APPENDIX I

OPERATIONS & MAINTENACE PLAN

STORM WATER
OPERATION AND MAINTENANCE PLAN

FOR

MILPITAS STATION
MILPITAS BOULEVARD AND PIPER DRIVE
MILPITAS, CALIFORNIA

Prepared by:

BKF ENGINEERS
980 9th STREET, SUITE 1770
SACRAMENTO, CA 95814

Prepared for:

RGC
4060 CAMPUS DRIVE, SUITE 100
NEWPORT BEACH, CA 92660

TABLE OF CONTENTS

FOR 1
BKF ENGINEERS 1
ATTACHMENT 2
INSPECTION AND MAINTENANCE LOG 3
INTRODUCTION 3
A. Overview of Project 3
RESPONSIBILITY FOR MAINTENANCE 3
A. General 3
B. Staff Training Program 4
C. Records 4
SUMMARY OF DRAINAGE AREAS AND BMPS 4
A. Drainage Areas 4
B. Treatment BMPs 5
BMP DESIGN DOCUMENTATION 5
A. BMP Detail Drawings 5
B. Manufacturer's Data and Manual 5
C. Specific Operation and Maintenance Concerns and Troubleshooting 5
BMP MAINTENANCE SCHEDULE 5
A. Summary of Maintenance Schedule and Requirements for each BMP 5

ATTACHMENT

Attachment 1 Stormwater Management Facilities Operation & Maintenance Agreement
Attachment 2 Designation of Individuals Responsible for Stormwater Treatment BMP Operation and Maintenance
Attachment 3 Stormwater BMP Inspection and Maintenance Log
Attachment 4 Media Filtration System Information
Attachment 5 Media Filtration System Maintenance Procedures

INSPECTION AND MAINTENANCE LOG

See Attachment 3

INTRODUCTION

A. Overview of Project

The proposed Milpitas Station project is located between Milpitas Boulevard and Piper Drive in Milpitas, California. The project site is approximately 9.40 acres. Assessor Parcel Number(s) and Property Description(s) will be determined following the recording of a separate final master map. The project is included in the Milpitas Transit Area Specific Plan and is zoned as high-density transit-oriented residential development. The intent of the project is to construct approximately 338 residential units within four distinct areas. See FIGURE 1 for vicinity map.

The site will be graded to create building pads and private access aisles. Areas between the buildings will include landscape and hardscape elements. The development will be divided into three drainage areas, discharging to the public system, within Garden Street and Merry Loop, at three separate locations. Media Filtration Devices will be the primary treatment BMP. The Media Filtration Devices are designed to receive runoff via downspouts leading from roofs and storm drain system through drainage areas. In a Media Filtration Device, pollutants are removed as runoff is being treated through the system. Bio-retention areas will also be provided within the development lots, where feasible, and within the Garden Street and Merry Loop Right-of-Way.

RESPONSIBILITY FOR MAINTENANCE

A. General

1) ***Metro Owners Association*** will be responsible for maintenance and operation of BMPs on the project site. Responsibility for the implementation and/or oversight of the monitoring and maintenance program for the BMPs at Milpitas Station is designated as listed below:

   Metro: BMPs within the private areas will be maintained by the ***Metro Owners Association*** will be incorporated into the use facilities. Actual maintenance responsibilities may be contracted out to parties other than the ***Metro Owners Association*** .

2) ***Metro Owners Association***.

Organization chart will be provided once ***Metro Owners Association*** is established.

3) Operation and Maintenance Agreement

a) See Attachment 1

4) Maintenance Funding

The growing body of experience related to stormwater BMPs shows the importance of reliable funding mechanisms to support ongoing operations and maintenance activities. In general, funding for maintenance of BMPs will be by ***Metro Owners Association***.

a) Source of funds will be revenue from the ***HOA*** Fees.
b) Budget categories or line items will be provided by ***Metro Owners Association***.
c) Adequate funding for the maintenance of BMPs will be provided by ***Metro Owners Association.***

B. Staff Training Program

The ***Metro Owners Association*** Operation and Maintenance designee will provide a training program to maintain BMPs.

C. Records

All maintenance and training will be documented by the ***Metro Owners Association*** Operation and Maintenance designee.

D. Safety

Safety guidelines will be established and enforced by the ***Metro Owners Association*** Operation and Maintenance designee.

SUMMARY OF DRAINAGE AREAS AND BMPS

A. Drainage Areas

1. See Figure 3 of the Storm Water Control Plan.

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B. Treatment BMPs

1. For locations and sizes of BMPs, See Figure 3 of the Storm Water Control Plan.

2. General Description of BMPs

   Media Filtration System: Three Up-Flo Filter by KriStar Enterprises, Inc. will be installed. The installation should comply with the manufacturer's recommendations and specifications.

   Bio-retention: Multiple Bio-Retention areas will be installed in the public right-of-way and within the private development area. Installation of bio-retention areas shall be per the construction documents prepared for the proposed improvements.

BMP DESIGN DOCUMENTATION

A. BMP Detail Drawings

Milpitas Station Improvement Plans will include BMP Detail Drawings.

B. Manufacturer's Data and Manual

See Attachment 4 and Attachment 5.

C. Specific Operation and Maintenance Concerns and Troubleshooting

To be Determined.

BMP MAINTENANCE SCHEDULE

A. Summary of Maintenance Schedule and Requirements for each BMP

1. Media Filtration System

The KriStar Up-Flo Filter shall be inspected quarterly for a period of two years to determine the required maintenance interval. Detailed Maintenance and Inspection procedures are outlined in Attachment 5. At the end of the second year, the frequency and dates of cleaning should be reviewed and a maintenance interval set. The unit should always be inspected in the month of October prior to commencement of the rainy season.

Sediment shall be removed in accordance with the manufacturer's recommendations. The material removed shall be disposed of in a legal manner.

The Operation and Maintenance department will maintain a log of the inspection and cleaning operations of the system. The log shall be made available to local regulatory agency having jurisdiction regarding storm water discharge.

2. Bio-Retention System

Bio-Retention components shall be inspected and repaired/replaced as necessary. This typically involves similar routine maintenance that is required of landscape areas. A health assessment of the vegetation within the bio-retention area should occur at least two times each year, with damaged vegetation being replaced. Routine inspections should occur to determine if there are areas of standing water and corrective measures should be implemented to restore the proper infiltration. Repair due to erosion and damage to the overflow structures should be completed, as necessary.

3. Storm Drain System

Storm drains and BMPs throughout the project will function best if the amount of sediment entering the system is kept to a minimum. The construction schedule should result in a low erosion potential and will help to reduce the overall amount of sediment generated within the drainage area, particularly after landscaping has been established. Many of the routine best management practices (BMPs) implemented under the National Pollutant Discharge Elimination Systems (NPDES) permit for Santa Clara County will work to reduce sediment production mobilization within the project. Among the most important will be:

- *Regular Street Sweeping.* Regular street sweeping can have a significant impact on the control of such constituents of concern as trash and debris, particulates, and heavy metals. All onsite streets and parking areas should be swept on a regular basis to control the build-up of sediment and trash with particular attention to the early fall period prior to the onset of the winter rainy season. Street Sweeping schedules will follow Santa Clara County standards, but should not be less than monthly in the dry season.

- *Inlet and Catch Basin Cleaning.* Stormwater inlets and catch basins can function as effective sediment traps for heavier materials. Therefore, these structures will need to be maintained and cleaned on at least an annual basis. Typical maintenance schedules for these activities include a thorough inspection and cleaning in late summer or early fall and a mid-winter inspection to identify any new problems that may have arisen.

- *The Operation and Maintenance Designee* will maintain a log of the inspection and cleaning operations of the system. The log shall be made available to the local regulatory agency having jurisdiction regarding storm water discharge.

4. Stenciled "NO DUMPING–DRAINS TO BAY"

All new inlets will be stenciled with the words "NO DUMPING–DRAINS TO BAY" with a thermoplastic material. The warnings will be regularly inspected and re-stenciled.

5. Landscape Maintenance

Minimize irrigation water use, minimize the use of fertilizers and pesticides, and include planting appropriate to site soils, slope, climate, sun, wind, rain, land use, air movement, and ecological consistency and plant interactions.

Replace and amend plants and soils as necessary to allow the BMPs to remain effective and attractive. Plants must remain healthy and trimmed if overgrown. Soils must be maintained to efficiently filter storm water.

Continue general landscape maintenance, including pruning and cleanup, throughout the year.

ATTACHMENT

1

BMP SITE PLAN

PERMEABLE AREA

BIO–RETENTION AREA

PERVIOUS PAVEMENT

STORM DRAIN INLET

UP–FLO FILTER MANHOLE

UP–FLO FILTER VAULT

PROPOSED TREE

ENTRANCE POINT TO BIO–RETENTION AREA

* SHARED MAINTENANCE AREA SEE DETAILS ON NEXT PAGE

GRAPHIC SCALE
50 0 50 100
1"=50'

N

TREATMENT BOUNDARY

DRAINAGE AREA 1

DRAINAGE AREA 2

DRAINAGE AREA 3

THRU SIDEWALK CHANNEL DIRECTS FLOW TO TREATMENT AREA

THRU SIDEWALK CHANNEL DIRECTS FLOW TO TREATMENT AREA

UP–FLO FILTER TO TREAT 84,000 SF TOTAL

*BIO–RETENTION AREA SIZED TO TREAT 1,300 SF (Within Public Right-of-Way)

BIO–RETENTION AREAS TREAT 2,775 SF TOTAL

*BIO–RETENTION AREA SIZED TO TREAT 6,800 SF (Within Public Right-of-Way)

CURB CUT DIRECTS FLOW TO TREATMENT AREA, TYPICAL

CURB CUT DIRECTS FLOW TO TREATMENT AREA, TYPICAL

*BIO–RETENTION AREA SIZED TO TREAT 3,875 SF (Within Public Right-of-Way)

B–B

SEE CURB CUT DETAIL BELOW

CURB CUT DIRECTS FLOW TO TREATMENT AREA, TYP

UP–FLO FILTER TO TREAT 180,000 SF

*BIO–RETENTION AREA (BY OTHERS) (Within Public Right-of-Way)

BIO–RETENTION AREA SIZED TO TREAT 2,000 SF

*BIO–RETENTION AREA SIZED TO TREAT 2,500 SF

*BIO–RETENTION AREA SIZED TO TREAT 5,000 SF (Within Public Right-of-Way)

UP–FLO FILTER TO TREAT 140,000 SF

BIO–RETENTION AREA SIZED TO TREAT 2,500 SF

*BIO–RETENTION AREA SIZED TO TREAT 5,300 SF (Within Public Right-of-Way)

BIO–RETENTION AREA SIZED TO TREAT 1,500 SF

BIO–RETENTION AREA SIZED TO TREAT 1,500 SF

TREATMENT BOUNDARY

TREATMENT BOUNDARY

BIO–RETENTION AREA SIZED TO TREAT 1,300 SF

MILPITAS BOULEVARD

PIPER DRIVE

SANTA CLARA VTA

SUMMARY OF TREATMENT AREAS FOR LOTS 1–4:

SURFACE AREAS	LOT 1	LOT 2/3	LOT 3/4
TOTAL	100,900 SF	188,165 SF	150,860 SF
IMPERVIOUS	76,904 SF	127,610 SF	130,710 SF
LANDSCAPE	23,996 SF	60,555 SF	20,150 SF
POTENTIAL PERVIOUS PAVEMENT	0 SF	2,740 SF	2,900 SF
BIO–RETENTION TREATED	2,775 SF	2,500 SF	12,300 SF
UP–FLO TREATED (NO PERV. PAVEMENT)	97,430 SF	175,865 SF	148,360 SF
UP–FLO TREATED (W/ PERV. PAVEMENT)	–	173,370 SF	136,060 SF

BIORETENTION AREAS WITHIN PUBLIC RIGHT-OF-WAY

1. SEE FIGURE 1 FOR HOA MAINTENANCE RESPONSIBILITY FOR BIORETENTION AREAS WITHIN THE PUBLIC RIGHT-OF-WAY.

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BKF ENGINEERS / SURVEYORS / PLANNERS

TRACT NO.
MILPITAS STATION
FIGURE 3

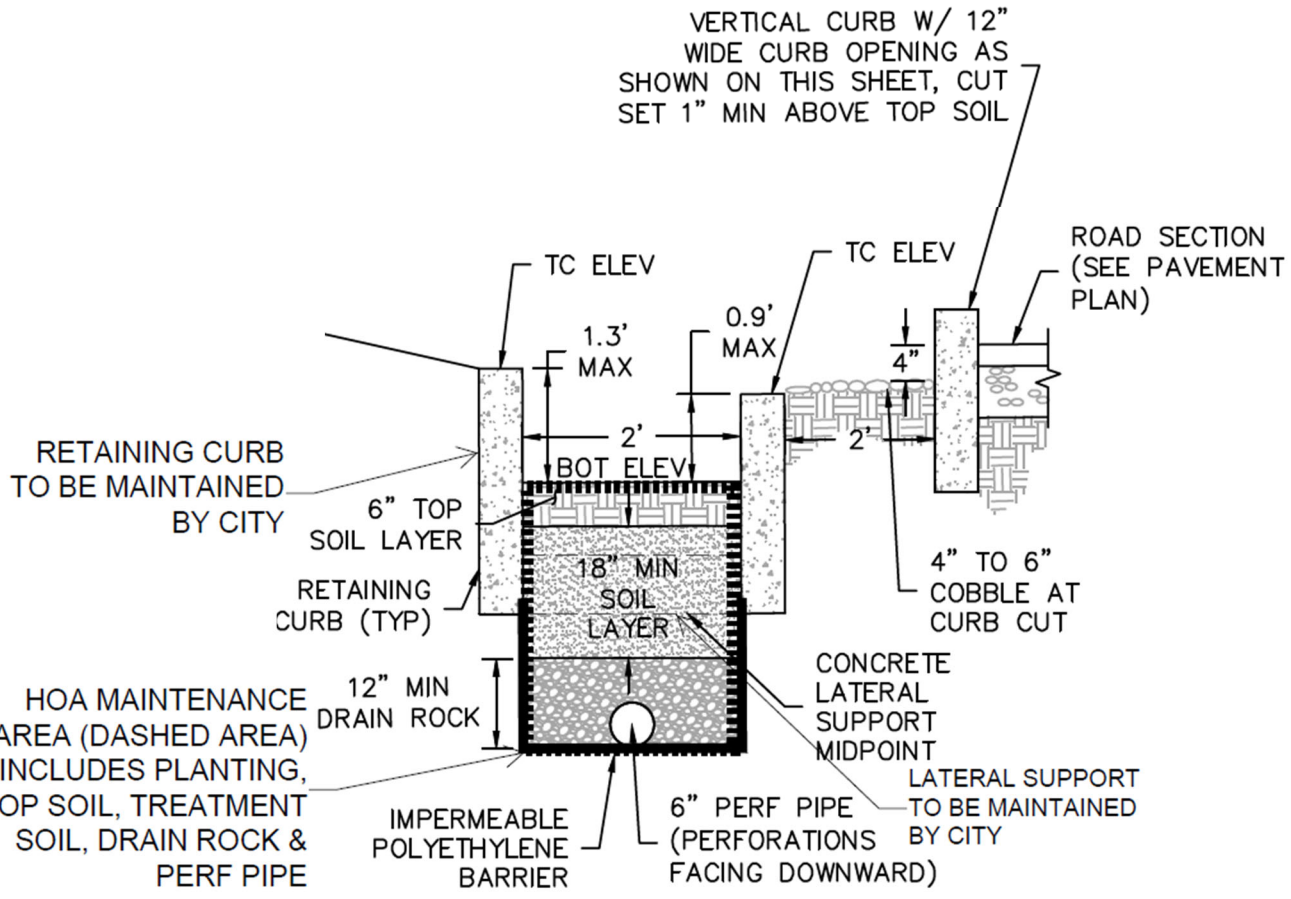
MILPITAS SANTA CLARA COUNTY CALIFORNIA

REVISIONS	Num.

