,914
1,947 - 2,930
963 - 1,947
0 - 963

GEOLABS-WESTLAKE VILLAGE
Foundation and Soils Engineering, Geology
31119 Via Colinas, Suite 502 • Westlake Village, CA 91362
Voice: (818) 889-2562 (805) 495-2197
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a dba of
R & R Services
Corporation

October 19, 2018
W.O. 9359

New Urban West, Inc.
1733 Ocean Avenue, Suite 260
Santa Monica, California 90401

Attention: Johnathan Frankel

SUBJECT: Feasibility of On-Site Stormwater Infiltration
Unnamed Tentative Tract, Camarillo Springs,
City of Camarillo, California

Mr. Frankel,

In accordance with your request we have prepared this letter-report regarding the contemplated storm water infiltration for the proposed residential development of a portion of the golf course at Camarillo Springs. In short, we believe infiltration within the residential development is *not* feasible. The basis for our belief is discussed below.

Near surface soils at the site consist primarily of clay-rich mixtures that contain variable amounts of silt and subordinate sand. Over the years, these soils have been observed in numerous borings and trenches. Water has been observed flowing from small sand stringers that occur sporadically within the soil, while the intervening clayey soil shows no sign of seepage, attesting to its low permeability even when in a poorly compacted state. When compacted, as they will be for the residential development, such soils have very slow infiltration rates; infiltration rates below the threshold for stormwater infiltration systems.

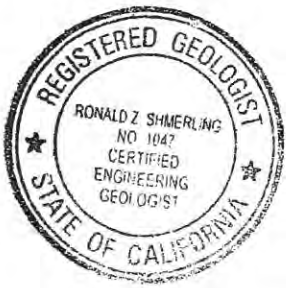
Ground water occurs at shallow depths throughout the development area; too shallow to allow stormwater infiltration systems. Piezometers set at 10 to 20 feet below the surface show pressure heads that place the piezometric surface 2 – 3 feet below the surface.

This geotechnical report has been prepared in accordance with generally accepted engineering practices at this time and location. No other express or implied warranty

regarding to the professional opinions provided under the terms of our agreement and included in this report is made.

Thank you for this opportunity to be of service. Please do not hesitate to call if you have any questions regarding this report.

Respectfully submitted,
GEOLABS-WESTLAKE VILLAGE



Ronald Z. Shmerling
C.E.G. 1047
R.C.E. 35444

XC: (2) Addressee
(1) Jensen Design & Civil, Attention: Kinsey Hensley
(3) City of Camarillo, c/o Jensen Design & Civil