Date 02/13/14
Scale: AS SHOWN
Design: JTM
Drawn: SCS
Approved: JTM
Job No. 20068010-31

Drawing Number:

OF



HOA MAINTENANCE DETAIL (TYP)

NTS

FIGURE I

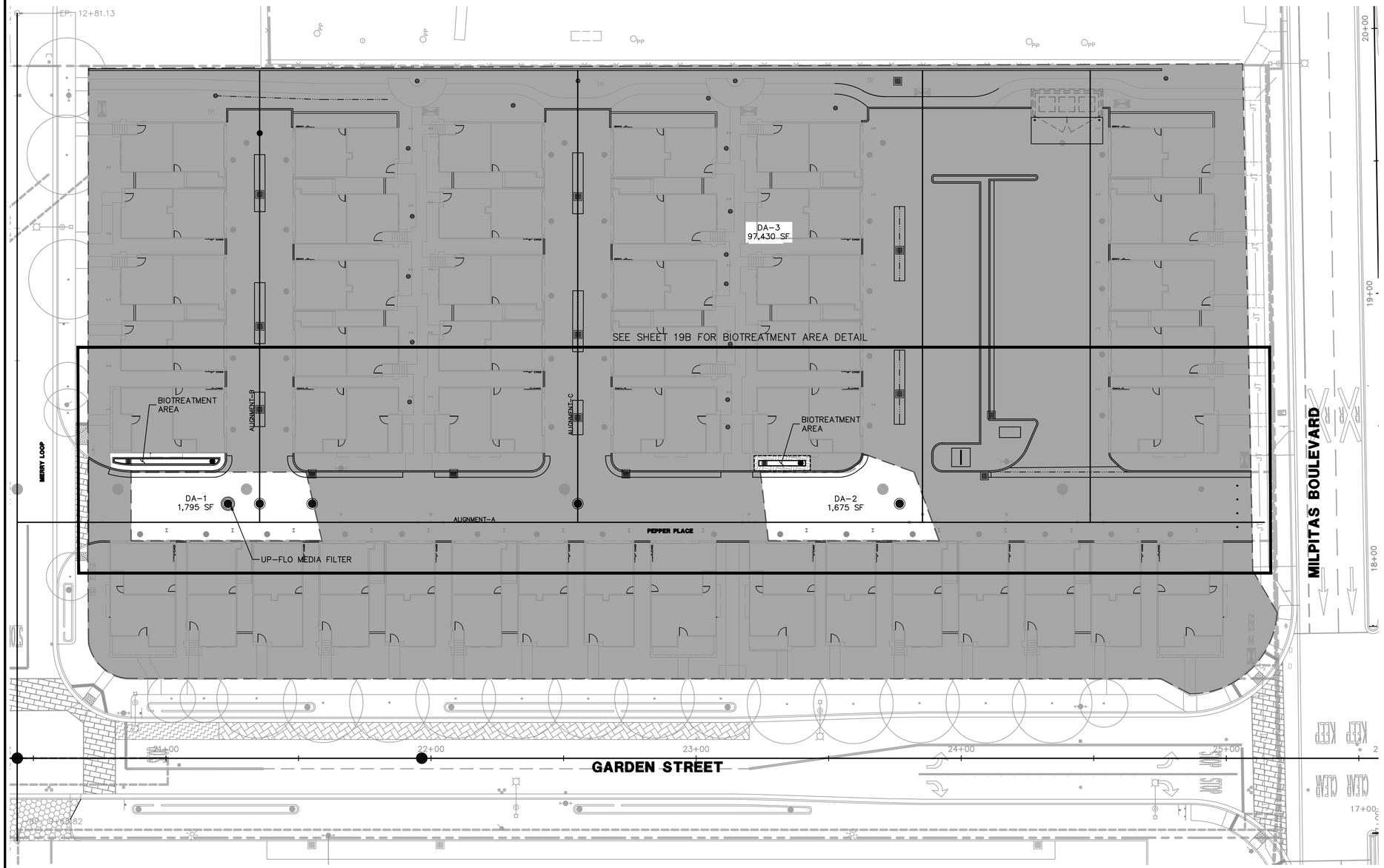
MILPITAS STATION

MILPITAS SANTA CLARA COUNTY CALIFORNIA

ATTACHMENT

2

BMP DETAILS



LEGEND

DRAINAGE AREA TO BE TREATED WITH MEDIA FILTER

DRAINAGE AREA BOUNDARY

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

Call Two Working Days Before You Dig!

Dig Safely.
1-800-227-2600

STORM WATER TREATMENT PLAN

CIVIL ENGINEER: I HEREBY DECLARE THAT I AM THE ENGINEER OF WORK FOR THIS PROJECT, THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PROJECT AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONS CODES, AND THAT THE DESIGN IS CONSISTENT WITH CURRENT STANDARDS. THE DESIGN SHOWN HEREON IS NECESSARY AND REASONABLE AND DOES NOT RESTRICT ANY HISTORIC DRAINAGE FLOWS FROM ADJACENT PROPERTIES NOR INCREASE DRAINAGE TO ADJACENT PROPOERTIES. THE DESIGN INCLUDES PRINCIPLES AND TECHNIQUES TO REDUCE QUANTITY AND IMPROVE THE QUALITY OF STORM WATER RUNOFF, AS REQUIRED BY NPDES. I UNDERSTAND THAT HE CHECK OF PROJECT DRAWINGS AND SPECIFICATIONS BY THE CITY OF MILPITAS IS CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS EGINEER OF WORK, OF MY RESPONSIBILITIES FOR PROJECT DESIGN.

SIGNATURE P.E.

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BKF ENGINEERS / SURVEYORS / PLANNERS

REGISTERED PROFESSIONAL ENGINEER
JAMES T. McCURDY
C 64850
EXP. 6/30/
CIVIL
STATE OF CALIFORNIA

DATE:	6/24/2015
SCALE:	AS SHOWN
DESIGN:	JTM/RS/SCS
DRAWN:	MMB/SCS
APPROVED:	JTM
JOB NO.	20068010-31

SOILS ENGINEER: THESE PLANS HAVE BEEN REVIEWED AND FOUND TO BE IN SUBSTANTIAL CONFORMANCE WITH THE INTENT AND PURPOSED OF THE GEOTECHNICAL EXPLORATION REPORT DATED _____, _____, PREPARED BY _____

(NAME) DATE

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TELEPHONE _____

RECORD DRAWINGS

TO BE COMPLETED PRIOR TO ACCEPTANCE OF WORK BY THE CITY

SIGNATURE & SEAL DATE

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Revisions

Num.	Date	By	Description	City Engr. Aprv.	Date

CITY OF MILPITAS ENGINEERING DIVISION

APPROVED: _____

CITY ENGINEER DATE

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RECOMMENDED FOR APPROVAL:

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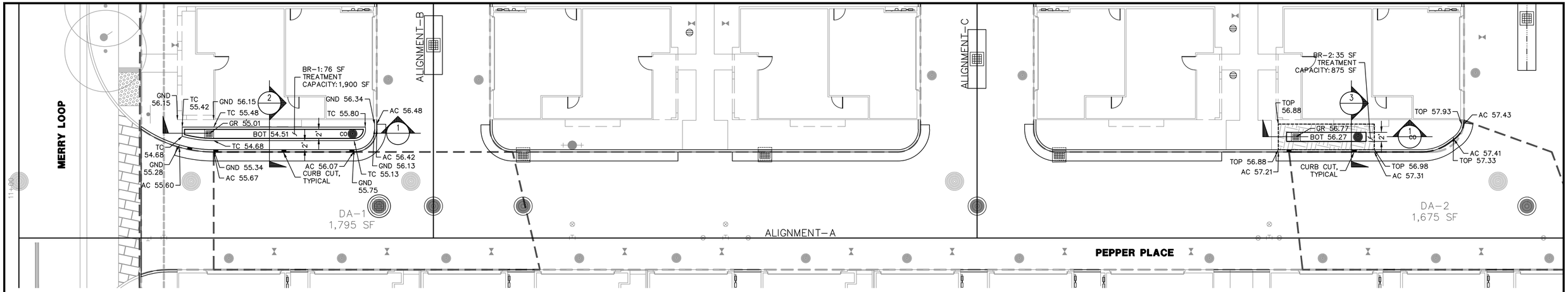
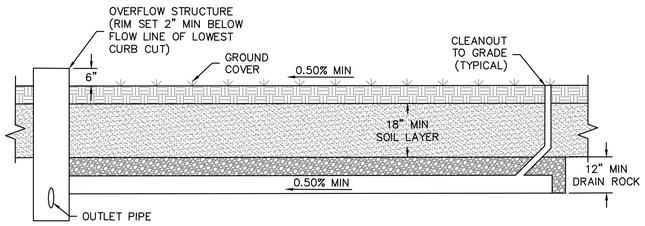
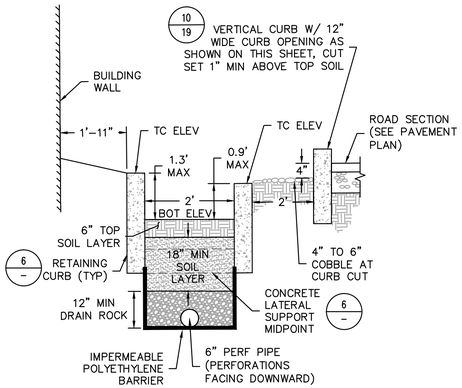
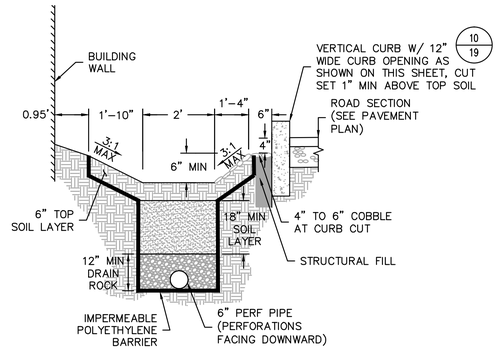




BIORETENTION NOTES:

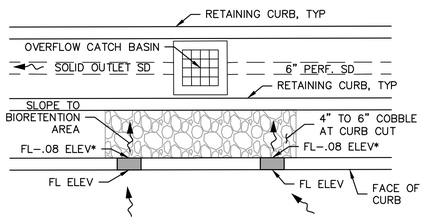
1. BIORETENTION AREAS WILL VARY AS TO LOCATION OF HIGH AND LOW POINTS BUT BASIC MATERIALS AND CONSTRUCTION METHODS SHOWN ABOVE SHALL REMAIN THE SAME.
2. SOIL LAYER USED IN BIORETENTION AREA SHALL MEET THE BIOTREATMENT SOIL MIX SPECIFICATIONS INCLUDED IN APPENDIX C OF THE SANTA CLARA COUNTY C3 HANDBOOK. A MINIMUM INFILTRATION RATE OF 5 INCHES PER HOUR AND A MAXIMUM INFILTRATION RATE OF 10 INCHES/HOUR ARE REQUIRED (INITIAL INFILTRATION RATE MAY EXCEED THIS TO ALLOW FOR TENDENCY OF INFILTRATION RATE TO REDUCE OVER TIME).
3. DRAIN ROCK LAYER SHALL CONSIST OF CLASS 2 PERMEABLE MATERIAL PER CALTRANS SPECIFICATION SECTION 68–1.025.





BIORETENTION SUMMARY TABLE				
DRAINAGE AREA	AREA (SF)	BIORETENTION	AREA (SF)	TREATMENT CAPACITY (SF)
DA–1	1,795	BR–1	76	1,900
DA–2	1,675	BR–2	35	875

1 BIO–TREATMENT LONGITUDINAL SECTION
NTS



2 RETAINED BIO–TREATMENT CROSS SECTION
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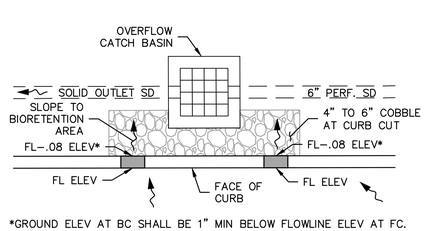

3 TYPICAL BIO–TREATMENT CROSS–SECTION
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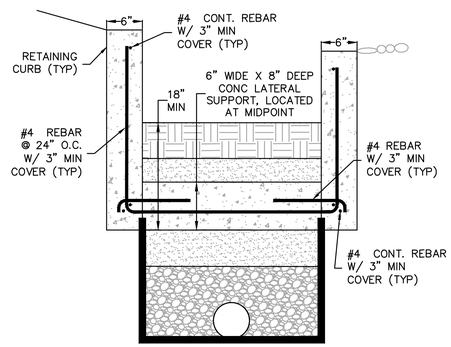

MEDIA FILTER SUMMARY TABLE			
DRAINAGE AREA	AREA (SF)	FLOW* (CFS)	MEDIA FILTER FLOW CAPACITY (CFS)
DA–3	97,430	0.31	0.33
* FLOW CALCULATED USING TREATMENT LEVEL STORM EVENT AND RATIONAL METHOD			

BIORETENTION DESIGN METHOD:

BIORETENTION AREAS HAVE BEEN DESIGNED PER THE SANTA CLARA VALLEY URBAN RUNOFF POLLUTION PREVENTION PROGRAM (SCVURPPP) "C3 STORMWATER HANDBOOK".

EACH BIORETENTION AREA HAS BEEN SIZED SO THAT THE FOOTPRINT OF THE BIORETENTION AREA IS GREATER THAN OR EQUAL TO 4% OF THE IMPERVIOUS AREA TO BE TREATED, PER SCVURPPP SECTION 6.1 OF THE "C.3 STORMWATER HANDBOOK".

BIORETENTION NOTES:

ANY EXPOSED EARTH IN BIORETENTION AREA SHALL RECEIVE A MINIMUM OF TWO INCHES OF FLOAT–RESISTANT MULCH.

4 CURB CUT AT RETAINED BIO–TREATMENT AREA
NTS

5 CURB CUT AT TYPICAL BIO–TREATMENT AREA
NTS

6 CONCRETE LATERAL SUPPORT
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REGISTERED PROFESSIONAL ENGINEER JAMES T. McCURDY C 64850 EXP. 6/30/ CIVIL STATE OF CALIFORNIA

DATE: 6/24/2015
SCALE: AS SHOWN
DESIGN: JTM/RS/SCS
DRAWN: MMB/SCS
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(NAME) DATE

FIRM:

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SIGNATURE & SEAL DATE

P.E. NO. _____ EXP: _____

PUBLIC WORKS INSPECTOR _____

Revisions

Num.	Date	By	Description	City Engr. Aprv.	Date

CITY OF MILPITAS
ENGINEERING DIVISION

APPROVED:

CITY ENGINEER DATE

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FIRE DEPT. _____ DATE: _____

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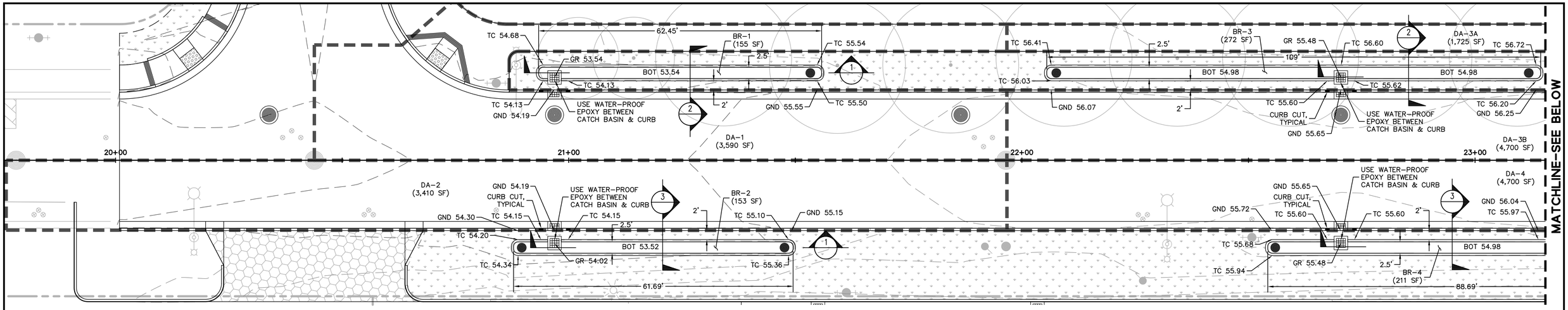

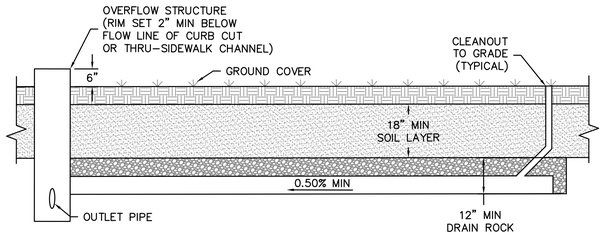

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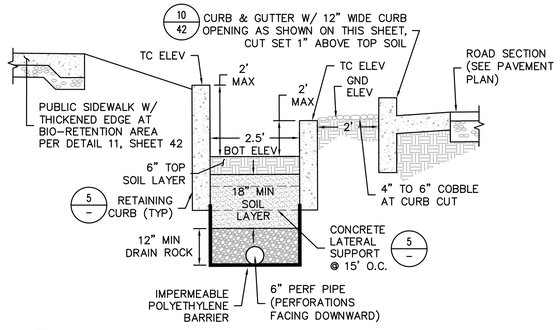
3. DRAIN ROCK LAYER SHALL CONSIST OF CLASS 2 PERMEABLE MATERIAL PER CALTRANS SPECIFICATION SECTION 68-1.025.

1 BIO-TREATMENT LONGITUDINAL SECTION

NTS



2 NORTH BIO-TREATMENT CROSS SECTION

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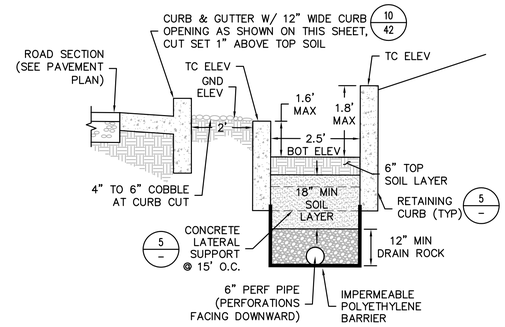

3 SOUTH BIO-TREATMENT CROSS SECTION

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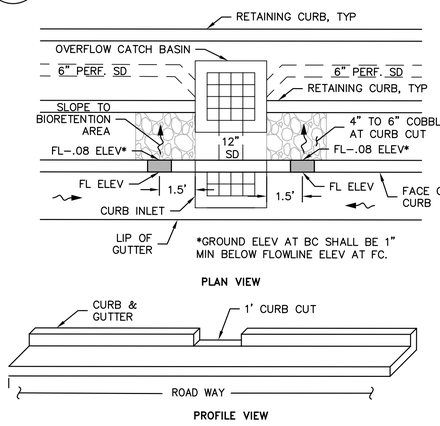
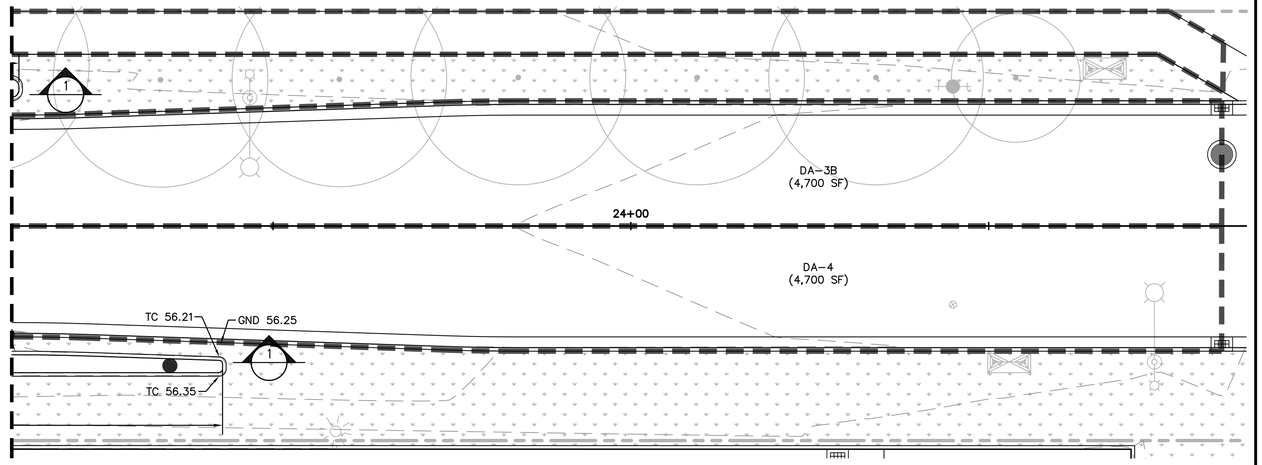
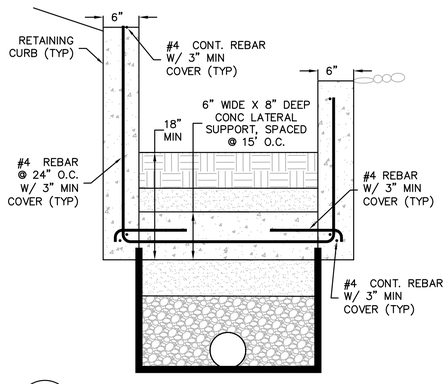


4 CURB CUT

NTS





5 RETAINING CURB

NTS

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

SEE TRACT 10060 MONTAGUE VILLAGE BACKBONE PUBLIC IMPROVEMENT PLANS FOR IMPROVEMENTS BEYOND THE EXTENT OF THIS PROJECT.

BIORETENTION DESIGN METHOD:

BIORETENTION AREAS HAVE BEEN DESIGNED PER THE SANTA CLARA VALLEY URBAN RUNOFF POLLUTION PREVENTION PROGRAM'S (SCVURPPP) C3 HANDBOOK.

EACH BIORETENTION AREA HAS BEEN SIZED SO THAT THE FOOTPRINT OF THE BIORETENTION AREA IS GREATER THAN OR EQUAL TO 4% OF THE IMPERVIOUS AREA TO BE TREATED, PER SECTION 6.1 OF THE SCVURPPP C3 HANDBOOK.

TREATMENT CALCULATIONS-GARDEN STREET

BIORETENTION FACILITY (BR)	BR AREA	DRAINAGE AREA (DA)	DA AREA	BR/DA
BR-1	155 SF	DA-1	3,590 SF	4.3%
BR-2	153 SF	DA-2	3,410 SF	4.5%
BR-3	272 SF	DA-3A	1,725 SF	4.2%
		DA-3B	4,700 SF	
BR-4	211 SF	DA-4	4,700 SF	4.5%

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GARDEN STREET STORM WATER TREATMENT PLAN

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SIGNATURE P.E.

FIRM: BKF ENGINEERS

ADDRESS: 980 9TH STREET, SUITE 1770, SACRAMENTO, CA 95814

TELEPHONE (916) 556-5800 PH/(916) 556-5899 FAX

BKF ENGINEERS / SURVEYORS / PLANNERS

REGISTERED PROFESSIONAL ENGINEER
JAMES T. McCURDY
C 64850
EXP. 6/30/
CIVIL
STATE OF CALIFORNIA

DATE:	11/8/2013
SCALE:	AS SHOWN
DESIGN:	JTM/RS/SCS
DRAWN:	RS/SCS
APPROVED:	JTM
JOB NO.	20068010-31

SOILS ENGINEER: THESE PLANS HAVE BEEN REVIEWED AND FOUND TO BE IN SUBSTANTIAL CONFORMANCE WITH THE INTENT AND PURPOSED OF THE GEOTECHNICAL EXPLORATION REPORT DATED _____, _____, PREPARED BY _____

(NAME) DATE

FIRM: _____

ADDRESS: _____

TELEPHONE _____

RECORD DRAWINGS

TO BE COMPLETED PRIOR TO ACCEPTANCE OF WORK BY THE CITY

SIGNATURE & SEAL DATE

P.E. NO. _____ EXP: _____

PUBLIC WORKS INSPECTOR _____

Revisions

Num.	Date	By	Description	City Engr. Aprv.	Date

CITY OF MILPITAS
ENGINEERING DIVISION

APPROVED FOR PUBLIC IMPROVEMENT AS SHOWN ON PLANS:

CITY ENGINEER DATE

ANY CHANGES TO PUBLIC IMPROVEMENTS SHALL BE APPROVED BY THE CITY ENGINEER

RECOMMENDED FOR APPROVAL:

FIRE DEPT. _____ DATE: _____

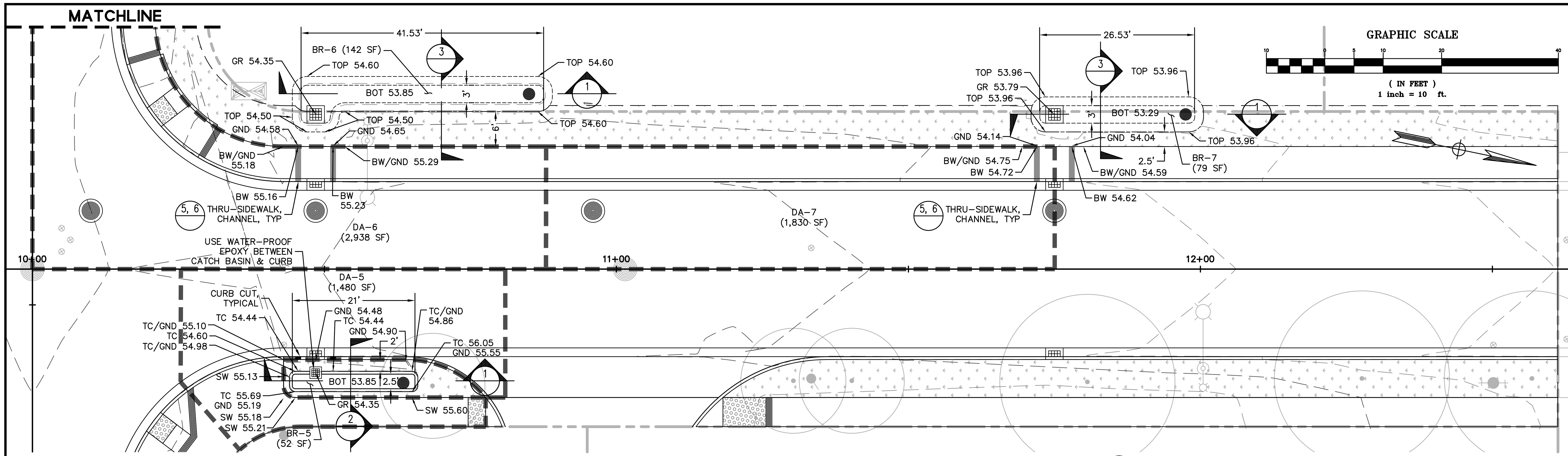
ENGINEERING _____ DATE: _____

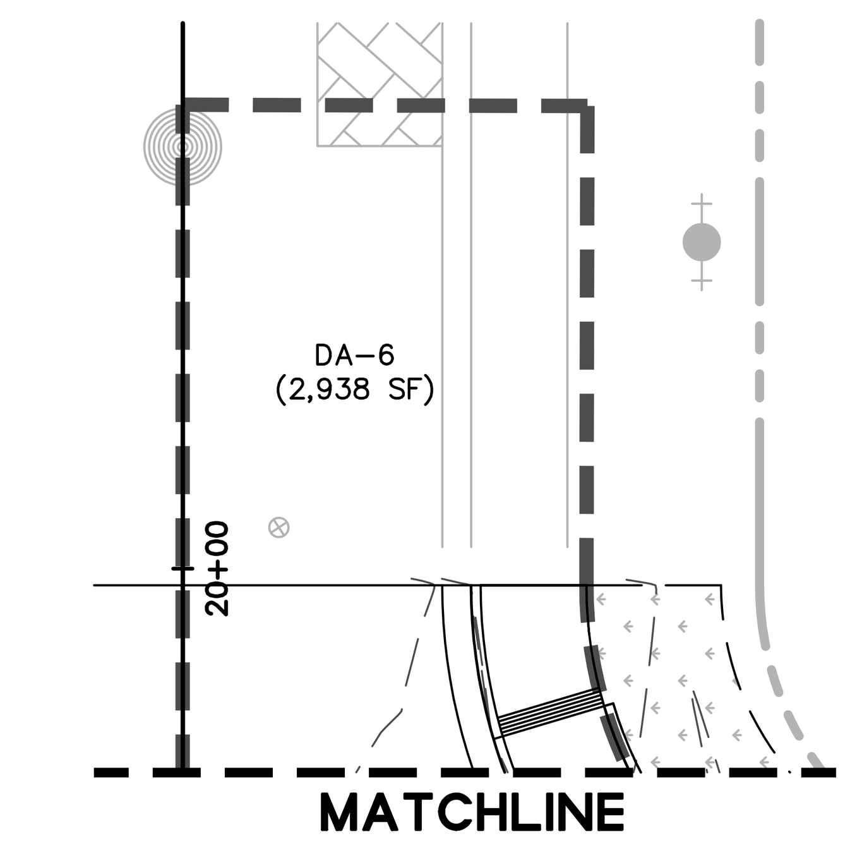
Project No. 3216

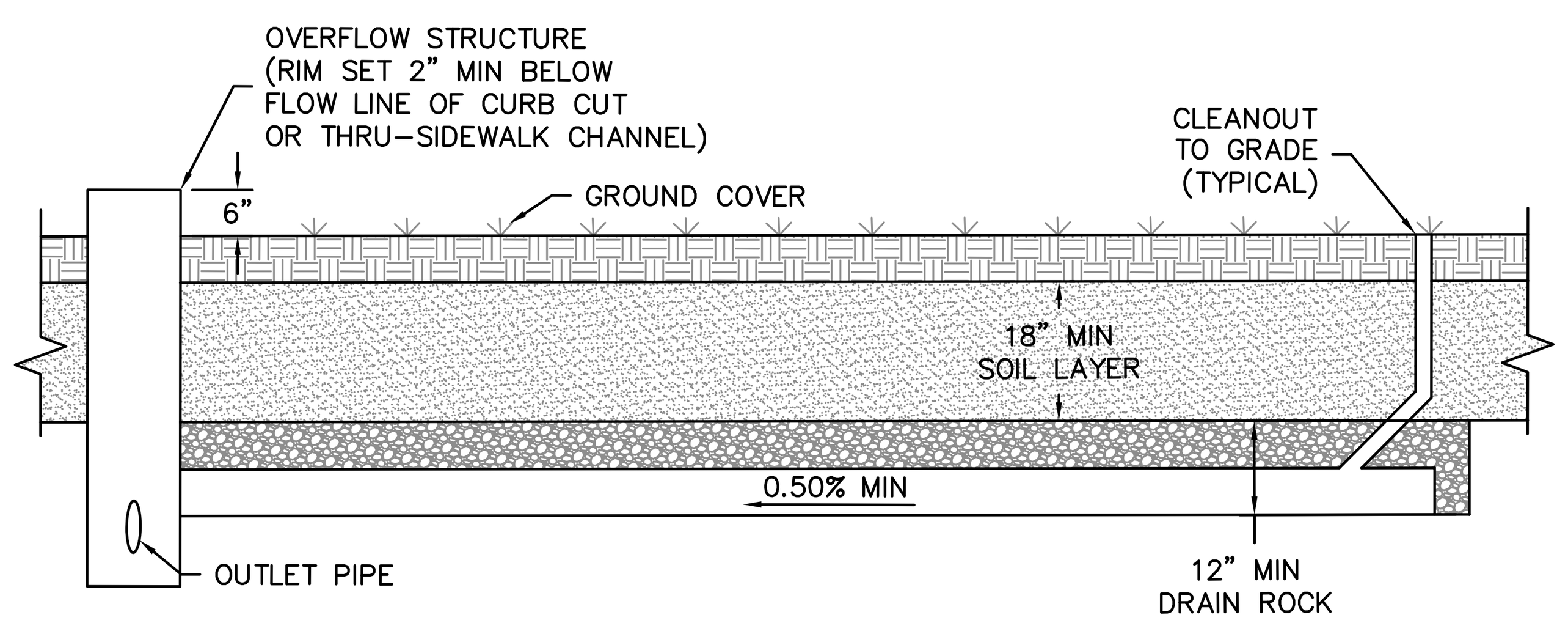
Drawing No. 2-1164

E.P. No.

Sheet 17 of 46





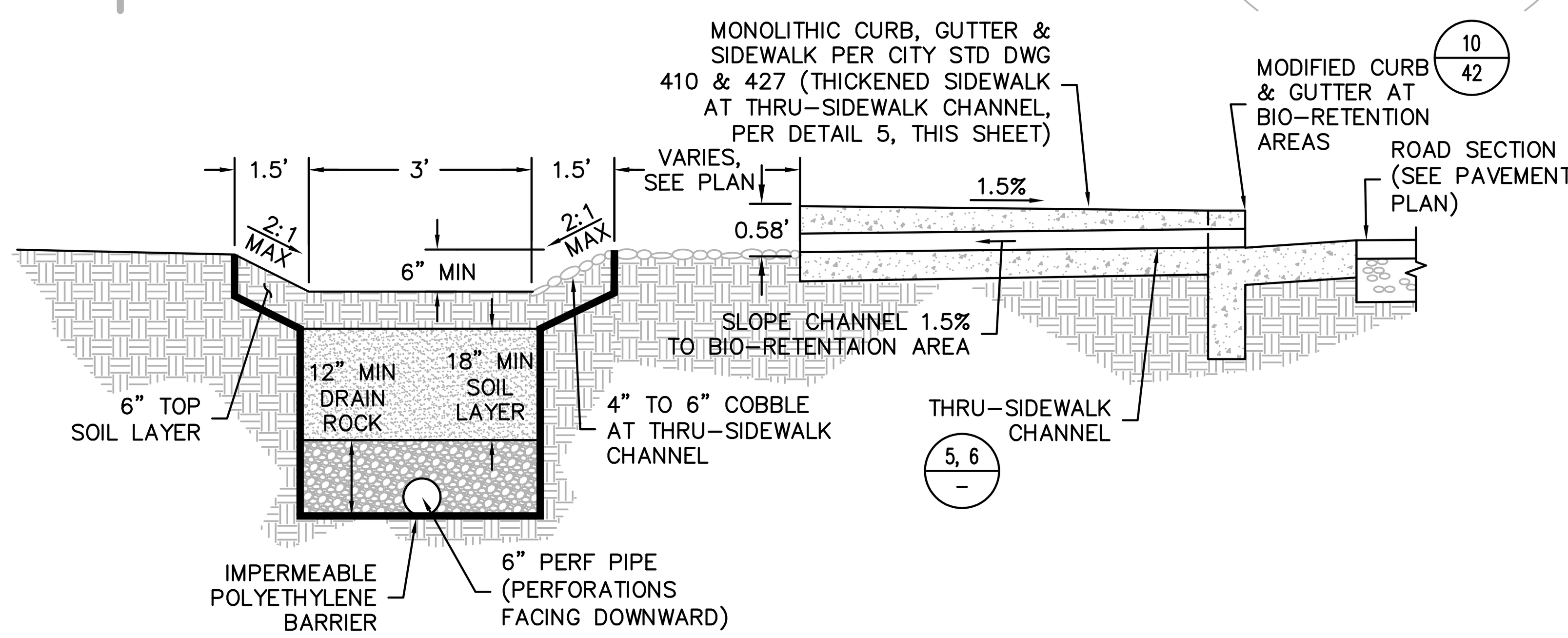


BIORETENTION NOTES:

1. BIORETENTION AREAS WILL VARY AS TO LOCATION OF HIGH AND LOW POINTS BUT BASIC MATERIALS AND CONSTRUCTION METHODS SHOWN ABOVE SHALL REMAIN THE SAME.
2. SOIL LAYER USED IN BIORETENTION AREA SHALL MEET THE BIOTREATMENT SOIL MIX SPECIFICATIONS INCLUDED IN APPENDIX C OF THE SANTA CLARA COUNTY C3 HANDBOOK. A MINIMUM INFILTRATION RATE OF 5 INCHES PER HOUR AND A MAXIMUM INFILTRATION RATE OF 10 INCHES/HOUR ARE REQUIRED (INITIAL INFILTRATION RATE MAY EXCEED THIS TO ALLOW FOR TENDENCY OF INFILTRATION RATE TO REDUCE OVER TIME).
3. DRAIN ROCK LAYER SHALL CONSIST OF CLASS 2 PERMEABLE MATERIAL PER CALTRANS SPECIFICATION SECTION 68-1.025.

1 BIO-TREATMENT LONGITUDINAL SECTION

NTS



3 WEST BIO-TREATMENT CROSS SECTION

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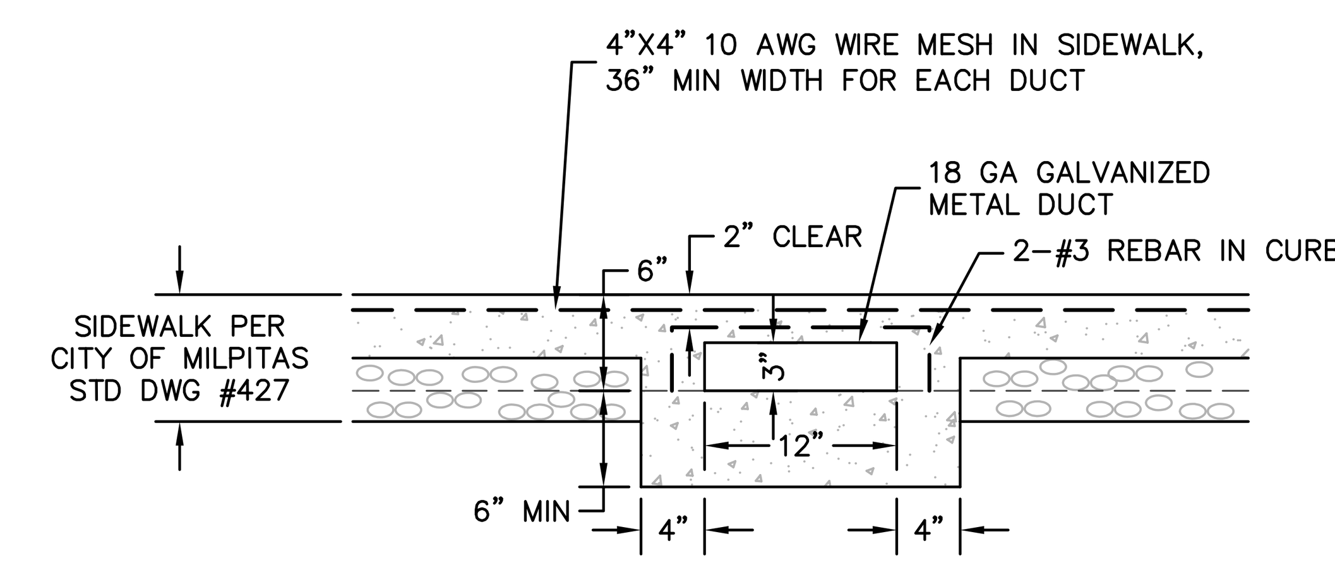
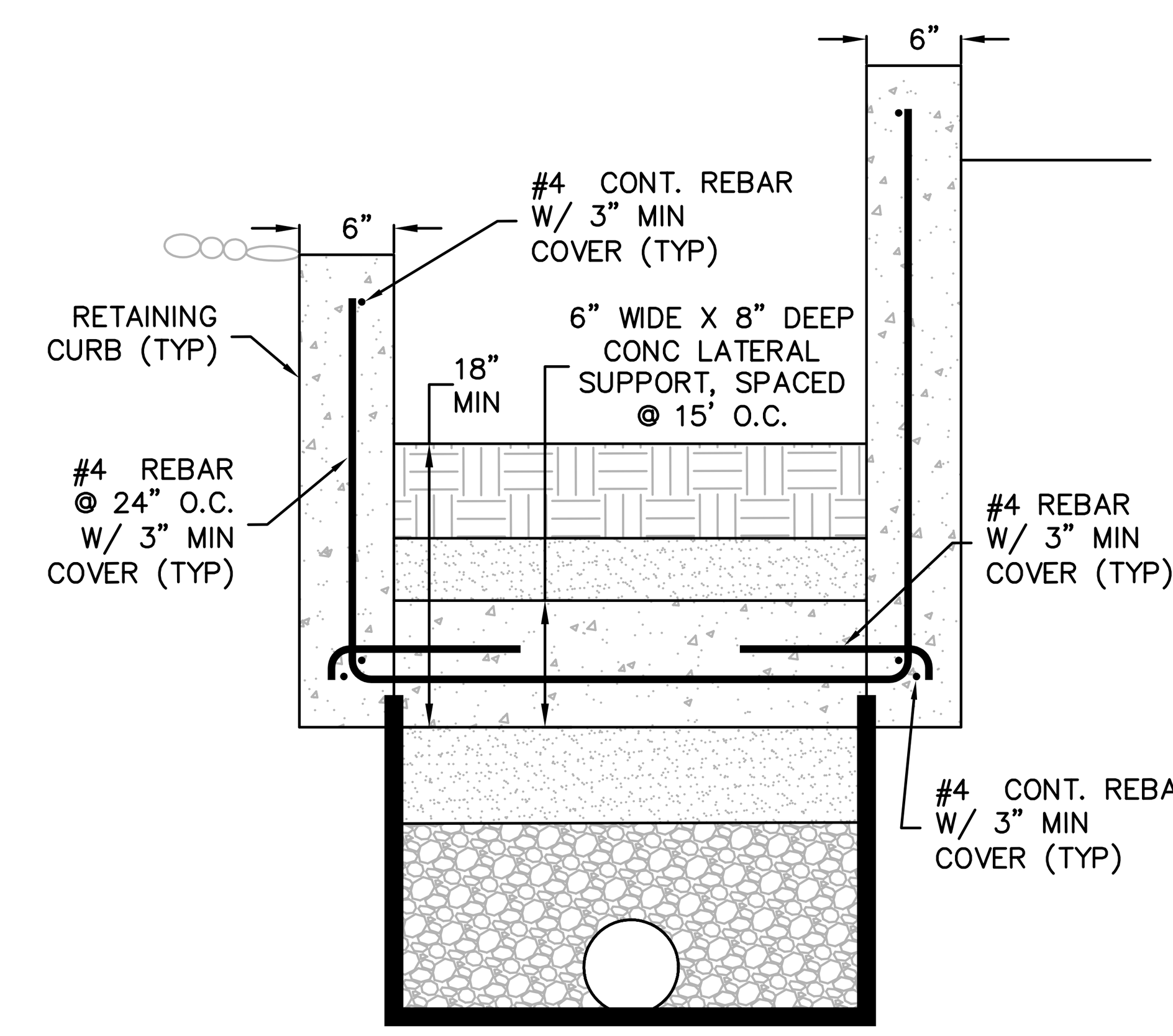


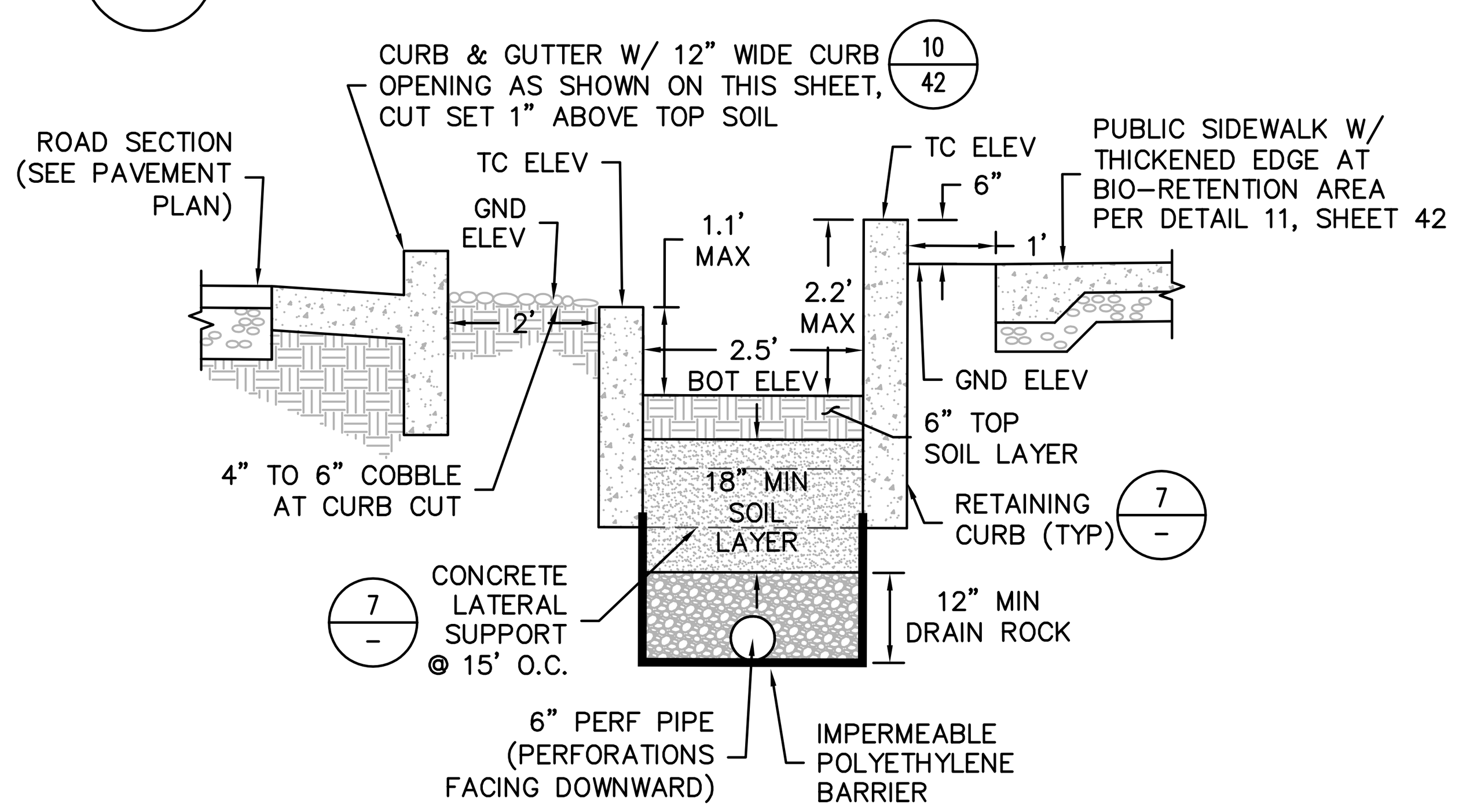
5 THRU-SIDEWALK CHANNEL DETAIL

NTS



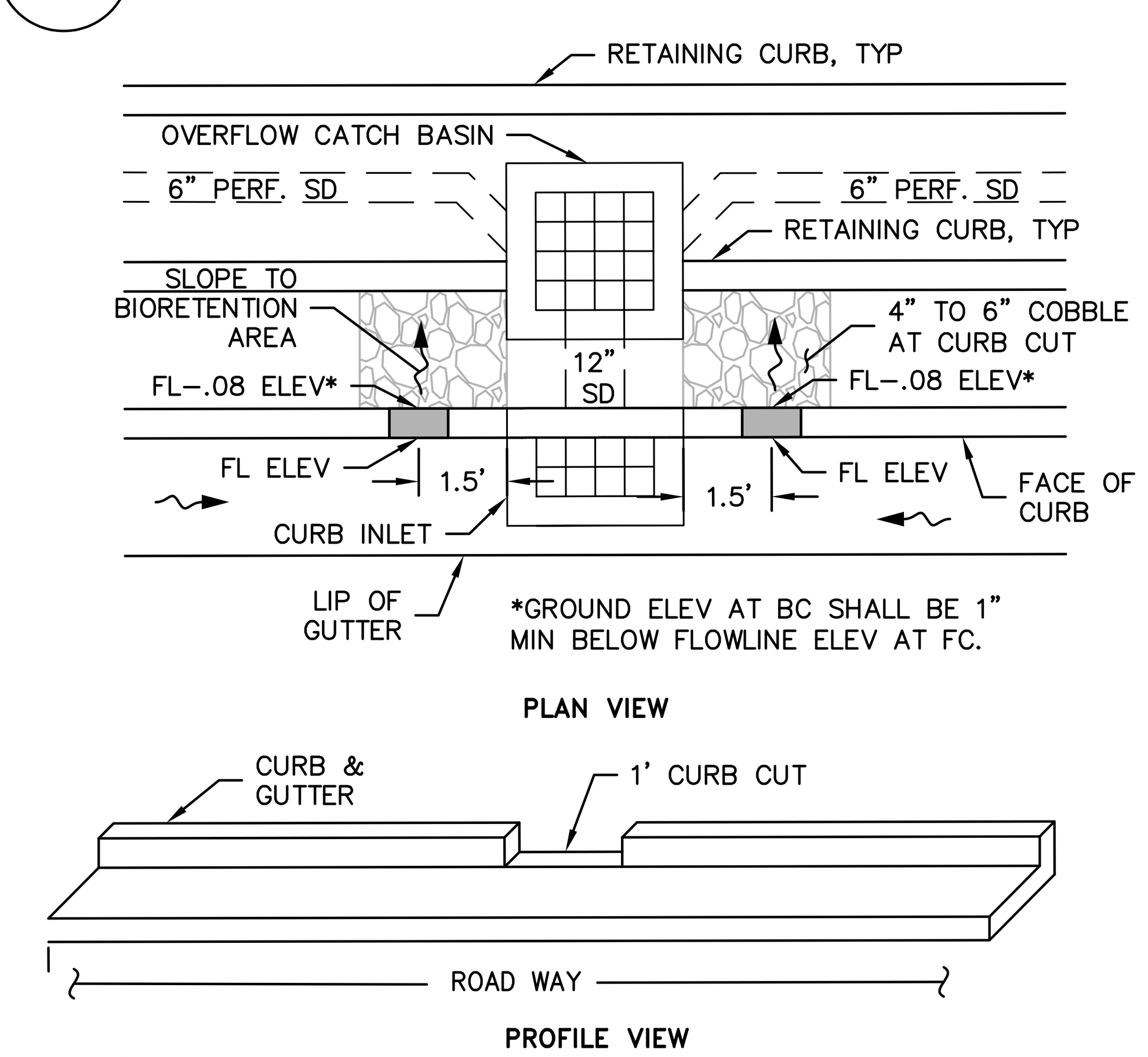
7 RETAINING CURB

NTS



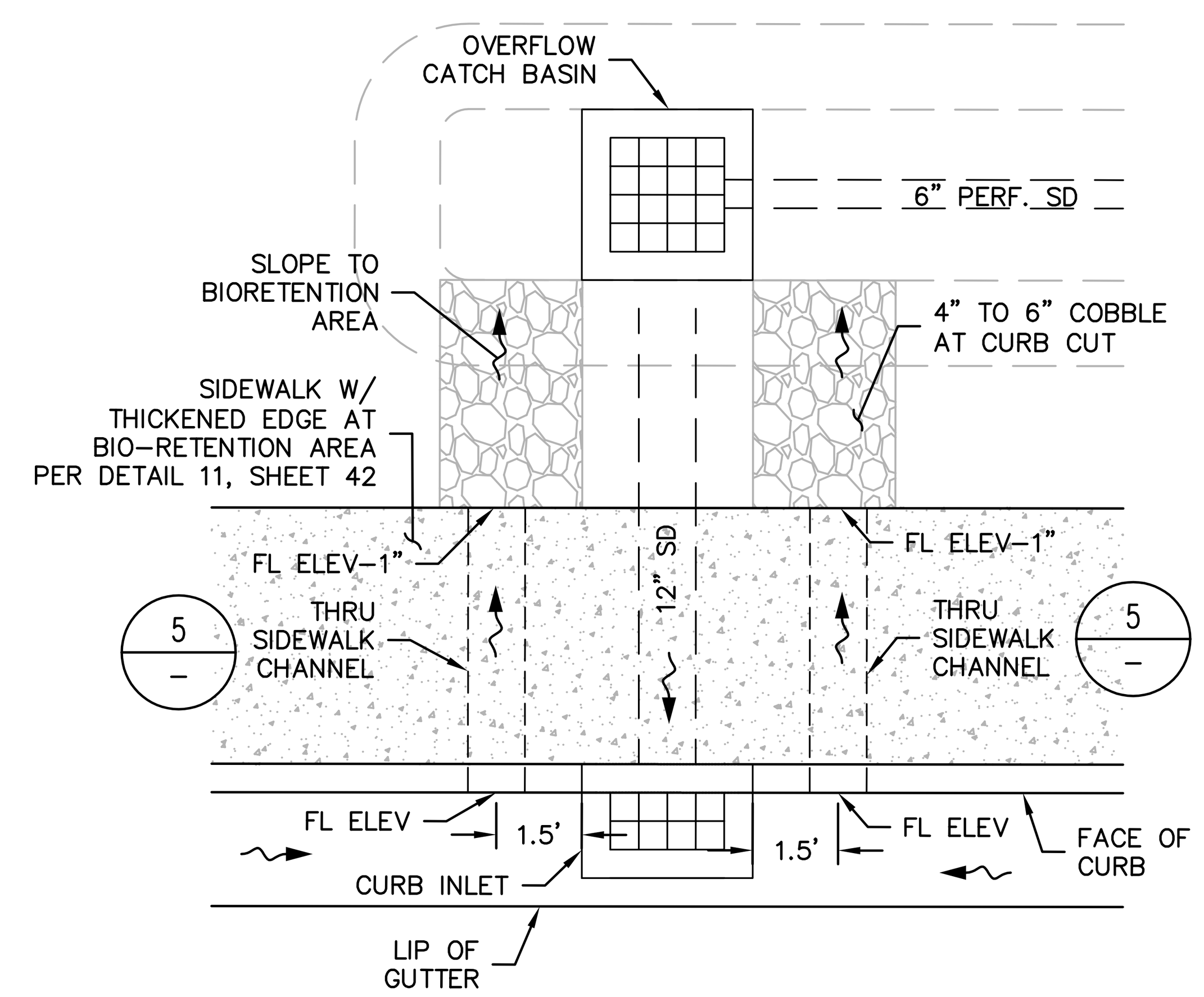
2 EAST BIO-TREATMENT CROSS SECTION

NTS



4 CURB CUT

NTS



6 BIO-RETENTION PLAN VIEW AT THRU SIDEWALK CHANNEL

NTS

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TREATMENT CALCULATIONS-MERRY LOOP

BIORETENTION FACILITY (BR)	BR AREA	DRAINAGE AREA (DA)	DA AREA	BR/DA
BR-5	52 SF	DA-5	1,282 SF	4.1%
BR-6	142 SF	DA-6	2,938 SF	4.8%
BR-7	79 SF	DA-7	1,830 SF	4.3%

SEE TRACT 10060 MONTAGUE VILLAGE BACKBONE PUBLIC IMPROVEMENT PLANS FOR IMPROVEMENTS BEYOND THE EXTENT OF THIS PROJECT.

MERRY LOOP STORM WATER TREATMENT PLAN

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REGISTERED PROFESSIONAL ENGINEER JAMES T. MCCURDY C 64850 EXP. 6/30/ CIVIL STATE OF CALIFORNIA

DATE: 11/8/2013
SCALE: AS SHOWN
DESIGN: JTM/RS/SCS
DRAWN: RS/SCS
APPROVED: JTM
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SOILS ENGINEER: THESE PLANS HAVE BEEN REVIEWED AND FOUND TO BE IN SUBSTANTIAL CONFORMANCE WITH THE INTENT AND PURPOSED OF THE GEOTECHNICAL EXPLORATION REPORT DATED ________ PREPARED BY ________

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RECORD DRAWINGS
TO BE COMPLETED PRIOR TO ACCEPTANCE OF WORK BY THE CITY

SIGNATURE & SEAL DATE
P.E. NO. EXP:
PUBLIC WORKS INSPECTOR

Revisions

Num.	Date	By	Description	City Engr. Aprv.	Date

CITY OF MILPITAS
ENGINEERING DIVISION

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RECOMMENDED FOR APPROVAL:
FIRE DEPT. DATE:
ENGINEERING DATE:

Project No. 3216
Drawing No. 2-1164
E.P. No.

ATTACHMENT

3

Stormwater BMP Inspection and Maintenance Log

Bioretention Area
Inspection and Maintenance Checklist

Property Address:_____ Property Owner: ***Metro Owners Association***_____

Treatment Measure No.:_____ Date of Inspection:_____Type of Inspection: Monthly Pre-Wet Season
After heavy runoff End of Wet Season

Inspector(s):_____ Other:_____

Defect	**Conditions When Maintenance Is Needed**	**Maintenance Needed? (Y/N)**	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)	**Results Expected When Maintenance Is Performed**
1. Standing Water	Water stands in the bioretention area between storms and does not drain within 2-3 days after rainfall.			There should be no areas of standing water once storm event has ceased. Any of the following may apply: sediment or trash blockages removed, improved grade from head to foot of bioretention area, or added underdrains.
2. Trash and Debris Accumulation	Trash and debris accumulated in the bioretention area.			Trash and debris removed from bioretention area and disposed of properly.
3. Sediment	Evidence of sedimentation in bioretention area.			Material removed so that there is no clogging or blockage. Material is disposed of properly.
4. Erosion	Channels have formed around inlets, there are areas of bare soil, and/or other evidence of erosion.			Obstructions and sediment removed so that water flows freely and disperses over a wide area. Obstructions and sediment are disposed of properly.
5. Vegetation	Vegetation is dead, diseased and/or overgrown.			Vegetation is healthy and attractive in appearance.
6. Mulch	Mulch is missing or patchy in appearance. Areas of bare earth are exposed, or mulch layer is less than 2 inches in depth.			All bare earth is covered, except mulch is kept 6 inches away from trunks of trees and shrubs. Mulch is even in appearance, at a depth of 2 inches.
7. Miscellaneous	Any condition not covered above that needs attention in order for the bioretention area to function as designed.			Meets the design specifications.

Up-Flo® Filter Inspection and Maintenance Log

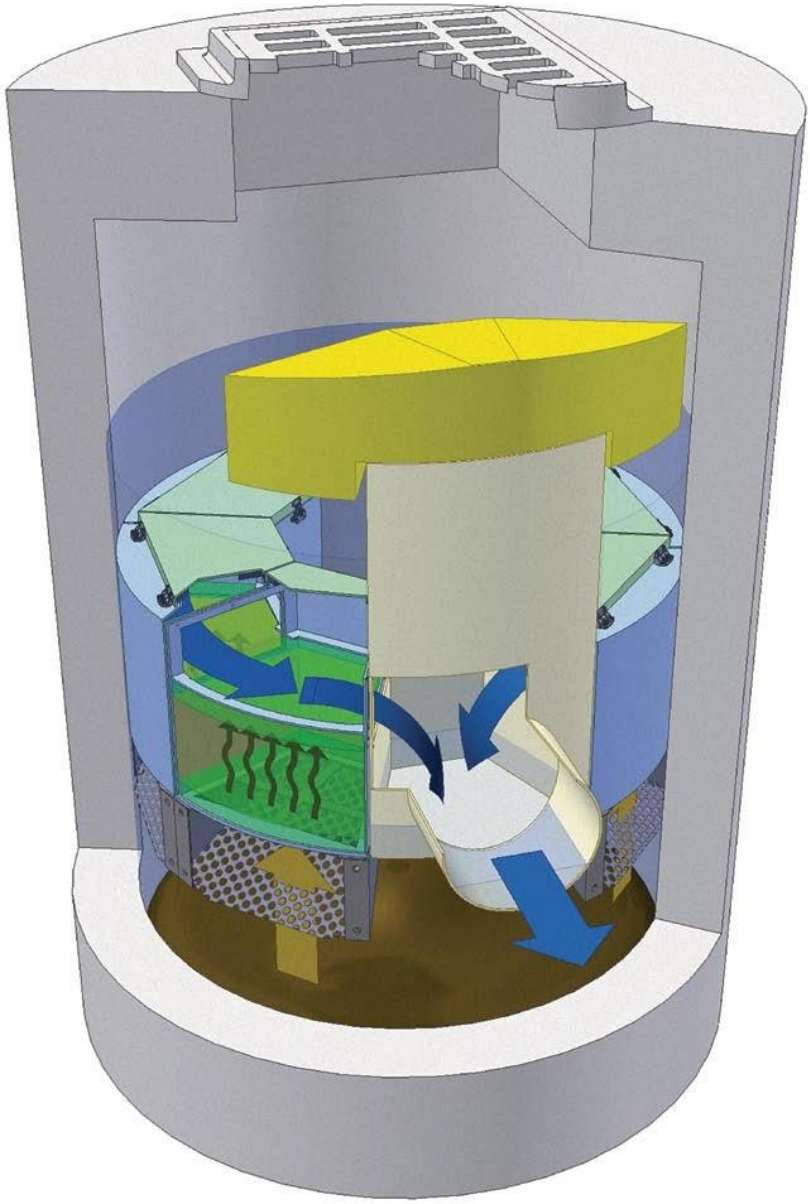
DATE	INITIALS	AREA/DEPTH OF FLOATABLES AND OILS	SEDIMENT DEPTH MEASURED	VOLUME OF SEDIMENT REMOVED	NUMBER OF MEDIA PACKS REPLACED	SITE ACTIVITY AND COMMENTS

ATTACHEMENT

4

BMP Information

Innovative stormwater management products



Up-Flo™ Filter

Stormwater Treatment System

UP –

The New Direction In Stormwater Filtration

Product Design

- Produces the highest per module filtration rate in the industry
- Customized media available for site-specific pollutants
- Long media life
- Ease of installation and maintenance
- Modular design allows for easy retrofits
- Multiple treatment train capabilities in one device

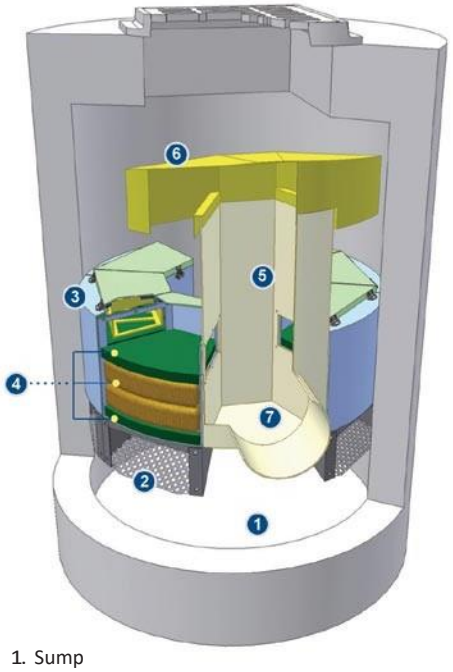
Up-Flo™ Filter

Stormwater Treatment System

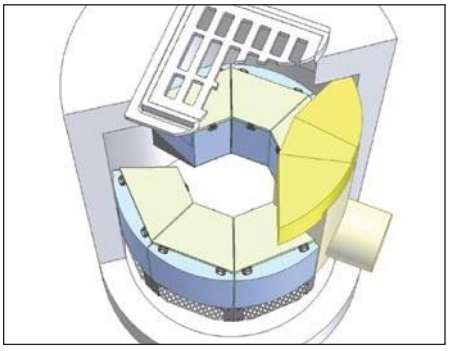
Hydro International's Up-Flo™ Filter is the new standard in stormwater treatment. Designed to meet the most stringent stormwater regulations by targeting a wide range of pollutants including floatable trash, gross debris, fine sediments, nutrients, metals, oils and grease, organics and bacteria, the Up-Flo™ Filter is a high rate, modular system that combines a patented upward flow path with a unique Drain Down design.

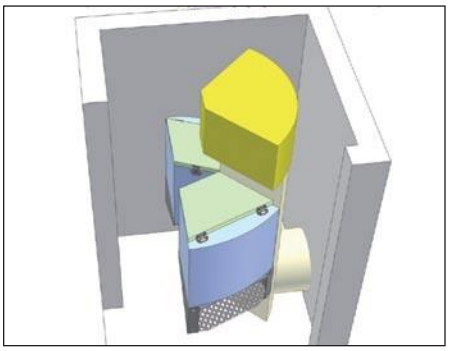
The multiple treatment train capabilities of the Up-Flo™ Filter – settling, screening and filtration – make it the most effective and economical stormwater treatment system available.

From a simple retrofit application to standard manhole configurations or even large vault system installations, the Up-Flo™ Filter is the future of stormwater treatment.



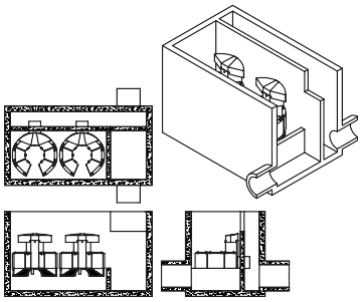
1. Sump
2. Angled Screen
3. Filter Module
4. Media Pack
5. Outlet Module
6. Bypass Siphon with Floatables Baffle
7. Drain Down Port



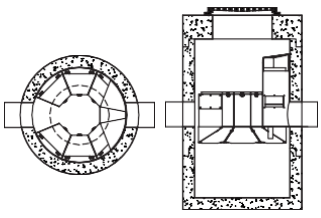


Up-Flo™ Filter in a standard manhole configuration (top). Up-Flo™ Filter in a retrofit application (bottom).

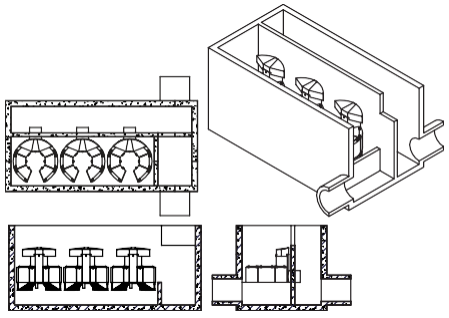
TYPICAL APPLICATIONS



Vault Style (small)



Manhole Style



Vault Style (large)

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Bioretention TC-32

Design Considerations

a Soil for Infiltration

- Tributary Area
- Slope
- Aesthetics
- Environmental Side-effects

Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoffs velocity is reduced by passing over or through buffer strip and subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

Targeted Constituents

IZI Sediment	■
fzl Nutrients	▲
lzl Trash	■
@l Metals	■
f2) Bacteria	■
IZI Oil and Grease	■
IZI Organics	■

Legend [Removal *Effectiveness)*

- Low
- High

A Medium

California Experience

None documented. Bioretention has been used as a stormwater BMP since i99u. In addition to Prince George's County, MD and Alexandria, VA, bioretention has been used successfully at urban and suburban areas in Montgomery County, MD; Baltimore County, MD; Chesterfield County, VA; Prince William County, VA; Smith Mountain Lake State Park, VA; and Cary, NC.

Advantages

- Bioretention provides stormwater treatment that enhances the quality of downstream water bodies by temporarily storing runoff in the BMP and releasing it over a period of four days to the receiving water (EPA, i999).
- The vegetation provides shade and wind breaks, absorbs noise, and improves an area's landscape.

Limitations

- The bioretention BMP is not recommended for areas with slopes greater than zo% or where mature tree removal would

be required since clogging may result, particularly if the BMP receives runoff with high sediment loads (EPA, i999).

- Bioretention is not a suitable BMP at locations where the water table is within 6 feet of the ground surface and where the surrounding soil stratum is unstable.
- By design, bioretention BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water.
- In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

Design and Sizing Guidelines

- The bioretention area should be sized to capture the design storm runoff.
- ln areas where the native soil permeability is less than o.5 in/hr an underdrain should be provided.
- Recommended minimum dimensions are •5 feet by 4o feet, although the preferred width is •s feet. Excavated depth should be 4 feet.
- Area should drain completely within 7 hours.
- Approximately i tree or shrub per 5o ft° Of bioretention area should be included.
- Cover area with about 3 inches of mulch.

Construetion/Jnspeetion Considerations

Bioretention area should not be established until contributing watershed is stabilized.

Performance

Bioretention removes stormwater pollutants through physical and biological processes, including adsorption, filtration, plant uptake, microbial activity, decomposition, sedimentation and volatilization (EPA, igg9). Adsorption is the process whereby particulate pollutants attach to soil (e.g., clay) or vegetation surfaces. Adequate contact time between the surface and pollutant must be provided for in the design of the system for this removal process to occur. Thus, the infiltration rate of the soils must not exceed those specified in the design criteria or pollutant removal may decrease. Pollutants removed by adsorption include metals, phosphorus, and hydrocarbons. Filtration occurs as runoff passes through the bioretention area media, such as the sand bed, ground cover, and planting soil.

Common particulates removed from stormwater include particulate organic matter, phosphorus, and suspended solids. Biological processes that occur in wetlands result in pollutant uptake by plants and microorganisms in the soil. Plant growth is sustained by the uptake of nutrients from the soils, with woody plants locking tip these nutrients through the seasons. Microbial activity within the soil also contributes to the removal of nitrogen and organic matter. Nitrogen is removed by nitrifying and denitrifying bacteria, while aerobic bacteria are responsible for the decomposition of the organic matter. Microbial processes require oxygen and can result in depleted oxygen levels if the bioretention area is not adequately

aerated. Sedimentation occurs in the swale or ponding area as the velocity slows and solids fall out of suspension.

The removal effectiveness of bioretention has been studied during field and laboratory studies conducted by the University of Maryland (Davis et al, i998). During these experiments, synthetic stormwater runoff was pumped through several laboratory and field bioretention areas to simulate typical storm events in Prince George's County, MD. Removal rates for heavy metals and nutrients are shown in Table i.

Table 1 Laboratory and Estimated Bioretention Davis et al. (1998); PGDER (1993)

POLutdWt	Removal Rate
Total Phosphorus	7°-8g%
Metals (Cu, Zn, Pb)	93-98%
TKN	68-8o%
Total Suspended Solids	90 %
Organics	9°%
Bacteria	90 %

Results for both the laboratory and field experiments were similar for each of the pollutants analyzed. Doubling or halving the influent pollutant levels had little effect on the effluent pollutants concentrations (Davis et a1, i998).

The microbial activity and plant uptake occurring in the bioretention area will likely result in higher removal rates than those determined for infiltration BMPs.

Siting Criteria

Bioretention BMPs are generally used to treat stormwater from impervious surfaces at commercial, residential, and industrial areas (EPA, i999). Implementation of bioretention for stormwater management is ideal for median strips, parking lot islands, and swales. Moreover, the runoff in these areas can be designed to either divert directly into the bioretention area or convey into the bioretention area by a curb and gutter collection system.

The best location for bioretention areas is upland from inlets that receive sheet flow from graded areas and at areas that will be excavated (EPA, i999). In order to maximize treatment effectiveness, the site must be graded in such a way that minimizes erosive conditions as sheet flow is conveyed to the treatment area. Locations where a bioretention area can be readily incorporated into the site plan without further environmental damage are preferred. Furthermore, to effectively minimize sediment loading in the treatment area, bioretention only should be used in stabilized drainage areas.

Additional Design Guidelines

The layout of the bioretention area is determined after site constraints such as location of utilities, underlying soils, existing vegetation, and drainage are considered (EPA, i999). Sites with loamy sand soils are especially appropriate for bioretention because the excavated soil can be backfilled and used as the planting soil, thus eliminating the cost of importing planting soil.

The use of bioretention may not be feasible given an unstable surrounding soil stratum, soils with clay content greater than z5 percent, a site with slopes greater than zo percent, and/or a site with mature trees that would be removed during construction of the BMP.

Bioretention can be designed to be off—line or on—line of the existing drainage system (EPA, i999). The drainage area for a bioretention area should be between o.i and o 4 hectares (o. 5 and i.o acres). Larger drainage areas may require multiple bioretention areas. Furthermore, the maximum drainage area for a bioretention area is determined by the expected rainfall intensity and ninoff rate. Stabilized areas may erode when velocities are greater than 5 feet per second (* s meter per second). The designer should determine the potential for erosive conditions at the site.

The size of the bioretention area, which is a function of the drainage area and the runoff generated from the area is sized to capture the water quality volume.

The recommended minimum dimensions of the bioretention area are i5 feet (4 6 meters) wide by 4 feet (in.u meters) long, where the minimum width allows enough space for a dense, randomly-distributed area of trees and shrubs to become established. Thus replicating a natural forest and creating a microclimate, thereby enabling the bioretention area to tolerate the effects of heat stress, acid rain, runoff pollutants, and insect and disease infestations which landscaped areas in urban settings typically are unable to tolerate. The preferred width is *s feet (7 6 meters), with a length of twice the width. Essentially, any facilities wider than zo feet (6.i meters) should be twice as long as they are wide, which promotes the distribution of flow and decreases the chances of concentrated flow.

In order to provide adequate storage and prevent water from standing for excessive periods of time the ponding depth of the bioretention area should not exceed 6 inches (1s centimeters). Water should not be left to stand for more than 7• hours. A restriction on the type of plants that can be used may be necessary due to some plants' water intolerance. Furthermore, if water is left standing for longer than 7* hours mosquitoes and other insects may start to breed.

The appropriate planting soil should be backfilled into the excavated bioretention area. Planting soils should be sandy loam, loamy sand, or loam texture with a clay content ranging from to to u5 percent.

Generally the soil should have infiltration rates greater than o 5 inches (i. *5 centimeters) per hour, which is typical of sandy loams, loamy sands, or loams. The pH of the soil should range between 5 5 and 6.5, where pollutants such as organic nitrogen and phosphorus can be adsorbed by the soil and microbial activity can flourish. Additional requirements for the planting soil include a i.5 to 3 percent organic content and a maxim•• 5 ppm concentration of soluble salts.

Soil tests should be performed for every soo cubic yards (382 Ctibic meters) of planting soil, with the exception of pH and organic content tests, which are required only once per bioretention area (EPA, i999). Planting soil should be 4 inches (to.i centimeters) deeper than the bottom of the largest root ball and 4 feet (i.z meters) altogether. This depth will provide adequate soil for the plants' root systems to become established, prevent plant damage due to severe wind, and provide adequate moisture capacity. Most sites will require excavation in order to obtain the recommended depth.

Planting soil depths of greater than 4 feet (i.z meters) may require additional construction practices such as shoring measures (EPA, i999). Planting soil should be placed in i8 inches or greater lifts and lightly compacted until the desired depth is reached. Since high canopy trees may be destroyed during maintenance the bioretention area should be vegetated to resemble a terrestrial forest community ecosystem that is dominated by tinderstory trees. Three species each of both trees and shrubs are recommended to be planted at a rate of •5 o trees and shrubs per hectare (iooo per acre). For instance, a i5 foot (4 6 meter) by to foot (iz.z meter) bioretention area (6oo square feet or s575 square meters) would require •4 trees and shrubs. The shrub-to-tree ratio should be z:i tO 3:*

Trees and shrubs should be planted when conditions are favorable. Vegetation should be watered at the end of each day for fourteen days following its planting. Plant species tolerant of pollutant loads and varying wet and dry conditions should be used in the bioretention area.

The designer should assess aesthetics, site layout, and maintenance requirements when selecting plant species. Adjacent non-native invasive species should be identified and the designer should take measures, such as providing a soil breach to eliminate the threat of these species invading the bioretention area. Regional landscaping manuals should be consulted to ensure that the planting of the bioretention area meets the landscaping requirements established by the local authorities. The designers should evaluate the best placement of vegetation within the bioretention area. Plants should be placed at irregular intervals to replicate a natural forest. Trees should be placed on the perimeter of the area to provide shade and shelter from the wind. Trees and shrubs can be sheltered from damaging flows if they are placed away from the path of the incoming runoff. In cold climates, species that are more tolerant to cold winds, such as evergreens, should be placed in windier areas of the site.

Following placement of the trees and shrubs, the ground cover and/or mulch should be established. Ground cover such as grasses or legumes can be planted at the beginning of the growing season. Mulch should be placed immediately after trees and shrubs are planted. Two to 3 inches (st076 cm) of commercially-available fine shredded hardwood mulch or shredded hardwood chips should be applied to the bioretention area to protect from erosion.

Maintenance

The primary maintenance requirement for bioretention areas is that of inspection and repair or replacement of the treatment area's components. Generally, this involves nothing more than the routine periodic maintenance that is required of any landscaped area. Plants that are appropriate for the site, climatic, and watering conditions should be selected for use in the bioretention cell. Appropriately selected plants will aide in reducing fertilizer, pesticide, water, and overall maintenance requirements. Bioretention system components should blend over time through plant and root growth, organic decomposition, and the development of a natural

soil horizon. These biologic and physical processes over time will lengthen the facility's life span and reduce the need for extensive maintenance.

Routine maintenance should include a bianntial health evaluation of the trees and shrubs and subsequent removal of any dead or diseased vegetation (EPA, i999). Diseased vegetation should be treated as needed using preventative and low-toxic measures to the extent possible. BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water. Routine inspections for areas of standing water within the BMP and corrective measures to restore proper infiltration rates are necessary to prevent creating mosquito and other vector habitat. In addition, bioretention BMPs are susceptible to invasion by aggressive plant species such as cattails, which increase the chances of water standing and subsequent vector production if not routinely maintained.

In order to maintain the treatment area's appearance it may be necessary to prune and weed. Furthermore, mulch replacement is suggested when erosion is evident or when the site begins to look unattractive. Specifically, the entire area may require mulch replacement every two to three years, although spot mulching may be sufficient when there are random void areas. Mulch replacement should be done prior to the start of the wet season.

New Jersey's Department of Environmental Protection states in their bioretention systems standards that accumulated sediment and debris removal (especially at the inflow point) will normally be the primary maintenance function. Other potential tasks include replacement of dead vegetation, soil pH regulation, erosion repair at inflow points, mulch replenishment, unclogging the underdrain, and repairing overflow structures. There is also the possibility that the cation exchange capacity of the soils in the cell will be significantly reduced over time. Depending on pollutant loads, soils may need to be replaced within s- to years of construction (LID, zooo).

Cost

Construction Cost

Construction cost estimates for a bioretention area are slightly greater than those for the required landscaping for a new development (EPA, i999). A general rtile of thumb (Hoffman, i999) is that residential bioretention areas average about $3 tO $4 per square foot, depending on soil conditions and the density and types of plants used. Commercial, industrial and institutional site costs can range between $io tO $4o per square foot, based on the need for control structures, curbing, storm drains and underdrains.

Retrofitting a site typically costs more, averaging $6,5oo per bioretention area. The higher costs are attributed to the demolition of existing concrete, asphalt, and existing structures and the replacement of fill material with planting soil. The costs of retrofitting a commercial site in Maryland, Kettering Development, with •s bioretention areas were estimated at $iii,6oo.

In any bioretention area design, the cost of plants varies substantially and can account for a significant portion of the expenditures. While these cost estimates are slightly greater than those of typical landscaping treatment (dtie to the increased number of plantings, additional soil excavation, backfill material, use of underdrains etc.), those landscaping expenses that would be required regardless of the bioretention installation should be subtracted when determining the net cost.

Perhaps of most importance, however, the cost savings compared to the use of traditional structural stormwater conveyance systems makes bioretention areas qtiite attractive financially. For example, the use of bioretention can decrease the cost required for constructing stormwater conveyance systems at a site. A medical office building in Maryland was able to reduce the amount of storm drain pipe that was needed from 8oo tO •3o feet — a cost savings of $*4.ooo (PGDER, i993) And a new residential development spent a total of approximately $ioo,ooo tising bioretention cells on each lot instead of nearly $4oO,oOo for the traditional stormwater ponds that were originally planned (Rappahanock,). Also, in residential areas, stormwater management controls become a part of each property owner's landscape, reducing the public burden to maintain large centralized facilities.

Maintenance Cost

The operation and maintenance costs for a bioretention facility will be comparable to those of typical landscaping required for a site. Costs beyond the normal landscaping fees will include the cost for testing the soils and may include costs for a sand bed and planting soil.

References and **Sources of Additional Information**

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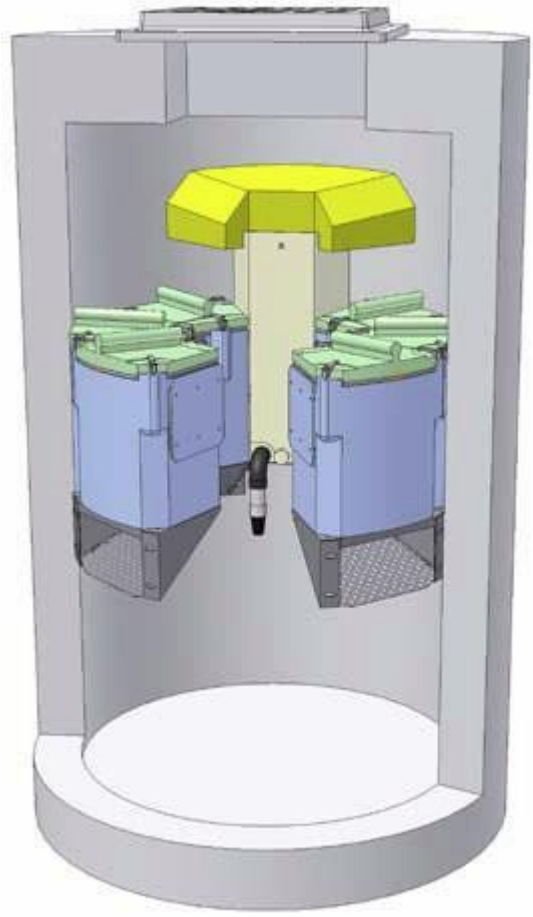
ATTACHMENT

5

Media Filtration Device Maintenance Procedures



The Up-Flo Filter

Stormwater Treatment System

Operation and Maintenance Manual

Distributed by KriStar Enterprises, Inc., (800) 579-8819 360 Sutton Place, Santa Rosa, CA 95407

Table of Contents

3 Up-Flo® Filter
- Overview
- General Product Description
- Typical Configurations
- Maintenance Services

4 Operation
- Introduction
- Pollutant Capture
- Reduced Clogging
- Overflow Protection

5 Maintenance
- Overview
- First-Year Monitoring
- Inspection
- Floatables, Oil and Sump Cleanout
- Replacement of Media Packs and Drain Down Filter

12 Up-Flo® Filter Installation Log

13 Up-Flo® Filter Inspection and Maintenance Log

IMPORTANT - ORDER REPLACEMENT PARTS FOR MAINTENANCE - **IMPORTANT**

Annual maintenance requires replacement of the filter media packs and the Drain Down filter. Contact KriStar Enterprises, Inc., to order replacements. Allow 2-4 weeks for delivery.

Office hours Monday thru Friday 8:00 A.M. to 5:00 P.M. PST
Toll free: 1-800-579-8819
Phone: 707-524-8181
Fax: 707-524-8186

Product Overview

The Up-Flo® Filter is a modular high-rate stormwater filtration device. As shown below, it is typically installed into a 4-ft diameter catch basin structure. Each Filter Module has a screen and support bracket that is attached to the concrete manhole and each contains a Media Pack that includes flow distribution and filtration media. Modules can attach to each other to form a “ring” of up to six modules. Up to two of the modules are attached to an Outlet Module that has a Bypass Hood and filtered Drain Down. The modular design can be supplied in different configurations depending on the application as shown in the following illustrations.

An upward flow path through the Filter Modules allow stormwater to be screened and filtered. In addition to the screening and filtering processes, gross pollutants will also settle into the sump or float to the surface of the water held within the manhole. The standard units are supplied with a 3-ft sump to allow for sediment and gross pollutant accumulations between maintenance intervals.

The following manual describes the operation of the Up-Flo Filter and provides general maintenance requirements that will ensure the filter will continue to operate and perform as intended. In general, a minimum of two inspections are required the first year to monitor sediment and gross pollutant accumulations in the manhole structure and inspect the Filter Media Pack and Drain Down Filter. The frequency of the maintenance interval is site specific as it will depend on the rate of pollutant accumulations. The first year of inspections and monitoring pollutant accumulations will determine future maintenance intervals.

Hydro International offers maintenance contracts nationwide, through Drainage Protections Systems (DPS). It is hoped that owners will take advantage of this service as operators of DPS have been trained and certified to ensure that maintenance will be performed properly. Should the owner choose to conduct maintenance procedures themselves, it is recommended that DPS be contacted to discuss the following procedures and consider contacting a representative from DPS for the first maintenance cycle.

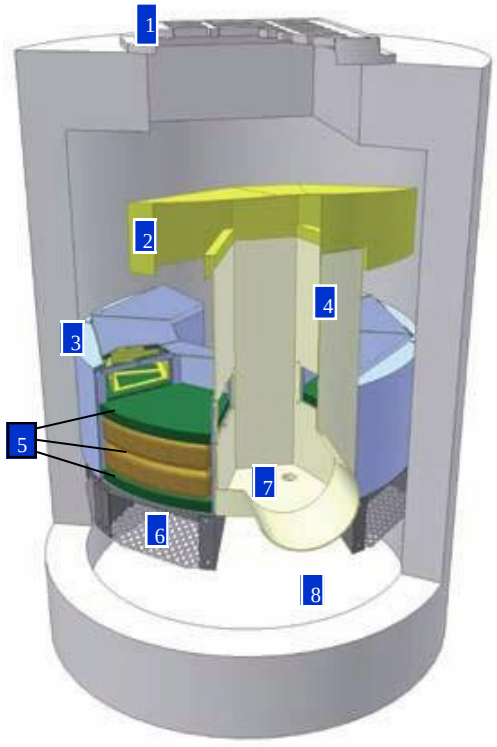
Contact our Maintenance Operations Department

Office hours Monday thru Friday 8:00 A.M. to 5:00 P.M. PST

Toll free: 1-888-950-8826
Phone: 951-698-3683
Fax: 951-698-8371

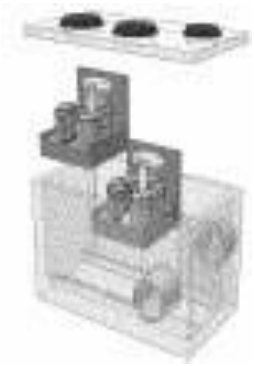
UP-FLO FILTER COMPONENTS

1. Inlet Grate
2. Bypass Siphon with Floatables Baffle
3. Filter Module
4. Outlet Module
5. Media Pack
6. Angled Screen
7. Drain Down Assembly (not visible)
8. Sump

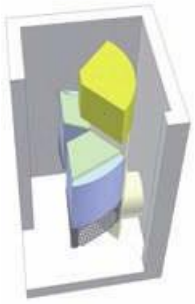


Configurations

Manhole



Vault



Retrofit

Operation

INTRODUCTION

The Up-Flo Filter operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirements and is fabricated with durable non-corrosive components. Personnel are not required to operate the unit and maintenance is limited to periodic inspections, sediment and floatables removal, Media Pack replacement and Drain Down Filter replacement.

POLLUTANT CAPTURE

The Up-Flo Filter is designed to operate as a “treatment train” by incorporating multiple treatment technologies into a single device. Trash and gross debris are removed by sedimentation and screening before they are introduced to the filtration media, preventing surface blinding of the filter media. The Up-Flo Filter is a wet sump device. Between storm events, oil and floatables are stored on the water surface separate from the sediment storage volume in the sump (see Figure 1). The high-capacity bypass siphon acts as a floatables baffle to prevent washout of captured floatable pollutants during high-intensity events.

REDUCED CLOGGING

The Up-Flo Filter has been designed to minimize the occurrence of clogging and blinding. The Up-Flo Filter employs a unique Drain Down design that allows the water level in the chamber to drop below the filter media between events. The Drain Down mechanism creates a reverse flow that flushes captured pollutants off the surface of the filter bag, helping to prevent blinding. By allowing the water to drain out, the drain-down mechanism also reduces the weight of the filter bags. This makes the bags easier and safer to remove during maintenance operations.

OVERFLOW PROTECTION

The Angled Screens are designed to prevent ragging and blinding. The Angled Screens are situated below the Filter Modules, sheltering them from the direct path of the influent. Coarse debris settles in the sump before the runoff flows up through the screens, protecting them from blinding. In the unlikely event of a blockage, the high capacity Siphonic Bypass is designed to convey high enough flow that large storm events will not create upstream flooding.

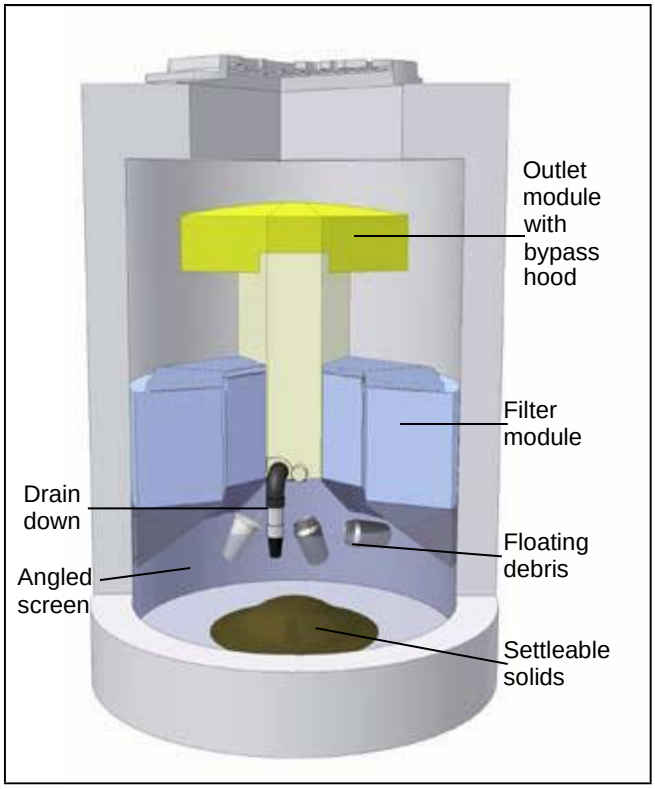


Figure 1: *Pollutants captured in the Up-Flo Filter*

Maintenance

OVERVIEW

The Up-Flo Filter protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the proper functioning of the Up-Flo Filter.

The Up-Flo Filter design allows for easy and safe inspection, monitoring and clean-out procedures. It has a wide central opening between the Filter Modules for easy and comfortable access to all of the components (See figure 2). Completion of all the maintenance activities for a typical manhole Up -Flo Filter takes less than one hour.

Maintenance activities include inspection, floatables removal, oil removal, sediment removal, Media Pack replacement, and Drain Down Filter replacement. Maintenance intervals are determined from monitoring the Up-Flo Filter during its first year of operation. Depending on the site, some maintenance activities may have to be performed on a more frequent basis than others. In the case of inspection and floatables removal, a vactor truck is not required. Otherwise, a vactor truck is normally required for oil removal, removal of sediment from the sump, and replacement of the Media Packs and Drain Down Filter. In most cases, entry into the Up-Flo Filter vessel is required for replacement of the Media Packs and Drain Down Filter, and OSHA Confined Space Entry procedures will have to be followed.

Media Packs should not be installed in the modules until construction activities are complete and site stabilization is effective.

FIRST-YEAR MONITORING

Hydro International recommends that inspections be performed at least every six months during the first year of operation. Use the following guidelines for determining maintenance intervals:

- Floatables and Oil Monitoring: The water surface in the Up-Flo Filter should be monitored for accumulation of floatables and oil. Floatables should not be allowed to accumulate to the point where they completely cover the surface of the water. Oil should not be allowed to accumulate to the point where it has formed a measurable thickness on the surface of the water. The rate of floatables and oil accumulation can be estimated by dividing the surface area covered by floatables and/or oil by the number of months since the Up-Flo Filter was installed.

- Sediment Monitoring: A simple probe, such as the Sludge-Judge®, should be used to determine the depth of sediment in the sump. The maximum allowable sediment depth in a typical 4-foot diameter manhole equipped with an Up-Flo Filter is 16”. In any case, sediment must be removed before it blocks the inlet to the Drain Down Filter. The rate of sediment accumulation can be estimated by dividing the measured depth of sediment by the number of months since the Up-Flo Filter was installed.

- Media Pack Monitoring: Filter bags should be weighed to determine the amount of particles that have been captured in the bags. Filter bags from one or two modules should be weighed. Spent filter bags weigh approximately 40 lbs wet. The rate of filter bag clogging can be estimated by subtracting the wet weight of a new bag (approximately 20 lbs.) from the measured wet weight of the bags being checked and dividing by the number of months since the bags were installed.

- Drain Down Filter Monitoring: The water level in the Up-Flo Filter should be monitored to ensure that the Drain Down Filter is operating properly. One to two days after a significant rainfall, the water level inside the vessel should have dropped to a point where it is equal with the base of the Filter Modules. If the water level has not reached that point, then the Drain Down Filter has either become clogged or blinded by trash or debris. If there is no evidence of trash or debris around the Drain Down Filter inlet, then it has likely become clogged with particles. The rate of Drain Down Filter clogging can be estimated by noting the number of months since the Up-Flo Filter was installed.

Hydro International recommends a maximum maintenance interval of one year for all maintenance activities but, based on the first-year monitoring, a shorter maintenance interval for some maintenance activities may be appropriate.

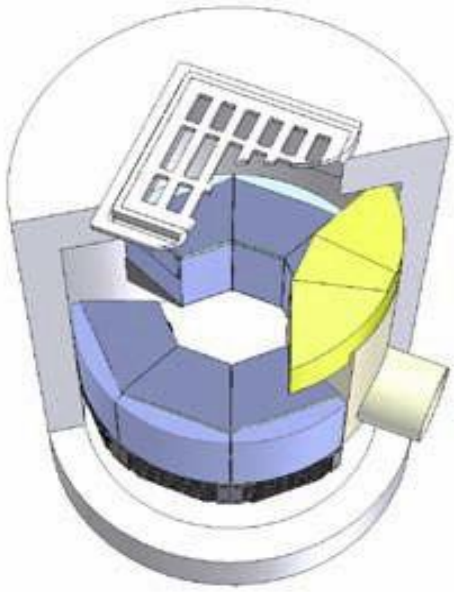


Figure 2: *The wide central opening in the Up-Flo Filter*

INSPECTION

Inspection is a simple process that requires monitoring pollutant accumulations. Maintenance crews should be familiar with the Up-Flo Filter and its components prior to inspection.

SCHEDULING

• Inspection may be conducted during any season of the year but should occur shortly after a predicted rainfall to ensure components are operating properly.

RECOMMENDED EQUIPMENT

• Safety Equipment and Personal Protective Equipment (traffic cones, work gloves, etc.)

- Scale to measure the weight of the filter bags
- Crow bar to remove grate or lid
- Pole with skimmer or net
- Sediment probe (such as a Sludge Judge®)
- Up-Flo Filter Maintenance Log
- Trash bags for removed floatables

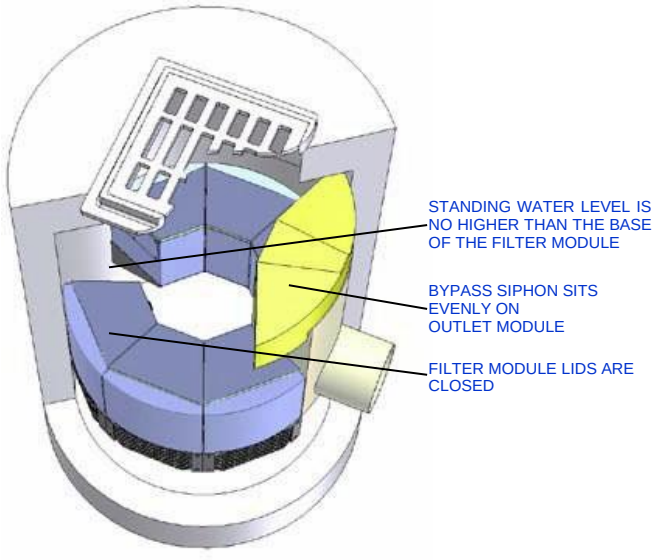


Figure 3: *Inspection view of the Up-Flo Filter*

INSPECTION PROCEDURES

1. Set up any necessary safety equipment (such as traffic cones) to provide access to the Up-Flo® Filter. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole or vault.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. See Figure 3 for a typical Inspection View.

4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the chamber.

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel. Maximum sediment depth is 16 inches.

6. Remove the Filter Module lid by turning the cam latch and remove the Filter Media Pack (*refer to page 8 Replacement Procedures*). Weigh the filter bags from one or two modules. Filter bags should be replaced if the wet weight exceeds 40 lbs.

7. On the Maintenance Log record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or a high standing water level (see Figure 3 for the standard standing water level).

8. Securely replace the grate or lid.

9. Remove safety equipment.

10. Contact Drainage Protection Services at 1-888-950-8826 to discuss any irregularities noted during inspection.

FLOATABLES, OIL, AND SUMP CLEANOUT

A commercially or municipally owned sump-vac is used to remove captured sediment, oil and floatables (Figure 4).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose and skimmer pole to be lowered to the base of the sump.

SCHEDULING

- Floatables and sump cleanout may typically be done during any season of the year - before and after the rainy season
- Floatables and sump cleanout should occur as soon as possible following a contaminated spill in the contributing drainage area

RECOMMENDED EQUIPMENT

- Safety Equipment (traffic cones, etc)
- Crow bar to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (flexible hose preferred)
- Pressure nozzle attachment or other screen-cleaning device
- Up-Flo Filter Maintenance Log

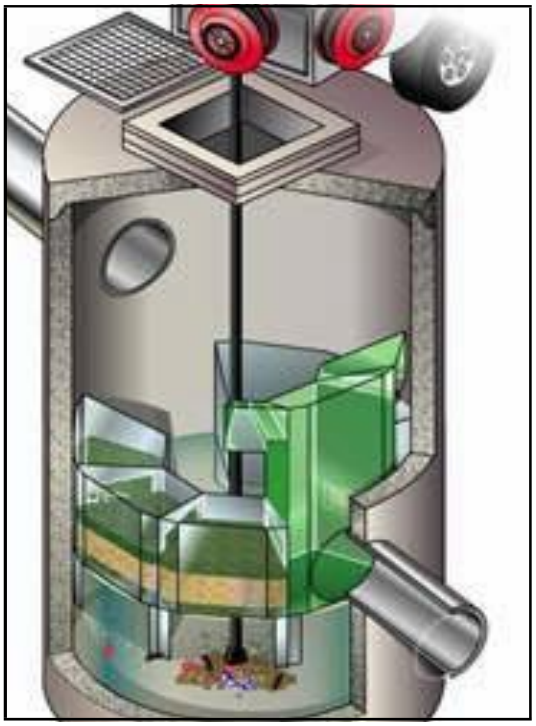


Figure 4: *Sediment is removed with a vactor hose*

FLOATABLES, OIL AND SUMP CLEAN OUT PROCEDURES

1. Set up any necessary safety equipment (such as traffic cones) around the access of the Up-Flo Filter. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole or vault.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.

4. If the standing water level in the sump is above the base of the Filter Modules (see Figure 3), tug the Pull Chain(s) to release the Drain Down Plug(s). Allow the excess water to drain out of the chamber.

5. Use the skimmer pole to fit the Drain Down plug back into the open port.

6. Once all floatables and oil have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris from the sump floor. Up to 0.6 yd_3 of sediment and 360 gallons of water will be removed from a typical manhole Up-Flo Filter during this process.

7. Retract the vactor hose from the vessel.

8. Inspect the Angled Screens for blockages and ragging. If present, remove the obstruction or ragging materials from the surface using a hose or other screen-cleaning device.

9. On the Maintenance Log record the date, unit location, estimated volume of floatables, oils, and gross debris removed, and the depth of sediment measured. Note any apparent irregularities such as damaged components or blockages.

10. Securely replace the grate or lid.

11. Remove safety equipment.

12. Dispose of sediment and gross debris at your local landfill; following local regulations.

13. Dispose of oil and sump water at a licensed water treatment facility.

14. Contact DPS at 1-888-950-8826 to discuss any irregularities noted during cleanout.

REPLACEMENT OF MEDIA PACKS AND DRAIN DOWN FILTER

Unless the Up-Flo Filter has been installed as a very shallow unit, it is necessary to have an OSHA-confined space entry trained person enter the vessel to replace Media Packs.

SCHEDULING

- Call DPS to order replacement Media Packs and Drain Down filter prior to scheduling maintenance.
- Because Media Pack replacement requires entry into the Up-Flo chamber, maintenance events should be scheduled during dry weather.
- Media Pack replacement should occur immediately after a contaminated spill in the contributing drainage area.

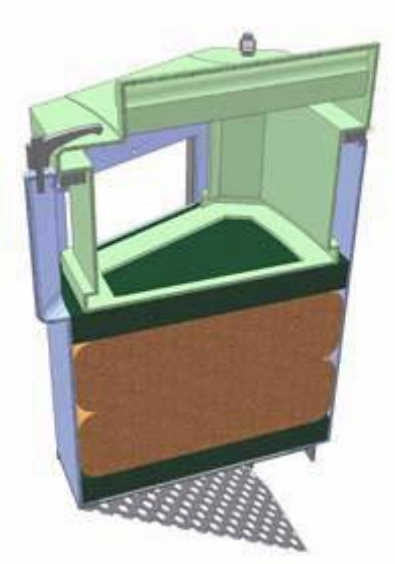


Figure 5: *Cut-away view of the Filter Module*

RECOMMENDED EQUIPMENT

- Safety Equipment (traffic cones, etc)
- Crow bar to remove grate or lid
- Pole with skimmer or net (if floatables removal is not to be done with vactor hose)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (flexible hose preferred)
- OSHA Confined Space Entry Equipment
- Up-Flo Filter Replacement Media Packs (available from DPS)
- Up-Flo Filter Maintenance Log
- Screwdriver (flat head)
- Replacement Drain Down Filter components supplied by DPS

MEDIA PACK AND DRAIN DOWN FILTER REPLACEMENT PROCEDURES

1. Follow Floatables and Sump Cleanout Procedures, 1 – 10.
2. Following OSHA Confined Space Entry procedures, enter the Up-Flo Filter Chamber.
3. Open the Filter Module by turning the three cam latches on the front and sides of the module. Remove the lid 1 to gain access to the Media Pack (Figure 6).
4. Remove and discard the spent **Media Pack**. The **Media Pack** contents include:
   - A top layer of green 2 Flow-Distributing Media.
   - Two (2) Media Bags 3 equipped with nylon handles.
   - A bottom layer of green 2 Flow-Distributing Media.

1. FILTER MODULE COVER AND MEDIA RESTRAINT

2. FLOW-DISTRIBUTING MEDIA

3. FILTER MEDIA BAGS

4. REPLACEABLE MEDIA PACK

5. CAM LATCH

6. CONVEYANCE CHANNEL

7. FILTER MODULE

8. SUPPORT BRACKET / ANGLED SCREEN

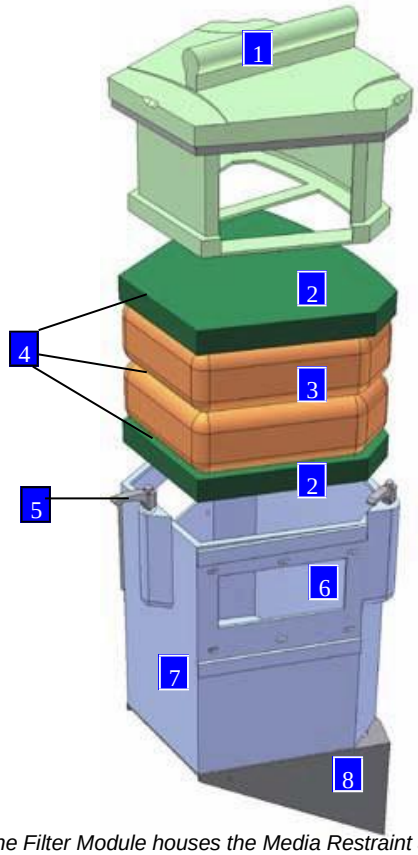


Figure 6: *The Filter Module houses the Media Restraint and the Media*

5. Insert a new Media Pack, supplied by DPS.

- First, insert a bottom layer of green **Flow-Distributing Media**. Be sure that the media sits snugly and level at the bottom of the Filter Module.
- Next, insert the first of two (2) replacement **Media Bags**. Smooth the bag out with your hands to make sure that the bag extends snugly to the walls and corners of the Filter Module.
- Insert the second **Media Bag**, following the same procedure.
- Insert the top layer of green **Flow-Distributing Media**. Be sure that the piece fits snugly against the walls and corners of the Filter Module.
- Put the lid on and secure the three latches. Check to make sure that the latches are closed properly.

6. Use a screwdriver to unscrew the **Drain Down Filter** from the face of the Outlet Module (see Figure 7). **DO NOT DISCARD THIS PIECE.**

7. Install new **Drain Down Filter** supplied by DPS.

8. Exit the Up-Flo Filter chamber and securely replace the grate or lid.

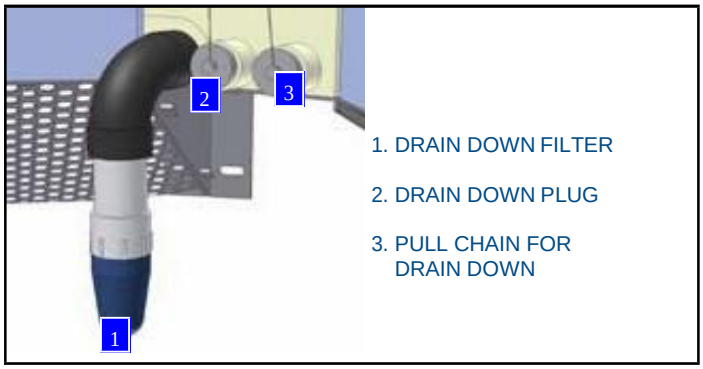


Figure 7: *The Drain Down Filter*

9. On the Maintenance Log provided by DPS, record the date, unit location, estimated volume of floatables, oil and gross debris removed, and the depth of sediment measured. Note the number of Media Packs replaced. Note any irregularities such as damaged components or blockages.

10. Remove safety equipment.

11. Dispose of spent media packs at your local landfill, following local regulations.

12. Return the spent Drain Down Filter to DPS.

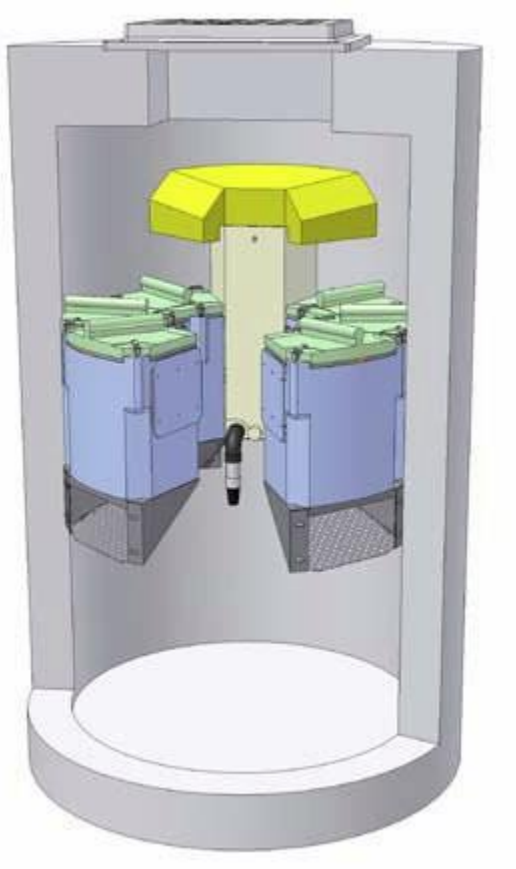
13. Contact DPS to discuss any irregularities noted during annual maintenance.

Maintenance at a Glance

ACTIVITY	FREQUENCY
Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Floatables/Oils Removal	- Twice per year or as needed - Following a contaminated spill in the drainage area
Sediment Removal	- Twice per year or as needed - Following a contaminated spill in the drainage area
Media Pack Replacement	- Once per year or as needed - Following a contaminated spill in the drainage area
Drain Down Filter Replacement	- Once per year with Media Pack replacement - As needed, in the event of continuous base flow conditions

UP-FLO® FILTER

INSPECTION & MAINTENANCE LOG



Up-Flo® Filter Installation Log

DPS REFERENCE NUMBER:	
SITE NAME: Metro	
SITE LOCATION:	
OWNER: ***Metro Owners Association***	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

CONFIGURATION (CIRCLE ONE): MANHOLE RETROFIT VAULT SYSTEM

TOTAL NUMBER OF UP-FLO$_{tm}$ FILTER MODULES: