

# OPERATION & MAINTENANCE MANUAL

**DFI No. : D00188**

**Facility Type: Water Quality Vault**



**JUNE, 2011**

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## 1. Identification

Drainage Facility ID (DFI): **D00188**

Facility Type: Water Quality Vault

Construction Drawings: (V-File Number) 26V-092

Location: District: 1 (Old 2A)

Highway No.: 92

Mile Post: 26.79 (beg./end)]

Description: This facility is located along the east side Hwy. 92 between Millard Road and Wilson Lane. It is adjacent to the northbound travel lanes and railroad tracks. Unobstructed access can be obtained from the right shoulder of Hwy. 92.

## 2. Facility Contact Information

Contact the Engineer of Record, Region Technical Center, or Geo-Environmental's Senior Hydraulics Engineer for:

- Operational clarification
- Maintenance clarification
- Repair or restoration assistance

### Engineering Contacts:

Region Technical Center Hydro Unit Manager

Or

Geo-Environmental Senior Hydraulics Engineer (503) 986-3365.

## 3. Construction

Engineer of Record:

Consultant Designer - W&H Pacific, William Evans,  
P.E., (503) 362-4675

Facility construction: 1996

Contractor: N/A

#### **4. Storm Drain System and Facility Overview**

This water quality vault is an underground media filter facility designed to treat stormwater runoff. The stormwater management system is a proprietary product called StormFilter<sup>®</sup> manufactured by Contech Construction Products, Inc. The underground media filtration system provides treatment using filtration by removing target pollutants from the water via the use of rechargeable circular-shaped media filter cartridges arranged in an array alongside one another inside the vault. Through the use of a 'variety of sustainable media', solids, dissolved metals, oil and total nutrients are actually separated from the water by 'trapping particulate matter in the porous composition of the individual cartridge filter media'. This facility contains an Operation and Maintenance manual as prepared by the manufacturer and is provided in Appendix C.

This facility is an on-line facility designed to treat low and high flows, providing both treatment and high flow conveyance in a single facility. The facility is a retrofit of an earlier designed water quality facility, containing 12 or more circular-shaped media filter cartridges in one large vault. The facility is located along the east side Columbia River Highway (Hwy092) just north of Wilson Lane, south of Millard Road, and adjacent to the northbound travel lanes and railroad tracks. Unobstructed access can be obtained from the right shoulder of Hwy. 92 just north of Wilson Lane and a water quality swale (D00187).

The water quality vault receives flow from 4,000 feet of drainage ditch to the north. This segment of the drainage ditch receives runoff from the stormwater inlets on US Route 30 and the railroad tracks. Flow from the drainage ditch enters the water quality vault from the north via a 6-inch pipe and exits to the drainage ditch and a water quality swale (D00187) via another 6-inch pipe to the south. Water quality treatment occurs within the modified vault before the stormwater outfalls to the swale. Photo 1 provides a view of the Compost Stormwater Filter looking southeast (Refer to Point A of the Operational Plan in Appendix A). Periodic maintenance of the circular-shaped media filter cartridges and vaults is required to maximize water quality treatment efficiencies; see Appendix C and the manufacturer's Inspection and Maintenance Guide.

##### **A. Maintenance equipment access:**

Unobstructed access can be obtained from the right shoulder of Hwy. 92. The hatch door has a locking mechanism that requires a flat-head screwdriver be placed in the keyhole to disengage the latch. Information on how to remove the pollutants and detailed drawing of the structure can be reviewed in the Appendix C.

##### **B. Heavy equipment access into facility:**

- Allowed (no limitations)
- Allowed (with limitations)
- Not allowed

C. Special Features:

- Amended Soils
- Porous Pavers
- Liners
- Treatment Cartridges

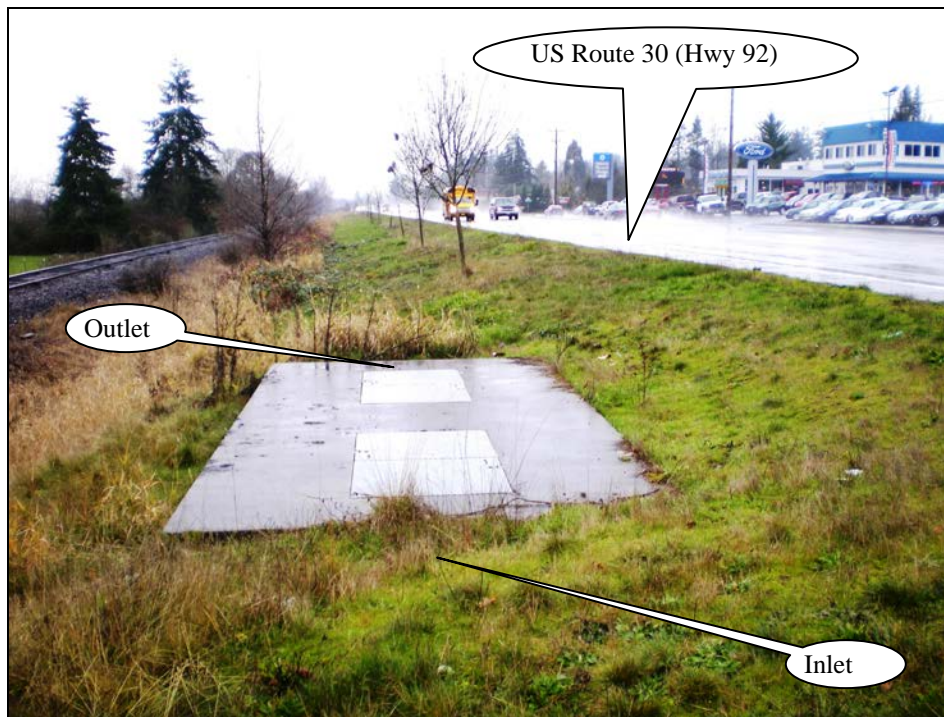


Photo 1: StormFilter System Vault looking southeast. US Route 30 is located to the right. The inlet and outlet for the treatment system is an underground 6-inch pipe that connects to the drainage ditch.



Photo 2: Zoomed in view of the inlet to the StormFilter System. The Compost Stormwater Filter has been retrofitted with StormFilter cartridges from Contech Products, Inc.



Photo 3: Zoomed in view of the outlet to the StormFilter System.

## 5. Facility HazMat Spill Feature(s)

The water quality vault can be used to store a volume of liquid by blocking the 6"-diameter outlet pipe located at the outlet of the water quality vault. This pipe is notes as point B on the Operational Plan.

## 6. Auxiliary Outlet (High Flow Bypass)

Auxiliary Outlets are provided if the primary outlet control structure can not safely pass the projected high flows. Broad-crested spillway weirs and over flow risers are the two most common auxiliary outlets used in stormwater treatment facility design. The auxiliary outlet feature is either a part of the facility or an additional storm drain feature/structure.

The auxiliary outlet feature for this facility is:

Designed into facility

Water quality vaults can be designed for use as either on-line or off-line facilities, though typically planned as on-line systems. As mentioned, this particular facility is an on-line facility designed to treat low and high flows alike, providing water quality treatment and high flow conveyance in a single facility. Twelve or more individual filter cartridges utilize an external bypass, to 'protect the media filter treatment chambers from high flows' - effectively bypassing the treatment features, so that flows exit the individual filter cartridges and leave any captured pollutants behind. Additionally, the overall facility itself contains an auxiliary outlet feature (overflow bypass) at its outlet for dealing with high flows while lower, water quality flows, exit elsewhere. See Appendix A and C.

Other, as noted below

## 7. Maintenance Requirements

Routine maintenance table for non-proprietary stormwater treatment and storage/detention facilities have been incorporated into ODOT's Maintenance Guide. These tables summarize the maintenance requirements for ponds, swales, filter strips, bioslopes, and detention tanks and vaults. Special maintenance requirements in addition to the routine requirements are noted below when applicable.

The ODOT Maintenance Guide can be viewed at the following website:

<http://www.oregon.gov/ODOT/HWY/OOM/MGuide.shtml>

Maintenance requirements for proprietary structures, such as underground water quality manholes and/or vaults with filter media are noted in Appendix C when applicable.

The following stormwater facility maintenance table (See ODOT Maintenance Guide) should be used to maintain the facility outlined in this Operation and Maintenance Manual or follow the Maintenance requirements outlined in Appendix C when proprietary structure is selected below:

- Table 1 (general maintenance)
- Table 2 (stormwater ponds)
- Table 3 (water quality biofiltration swales)
- Table 4 (water quality filter strips)
- Table 5 (water quality bioslopes)
- Table 6 (detention tank)
- Table 7 (detention vault)
- Appendix C (proprietary structure)
- Special Maintenance requirements: See Appendix C and the Proprietary Structure Maintenance Requirements for an O&M Manual specifically written for the water quality structure.

Note: Special maintenance Requirements Require Concurrence from ODOT SR Hydraulics Engineer.

## **8. Waste Material Handling**

Material removed from the facility is defined as waste by DEQ. Refer to the roadwaste section of the ODOT Maintenance Yard Environmental Management System (EMS) Policy and Procedures Manual for disposal options: <http://egov.oregon.gov/ODOT/HWY/OOM/EMS.shtml>

Contact any of the following for more detailed information about management of waste materials found on site:

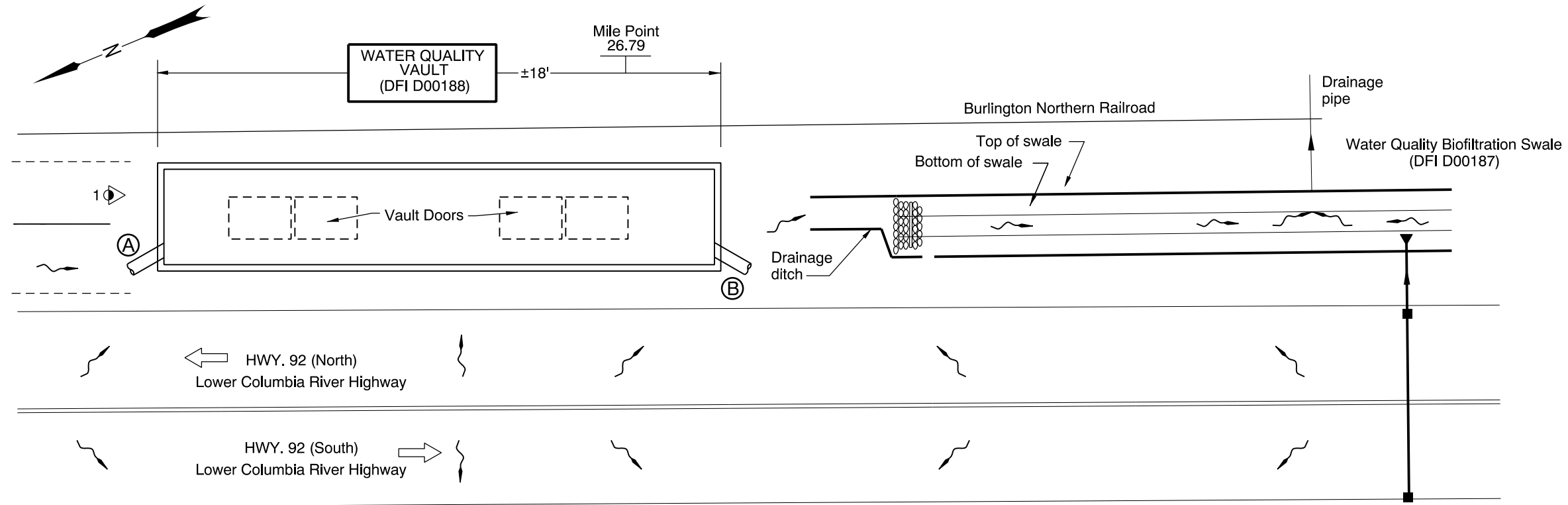
ODOT Clean Water Unit	(503) 986-3008
ODOT Statewide Hazmat Coordinator	(503) 229-5129
ODOT Region Hazmat Coordinator	(503) 731-8304
ODEQ Northwest Region Office	(503) 229-5263



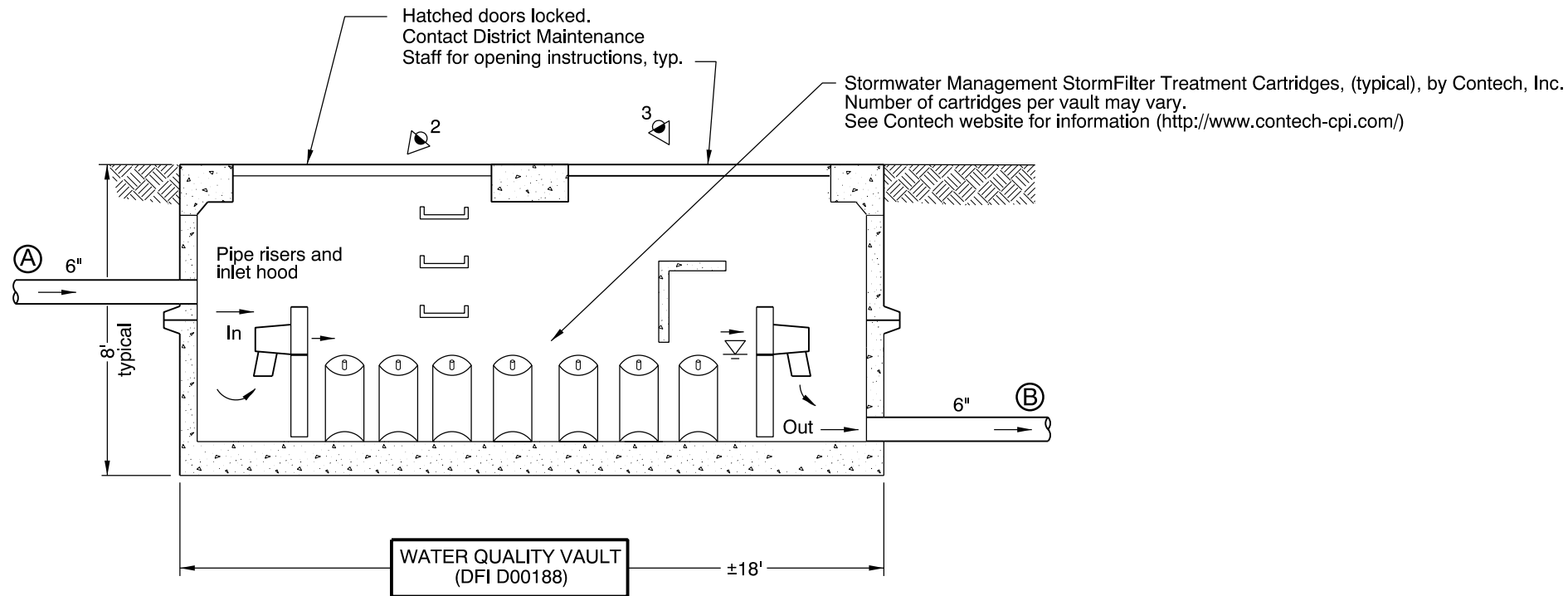
# Appendix A

## Content:

- **Operational Plan and Profile Drawing(s)**



**PLAN**  
N.T.S.



**SECTION A-A**  
N.T.S.

- LEGEND:**
- Photograph location / direction
  - 6" Pipe Inlet To Water Quality Vault
  - Treated Water Outlets from 6" Pipe And Flows to water quality swale (D00187)
  - and Manhole
  - and Inlet
  - Storm Pipe (Facility)
  - Storm Pipe
  - Conveyance Direction
  - Pavement / Facility Flow Path

Sht. 1 of 1

OREGON DEPARTMENT OF TRANSPORTATION

Prepared By:  
Bob Knorr

Drafted By:  
Bob Knorr

**DFI D00188**  
**MAINTENANCE DISTRICT 1 HWY 92**  
**WATER QUALITY VAULT**  
LOWER COLUMBIA HWY MP 26.79  
COLUMBIA COUNTY

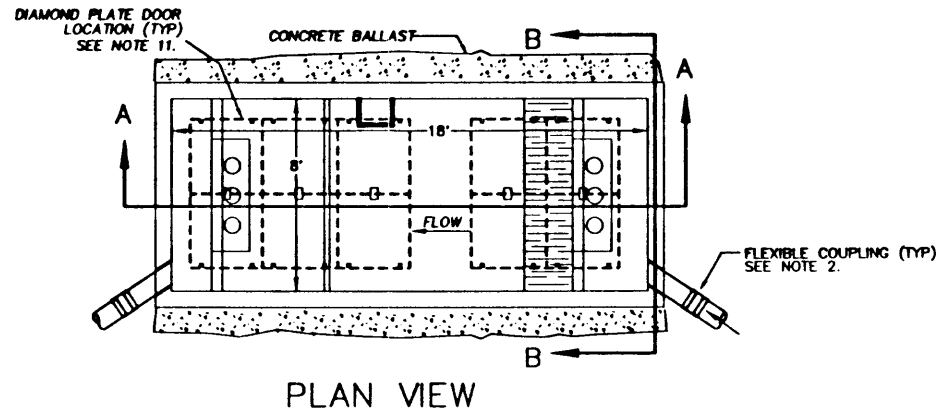
# Appendix B

## Content:

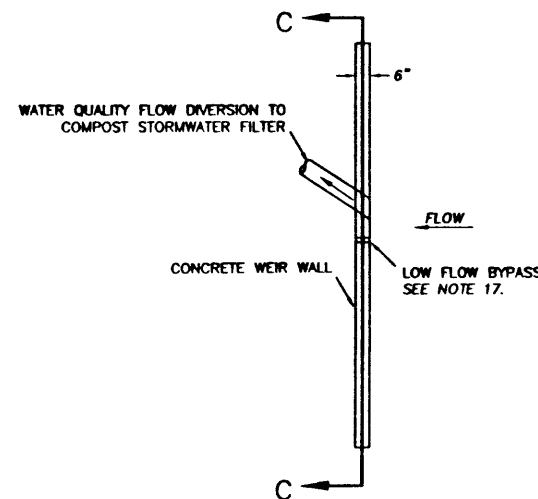
- **ODOT Project Plan Sheets**
  - *Cover/Title Sheet*
  - *Water Quality/Detention Plan Sheets*
  - *Other Details*



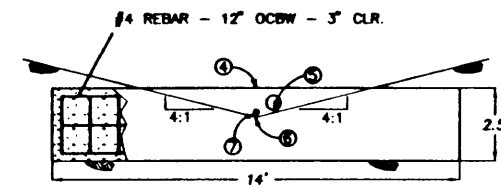
# COMPOST STORMWATER FILTER - DROP-IN UNIT STA. 854+34



PLAN VIEW



WEIR PLAN VIEW



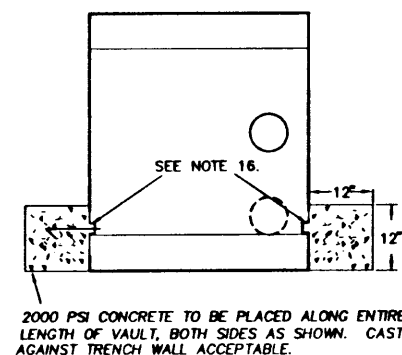
WEIR DETAIL  
Section C-C

### DATA TABLE

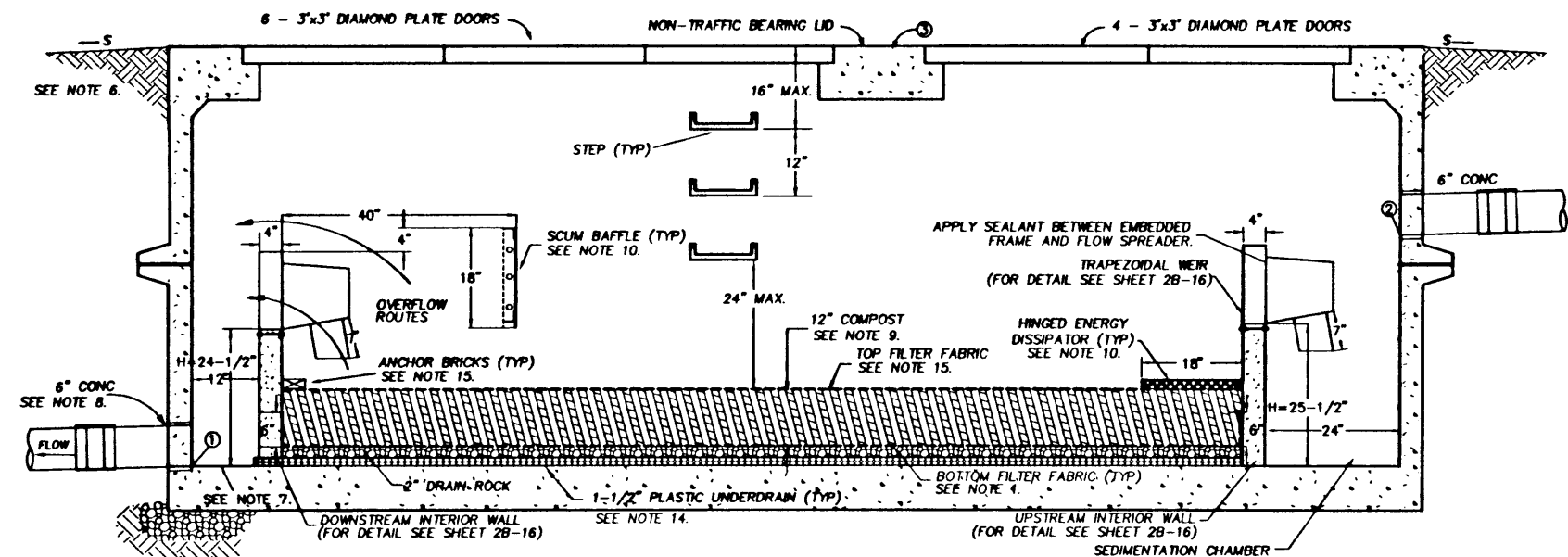
DESCRIPTION	ELEV (FT)
① I.E. OUT 6" CONC AND BOTTOM OF DOWNSTREAM END OF VAULT SEE NOTE 7.	54.9
② I.E. IN 6" CONC	57.1
③ TOP OF VAULT (CENTER) STA. 854+24 - 854+44, 57.5 LT.	60.9
④ TOP OF WEIR (CENTER) STA. 854+00, 77.5 LT.	58.2
⑤ I.E. 6" WATER QUALITY FLOW PIPE STA. 854+00, 77 LT.	57.45
⑥ BOTTOM OF DITCH STA. 854+00, 77.5 LT.	57.2
⑦ I.E. OF 2" LOW FLOW BYPASS STA. 854+00, 77.5 LT.	57.4

### MATERIALS LIST:

- VAULT: PRECAST CONCRETE VAULT TO MEET OR EXCEED THE APPLICABLE REQUIREMENTS OF ASTM B58-B3. CONTRACTOR TO SUBMIT SHOP DRAWING TO ENGINEER FOR APPROVAL.
  - 4.25 C.Y. COMPOST AS SPECIFIED. CSF TREATMENT SYSTEMS, PORTLAND, OREGON OR ENGINEER APPROVED.
  - DRAIN ROCK: 5/8" TO 3/4" OPEN GRADED, CLEANED AND WASHED.
  - INTERIOR APPURTENANCES:
    - PLASTIFAB "FLOW KIT" COMPONENTS (PLASTIFAB, INC., TUALATIN, OREGON OR ENGINEER APPROVED)
    - FLOW SPREADER 46" - 2 (MODEL FS-1)
    - EMBEDDED FRAME - 2 (OPTIONAL FOR PRE-CASTERS)
    - TRAPEZOIDAL WEIR 46" - 1 (MODEL TW46)
    - SCUM BAFFLE 18" - 1 (MODEL SB6)
    - HINGED ENERGY DISSIPATOR 18" - 1 (MODEL HED8)
    - TOP FILTER FABRIC - 115 S.F. - 8'x14.34' (AMOCO 4545 OR ENGINEER APPROVED)
    - BOTTOM FILTER FABRIC - 138 S.F. - 8'x15.34' (EROSION X STYLE 52047-000 BY SYNTHETIC INDUSTRIES, AVAILABLE FROM ACF WEST, INC. 503-771-5115)
    - UNDERDRAIN - 118 S.F. - 8'x14.75'. (ADS ADVANTEDGE OR ENGINEER APPROVED)
- (ALL COMPONENTS CONSTRUCTED FROM FIBERGLASS AND PVC PLASTIC)



BALLAST DETAIL  
Section B-B



18' X 8' "DROP IN" COMPOST STORMWATER FILTER  
Section A-A  
U.S. PATENT 5,322,629

### NOTES:

- FILTER FABRIC SHALL EXTEND 6" ABOVE THE BASE OF THE COMPOST ON ALL FOUR SIDES. TAPE FILTER FABRIC TO VAULT WALL PRIOR TO COMPOST INSTALLATION TO PREVENT COMPOST FROM GETTING BETWEEN FABRIC AND VAULT WALL.
- PROVIDE FLEXIBLE COUPLINGS TYPICAL ALL PIPES. COUPLING TO BE SET 18" OUTSIDE FACE OF WALL. FERRO OR ENGINEER APPROVED EQUAL.
- INSTALL ALL PIPES FLUSH WITH VAULT WALL.
- SUB-BASE TO BE 6" (MIN) OF 3/4" MINUS ROCK, 95% COMPACTION. COMPACT UNDISTURBED SUBGRADE MATERIALS TO 95% OF MAX. DENSITY AT ±2% OF OPTIMUM MOISTURE. UNSUITABLE MATERIAL BELOW SUBGRADE SHALL BE REPLACED TO ENGINEER'S APPROVAL.
- JOINT SEALANT TO BE CONSEAL CS-101 OR ENGINEER APPROVED EQUAL. APPLY NON-SHRINK GROUT TO INTERIOR FACE AFTER SEALING.
- MATCH VAULT LID TO PROJECT GRADING AND PAVING PLANS AND SPECS.
- VAULT FLOOR SHALL BE LEVEL WITHIN 1/4" ACROSS THE WIDTH AND LEVEL TO A DOWNSTREAM SLOPE OF 1" PER 12' OF LENGTH.
- GROUT ALL PIPES IN PLACE.
- SITE MUST BE CLEAN AND STABILIZED AS PER SPECS PRIOR TO COMPOST INSTALLATION. CONTRACTOR MUST NOTIFY CSF TREATMENT SYSTEMS (503-644-8220) 48 HOURS PRIOR TO COMPOST INSTALLATION. COMPOST INSTALLATION: INSTALL 12" OF COMPOST. DO NOT COMPACT. SLOWLY AND UNIFORMLY WET COMPOST AFTER INSTALLATION TO THE POINT WHERE WATER DRAINS FROM OUTLET AND STOP. DO NOT WALK ON COMPOST AFTER WETTING. COMPOST MUST BE KEPT DRY PRIOR TO INSTALLATION.
- DRILL 1/2" HOLE AND SET THREADED ANCHORS. USE RAWL STAINLESS STEEL DROP-IN OR ENGINEER APPROVED EQUAL. INSTALL WITH 3/8" STAINLESS STEEL BOLTS & WASHERS. EMBEDDED UNI-STRUT ALTERNATIVE ACCEPTABLE.
- DIAMOND PLATE DOOR COVERS SHALL HAVE A HOT DIPPED GALVANIZED FINISH. DOORS SHALL BE SPRING ASSISTED WITH A RECESSED LIFT HANDLE. DOORS SHALL HAVE A LOCKING LATCH WITH 3/8" PENTAHEAD BOLTS. CONTRACTOR SHALL SUPPLY TWO 3/8" PENTAHEAD KEYS.
- INTERIOR WALLS SHALL BE 3,000 PSI MIN. CONTRACTOR SHALL SUBMIT SHOP DRAWING TO ENGINEER.
- CONTRACTOR SHALL SEAL ALL JOINTS, BOTH SIDES, WITH NON-SHRINK GROUT.
- UNDERDRAIN SHALL EXTEND A MINIMUM OF 1" BEYOND THE DOWNSTREAM INTERIOR WALL.
- INSTALL TOP FILTER FABRIC AS SPECIFIED ON COMPOST SURFACE. EVENLY SPACE 12 ANCHOR BRICKS AROUND THE EDGE OF THE FABRIC TO HOLD IN PLACE.
- TO ATTACH BALLAST CAST A 1" DEEP x 2" WIDE CONTINUOUS KEYWAY OR EMBED 9" J-HOOKS AT AN 18" SPACING ALONG ENTIRE LENGTH OF FILTER.
- SET 2" PVC PIPE WITH COUPLING INTO CONCRETE WEIR. COUPLING SHOULD BE FLUSH WITH UPSTREAM FACE OF THE WEIR.

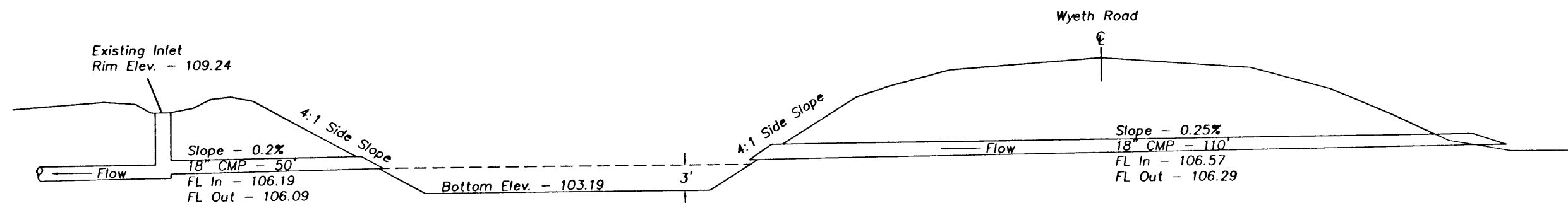
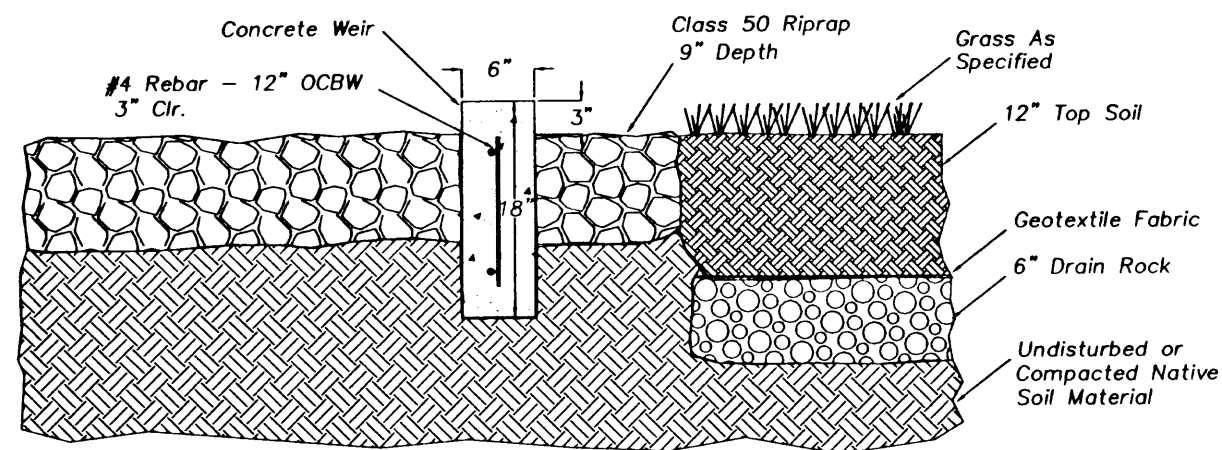
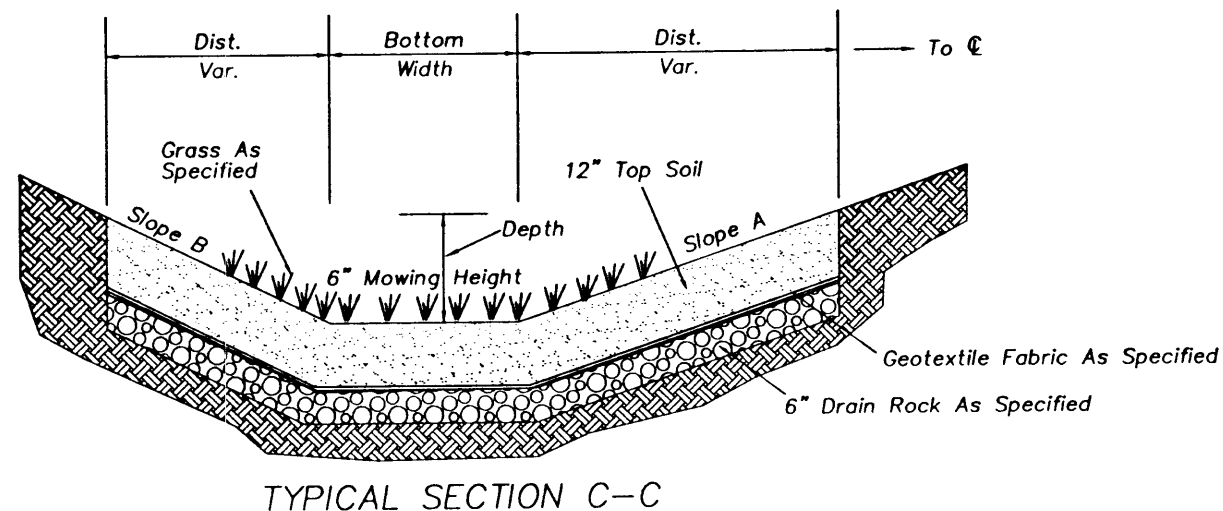
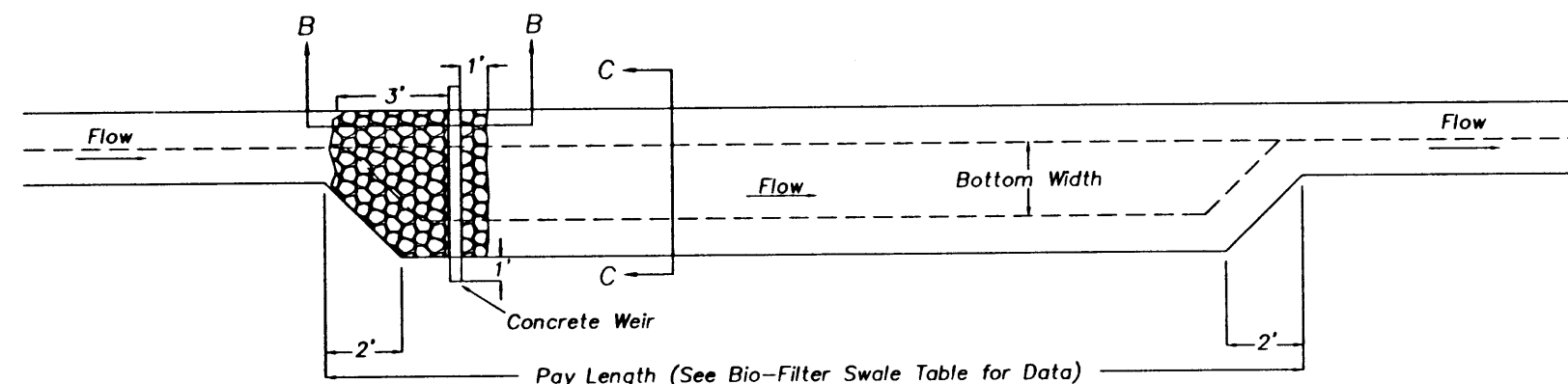
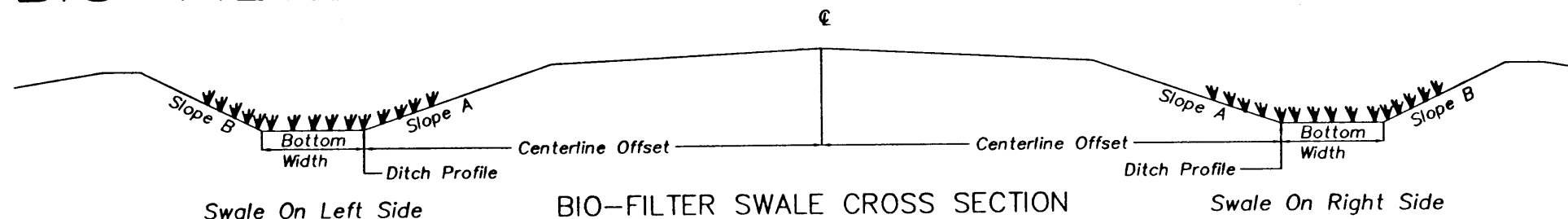
COLUMBIA CITY N.C.L. - WARREN SEC. COLUMBIA RIVER HIGHWAY (LOWER) COLUMBIA COUNTY		
FEDERAL HIGHWAY ADMINISTRATION	PROJECT NUMBER	SHEET NO.
REGION 10	OREGON DIVISION	2B-16A

12-OCT-1995 MOM 2B-16A.DWG

# BIO-FILTER SWALE

Bio-Filter Swale Table

Station From	Station To	Left Or Right	Slope A	Slope B	Bottom Width (Ft)	Depth (Ft)	Length (Ft)	Channel Slope (%)
573+00	575+50	Rt	6:1	4:1	4	1	250	1.83
610+50	613+50	Rt	6:1	4:1	4	1	300	1.10
615+20	618+20	Rt	6:1	1 1/2:1	4	1	300	0.57
719+70	720+90	Rt	6:1	4:1	4	1	120	1.57
720+90	722+60	Rt	6:1	4:1	4	1	170	1.33
797+90	800+08	Lt	3:1	2:1	4	1	218	0.83
839+45	-	Lt	2:1	2:1	10	1	160	3.12
856+70	860+75	Lt	4:1	4:1	4	1	405	0.75-2.0
897+37	-	Lt	3:1	3:1	6	1	290	1.20
898+50	900+75	Rt	4:1	1 1/2:1	4	1	225	0.98

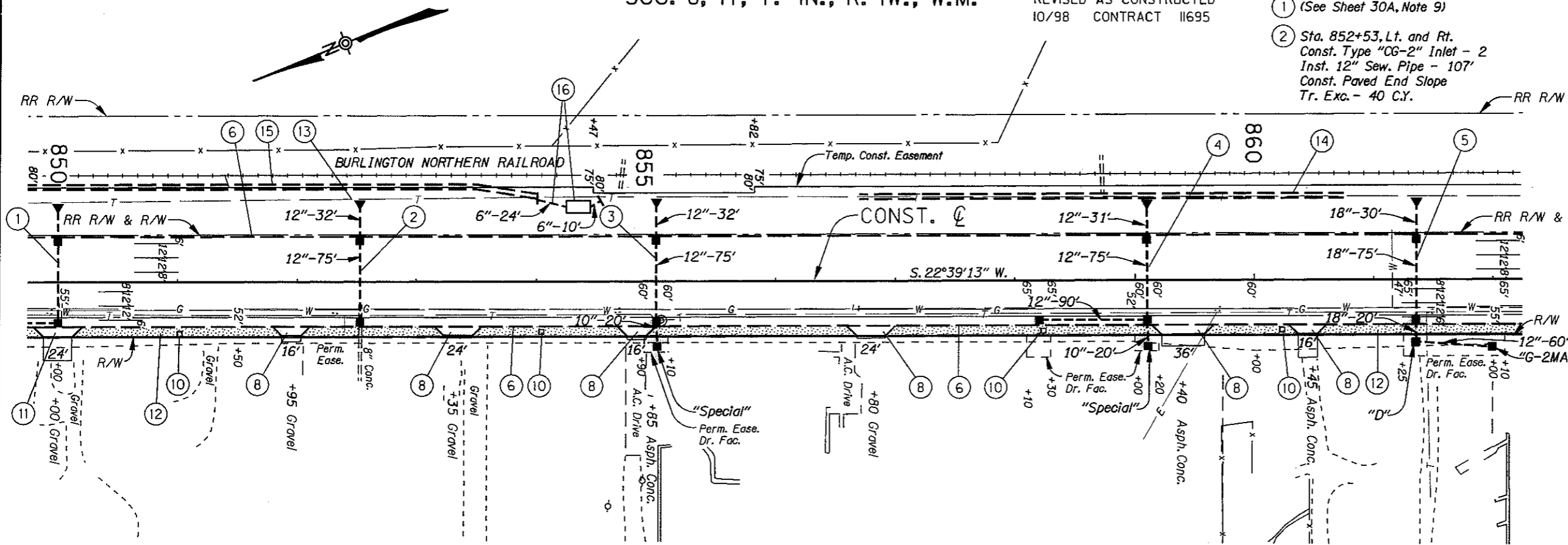


COLUMBIA CITY N.C.L. - WARREN SEC. COLUMBIA RIVER HIGHWAY (LOWER) COLUMBIA COUNTY		
FEDERAL HIGHWAY ADMINISTRATION	PROJECT NUMBER	SHEET NO.
REGION 10	OREGON DIVISION	2B-17

2B-17.DWG 05-OCT-1995 MOM

Sec. 8, 17, T. 4N., R. 1W., W.M.

REVISED AS CONSTRUCTED  
10/98 CONTRACT 11695



① (See Sheet 30A, Note 9)

② Sta. 852+53, Lt. and Rt.  
Const. Type "CG-2" Inlet - 2  
Inst. 10" Sew. Pipe - 20'  
Inst. 12" Sew. Pipe - 107'  
Const. Paved End Slope  
Tr. Exc. - 40 C.Y.

③ Sta. 855+00, Lt. and Rt.  
Const. Type "CG-2" Inlet - 2  
Const. Special Inlet  
Inst. 10" Sew. Pipe - 20'  
Inst. 12" Sew. Pipe - 107'  
Const. Paved End Slope  
Tr. Exc. - 56 C.Y.  
(For Details, See Sheet 2B-3)

④ Sta. 859+10, Lt. and Rt.  
Const. Type "CG-2" Inlet - 3  
Const. Special Inlet  
Inst. 10" Sew. Pipe - 20'  
Inst. 12" Sew. Pipe - 196'  
Const. Paved End Slope  
Tr. Exc. - 76 C.Y.  
(For Details, See Sheet 2B-3)

⑤ Sta. 861+35, Lt. and Rt.  
Const. Type "D" Inlet  
Const. Type "G-2MA" Inlet  
Inst. 12" Sew. Pipe - 60'  
Inst. 18" Sew. Pipe - 125'  
Const. Paved End Slope  
Tr. Exc. - 88 C.Y.

⑥ Const. Type "D" Mod. Curb  
(For Detail, See Shf. 2B-5)

⑧ Const. P.C. Conc. Dwy. Type "A" - 6  
Const. Asp. Conc. Dwy. Connection - 6  
(For Detail, See Shf. 2B-6)

⑩ Inst. Multiple Mailbox Support - 4  
Const. Conc. Collar - 4

⑪ (See Sheet 30A, Note 15)

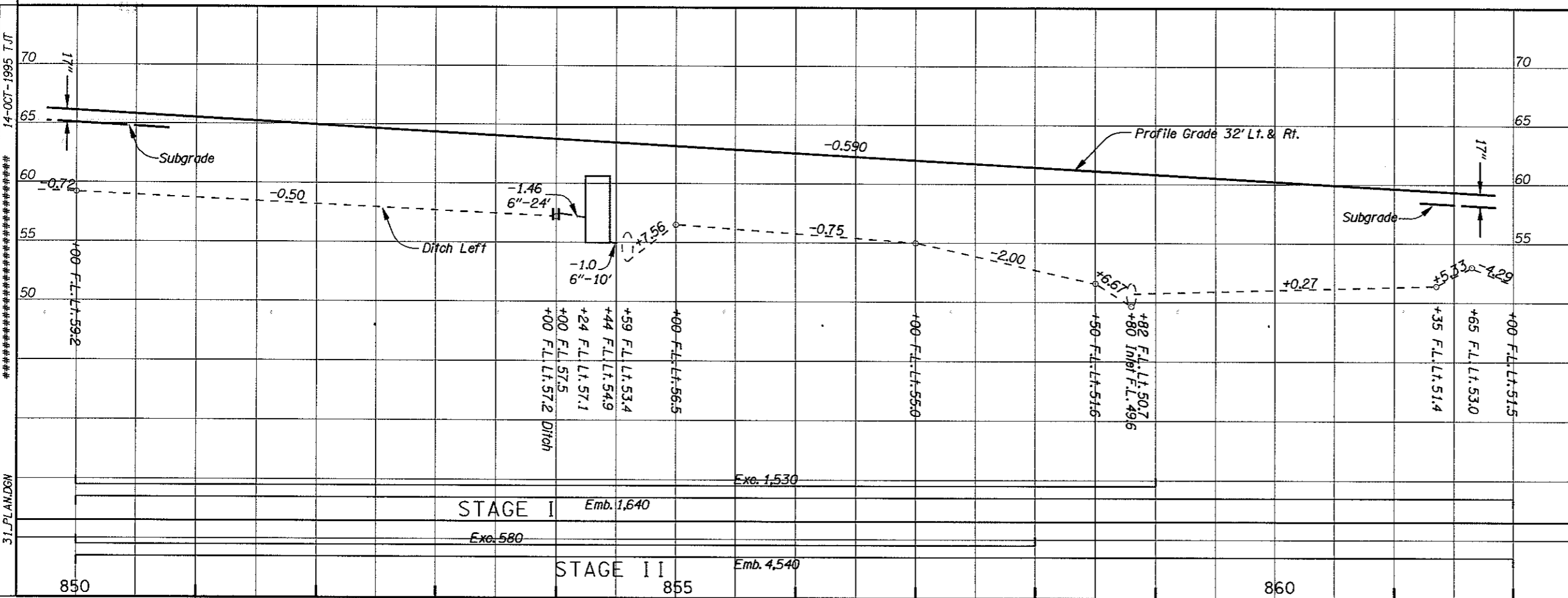
⑫ Const. P.C. Conc. Walk  
(For Planing Detail, See Sheets 37, 37A & 37B)

⑬ Sta. 852+25 To Sta. 852+75  
Lower Tel. Conduit - 50'  
Inst. BSP Tel. Conduit Protection - 20'  
(For Details, See Sheet 2B-26)

⑭ Sta. 856+70 To Sta. 860+75  
Const. Swale - 535 S.Y.  
Dt. Exc. - 270 C.Y.  
(For Details, See Sheet 2B-17)

⑮ See Sheet 30A, Note 33

⑯ Sta. 854+00 To Sta. 854+45  
Inst. Compost Stormwater Filter  
Drop-In Unit With Weir  
Inst. 6" Sew. Pipe - 34'  
Tr. Exc. - 18 C.Y.  
(For Details, See Sheet 2B-16A)



14-OCT-1995 T.JT  
31\_JPLANDSN

COLUMBIA CITY N.C.L. - WARREN SEC.		
COLUMBIA RIVER HIGHWAY (LOWER)		
COLUMBIA COUNTY		
FEDERAL HIGHWAY ADMINISTRATION	PROJECT NUMBER	SHEET NO.
REGION 10 OREGON DIVISION		31

# Appendix C

## Content:

- **Proprietary Structure Maintenance Requirements**



## StormFilter Inspection and Maintenance Procedures



## Maintenance Guidelines

The primary purpose of the Stormwater Management StormFilter® is to filter out and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance activities may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is a good practice to inspect the system after major storm events.

## Maintenance Procedures

Although there are likely many effective maintenance options, we believe the following procedure is efficient and can be implemented using common equipment and existing maintenance protocols. A two step procedure is recommended as follows:

### 1. Inspection

Inspection of the vault interior to determine the need for maintenance.

### 2. Maintenance

Cartridge replacement

Sediment removal

## Inspection and Maintenance Timing

At least one scheduled inspection should take place per year with maintenance following as warranted.

First, an inspection should be done before the winter season. During the inspection the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, a maintenance (replacement of the filter cartridges and removal of accumulated sediments) should be performed during periods of dry weather.



In addition to these two activities, it is important to check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the inspection/maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time, and maintenance should occur, if warranted, in late summer to early fall when flows into the system are not likely to be present.

## Maintenance Frequency

The primary factor controlling timing of maintenance of the StormFilter is sediment loading.

A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media inside the cartridges. The flow through the system will naturally decrease as more and more particulates are trapped. Eventually the flow through the cartridges will be low enough to require replacement. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on a routine as-needed basis in order to prevent material from being re-suspended and discharged to the StormFilter treatment system.

Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction may need to be inspected and maintained more often than those with fully stabilized surface conditions.

The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after major storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system or site. It is recommended that the site owner develop a database to properly manage StormFilter inspection and maintenance programs.

Prior to the development of the maintenance database, the following maintenance frequencies should be followed:

### Inspection

One time per year

After major storms

### Maintenance

As needed, based on results of inspection (The average maintenance lifecycle is approximately 1-3 years)

Per Regulatory requirement

In the event of a chemical spill

Frequencies should be updated as required. The recommended initial frequency for inspection is one time per year. StormFilter units should be inspected after major storms.

Sediment removal and cartridge replacement on an as needed basis is recommended unless site conditions warrant.

Once an understanding of site characteristics has been established, maintenance may not be needed for one to three years, but inspection is warranted and recommended annually.

## Inspection Procedures

The primary goal of an inspection is to assess the condition of the cartridges relative to the level of visual sediment loading as it relates to decreased treatment capacity. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

**Warning:** In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and CONTECH Construction Products immediately.

To conduct an inspection:

**Important:** Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit.

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.



3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.

7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to whether or not maintenance is needed.

## Maintenance Decision Tree

The need for maintenance is typically based on results of the inspection. The following Maintenance Decision Tree should be used as a general guide. (Other factors, such as Regulatory Requirements, may need to be considered)



1. Sediment loading on the vault floor.
  - a. If  $>4''$  of accumulated sediment, maintenance is required.
2. Sediment loading on top of the cartridge.
  - a. If  $>1/4''$  of accumulation, maintenance is required.
3. Submerged cartridges.
  - a. If  $>4''$  of static water in the cartridge bay for more than 24 hours after end of rain event, maintenance is required.
4. Plugged media.
  - a. If pore space between media granules is absent, maintenance is required.
5. Bypass condition.
  - a. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
6. Hazardous material release.
  - a. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
7. Pronounced scum line.
  - a. If pronounced scum line (say  $\geq 1/4''$  thick) is present above top cap, maintenance is required.
8. Calendar Lifecycle.
  - a. If system has not been maintained for 3 years maintenance is required.

## Assumptions

- No rainfall for 24 hours or more
- No upstream detention (at least not draining into StormFilter)
- Structure is online
- Outlet pipe is clear of obstruction
- Construction bypass is plugged

## Maintenance

Depending on the configuration of the particular system, maintenance personnel will be required to enter the vault to perform the maintenance.

**Important:** If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flows is occurring.

Replacement cartridges can be delivered to the site or customers facility. Information concerning how to obtain the replacement cartridges is available from CONTECH Construction Products.

**Warning:** In the case of a spill, the maintenance personnel should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and CONTECH Construction Products immediately.

To conduct cartridge replacement and sediment removal maintenance:

1. If applicable, set up safety equipment to protect maintenance personnel and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.
4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

### Method 1:

- A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Unscrew (counterclockwise rotations) each filter cartridge from the underdrain connector. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact CONTECH Construction Products for suggested attachment devices.



**Important:** Note that cartridges containing leaf media (CSF) do not require unscrewing from their connectors. Take care not to damage the manifold connectors. This connector should remain installed in the manifold and could be capped during the maintenance activity to prevent sediments from entering the underdrain manifold.

- B. Remove the used cartridges (up to 250 lbs. each) from the vault.

**Important:** Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner unless CONTECH Construction Products performs the maintenance activities and damage is not related to discharges to the system.

- C. Set the used cartridge aside or load onto the hauling truck.
- D. Continue steps a through c until all cartridges have been removed.

### Method 2:

- A. Enter the vault using appropriate confined space protocols.
- B. Unscrew the cartridge cap.
- C. Remove the cartridge hood screws (3) hood and float.
- D. At location under structure access, tip the cartridge on its side.

**Important:** Note that cartridges containing media other than the leaf media require unscrewing from their threaded connectors. Take care not to damage the manifold connectors. This connector should remain installed in the manifold and capped if necessary.

- D. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.
- E. Set the empty, used cartridge aside or load onto the hauling truck.
- F. Continue steps a through e until all cartridges have been removed.



- 8. Remove accumulated sediment from the floor of the vault and from the forebay. This can most effectively be accomplished by use of a vacuum truck.
- 9. Once the sediments are removed, assess the condition of the vault and the condition of the connectors. The connectors are short sections of 2-inch schedule 40 PVC, or threaded schedule 80 PVC that should protrude about 1" above the floor of the vault. Lightly wash down the vault interior.
  - a. Replace any damaged connectors.
- 10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.
- 11. Close and fasten the door.
- 12. Remove safety equipment.
- 13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used empty cartridges to CONTECH Construction Products.



## Related Maintenance Activities -

### Performed on an as-needed basis

StormFilter units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.

## Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.



800.338.1122

[www.contech-cpi.com](http://www.contech-cpi.com)

## Support

- Drawings and specifications are available at [contechstormwater.com](http://contechstormwater.com).
- Site-specific design support is available from our engineers.

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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; related foreign patents or other patents pending.

# Inspection Report

Date: \_\_\_\_\_ Personnel: \_\_\_\_\_

Location: \_\_\_\_\_ System Size: \_\_\_\_\_

System Type: Vault  Cast-In-Place  Linear Catch Basin  Manhole  Other

Sediment Thickness in Forebay: \_\_\_\_\_ Date: \_\_\_\_\_

Sediment Depth on Vault Floor: \_\_\_\_\_

Structural Damage: \_\_\_\_\_

Estimated Flow from Drainage Pipes (if available): \_\_\_\_\_

Cartridges Submerged: Yes  No  Depth of Standing Water: \_\_\_\_\_

StormFilter Maintenance Activities (check off if done and give description)

Trash and Debris Removal: \_\_\_\_\_

Minor Structural Repairs: \_\_\_\_\_

Drainage Area Report \_\_\_\_\_

Excessive Oil Loading: Yes  No  Source: \_\_\_\_\_

Sediment Accumulation on Pavement: Yes  No  Source: \_\_\_\_\_

Erosion of Landscaped Areas: Yes  No  Source: \_\_\_\_\_

Items Needing Further Work: \_\_\_\_\_

Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals.

Other Comments:

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Review the condition reports from the previous inspection visits.

## StormFilter Maintenance Report

Date: \_\_\_\_\_ Personnel: \_\_\_\_\_

Location: \_\_\_\_\_ System Size: \_\_\_\_\_

System Type: Vault  Cast-In-Place  Linear Catch Basin  Manhole  Other

List Safety Procedures and Equipment Used: \_\_\_\_\_

### System Observations

Months in Service: \_\_\_\_\_

Oil in Forebay: Yes  No

Sediment Depth in Forebay: \_\_\_\_\_

Sediment Depth on Vault Floor: \_\_\_\_\_

Structural Damage: \_\_\_\_\_

### Drainage Area Report

Excessive Oil Loading: Yes  No  Source: \_\_\_\_\_

Sediment Accumulation on Pavement: Yes  No  Source: \_\_\_\_\_

Erosion of Landscaped Areas: Yes  No  Source: \_\_\_\_\_

### StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris: Yes  No  Details: \_\_\_\_\_

Replace Cartridges: Yes  No  Details: \_\_\_\_\_

Sediment Removed: Yes  No  Details: \_\_\_\_\_

Quantity of Sediment Removed (estimate?): \_\_\_\_\_

Minor Structural Repairs: Yes  No  Details: \_\_\_\_\_

Residuals (debris, sediment) Disposal Methods: \_\_\_\_\_

Notes: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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\_\_\_\_\_

\_\_\_\_\_



**Important: Inspection should be performed by a person who is familiar with the StormFilter treatment unit.**

## StormFilter Maintenance Guidelines

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site, and may be required in the event of a chemical spill or due to excessive sediment loading.

## Maintenance Procedures

Although there are other effective maintenance options, CONTECH recommends the following two step procedure:

1. Inspection: Determine the need for maintenance.
2. Maintenance: Cartridge replacement and sediment removal.

## Inspection and Maintenance Activity Timing

At least one scheduled inspection activity should take place per year with maintenance following as warranted.

First, inspection should be done before the winter season. During which, the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, maintenance should be performed during periods of dry weather.

In addition, you should check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation. It may be necessary to adjust the inspection/maintenance activity schedule depending on the actual operating conditions encountered by the system.

Generally, inspection activities can be conducted at any time, and maintenance should occur when flows into the system are unlikely.

## Maintenance Activity Frequency

Maintenance is performed on an as needed basis, based on inspection. Average maintenance lifecycle is 1-3 years. The primary factor controlling timing of maintenance of the StormFilter is sediment loading. Until appropriate timeline is determined, use the following:

### Inspection:

- One time per year
- After major storms

### Maintenance:

- As needed
- Per regulatory requirement
- In the event of a chemical spill

## Inspection Procedures

It is desirable to inspect during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

**Warning:** In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and CONTECH immediately.

To conduct an inspection:

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.
7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to whether or not maintenance is needed.

## Maintenance Decision Tree

The need for maintenance is typically based on results of the inspection. Use the following as a general guide. (Other factors, such as regulatory requirements, may need to be considered)

1. Sediment loading on the vault floor. If  $>4"$  of accumulated sediment, then go to maintenance.
2. Sediment loading on top of the cartridge. If  $>1/4"$  of accumulation, then go to maintenance.
3. Submerged cartridges. If  $>4"$  of static water in the cartridge bay for more than 24 hrs after end of rain event, then go to maintenance.
4. Plugged media. If pore space between media granules is absent, then go to maintenance.
5. Bypass condition. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), then go to maintenance.
6. Hazardous material release. If hazardous material release (automotive fluids or other) is reported, then go to maintenance.
7. Pronounced scum line. If pronounced scum line (say  $\geq 1/4"$  thick) is present above top cap, then go to maintenance.
8. Calendar Lifecycle. If system has not been maintained for 3 years, then go to maintenance.

### Assumptions:

No rainfall for 24 hours or more.

No upstream detention (at least not draining into StormFilter).

Structure is online. Outlet pipe is clear of obstruction. Construction bypass is plugged.

## Maintenance

Depending on the configuration of the particular system, workers will be required to enter the vault to perform the maintenance.

Important: If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flow is occurring.

Replacement cartridges can be delivered to the site or customers facility. Contact CONTECH for more information.

Warning: In the case of a spill, the worker should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and CONTECH immediately.

To conduct cartridge replacement and sediment removal:

1. If applicable, set up safety equipment to protect workers and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.
4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

#### Method 1:

- A. This activity will require that workers enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Unscrew (counterclockwise rotations) each filter cartridge from the underdrain connector. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact CONTECH for suggested attachment devices.

**Important: Cartridges containing leaf media (CSF) do not require unscrewing from their connectors. Do not damage the manifold connectors. They should remain installed in the manifold and can be capped during the maintenance activity to prevent sediments from entering the under drain manifold.**

- B. Remove the used cartridges (up to 250 lbs.) from the vault.

**Important: Avoid damaging the cartridges during removal and installation.**

- C. Set the used cartridge aside or load onto the hauling truck.
- D. Continue steps A through C until all cartridges have been removed.

#### Method 2:

- A. Enter the vault using appropriate confined space protocols.
- B. Unscrew the cartridge cap.
- C. Remove the cartridge hood screws (3) hood and float.
- D. At location under structure access, tip the cartridge on its side.

**Important: Note that cartridges containing media other than the leaf media require unscrewing from their threaded connectors. Take care not to damage the manifold connectors. This connector should remain installed in the manifold and capped if necessary.**

- E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.
  - F. Set the empty, used cartridge aside or load onto the hauling truck.
  - G. Continue steps A through E until all cartridges have been removed.
8. Remove accumulated sediment from the floor of the vault and from the forebay. Use vacuum truck for highest effectiveness.
  9. Once the sediments are removed, assess the condition of the vault and the connectors. The connectors are short sections of 2-inch schedule 40 PVC, or threaded schedule 80 PVC that should protrude about 1" above the floor of the vault. Lightly wash down the vault interior.
    - a. Replace any damaged connectors.
  10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Take care not to damage connections.
  11. Close and fasten the door.
  12. Remove safety equipment.
  13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used empty cartridges to CONTECH.

#### Material Disposal

The accumulated sediment must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals. Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

Sediments and water must be disposed of in accordance with applicable waste disposal regulations. Coordinate disposal of solids and liquids as part of your maintenance procedure. Contact the local public works department to inquire how they disposes of their street waste residuals.

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**Configuration Guide**



# The Stormwater Management StormFilter®

The Stormwater Management StormFilter® (StormFilter) is a passive, flow-through, stormwater filtration system. The system is comprised of one or more structures that house rechargeable, media-filled cartridges which trap particulates and adsorb materials such as dissolved metals, hydrocarbons, and nutrients in polluted runoff.

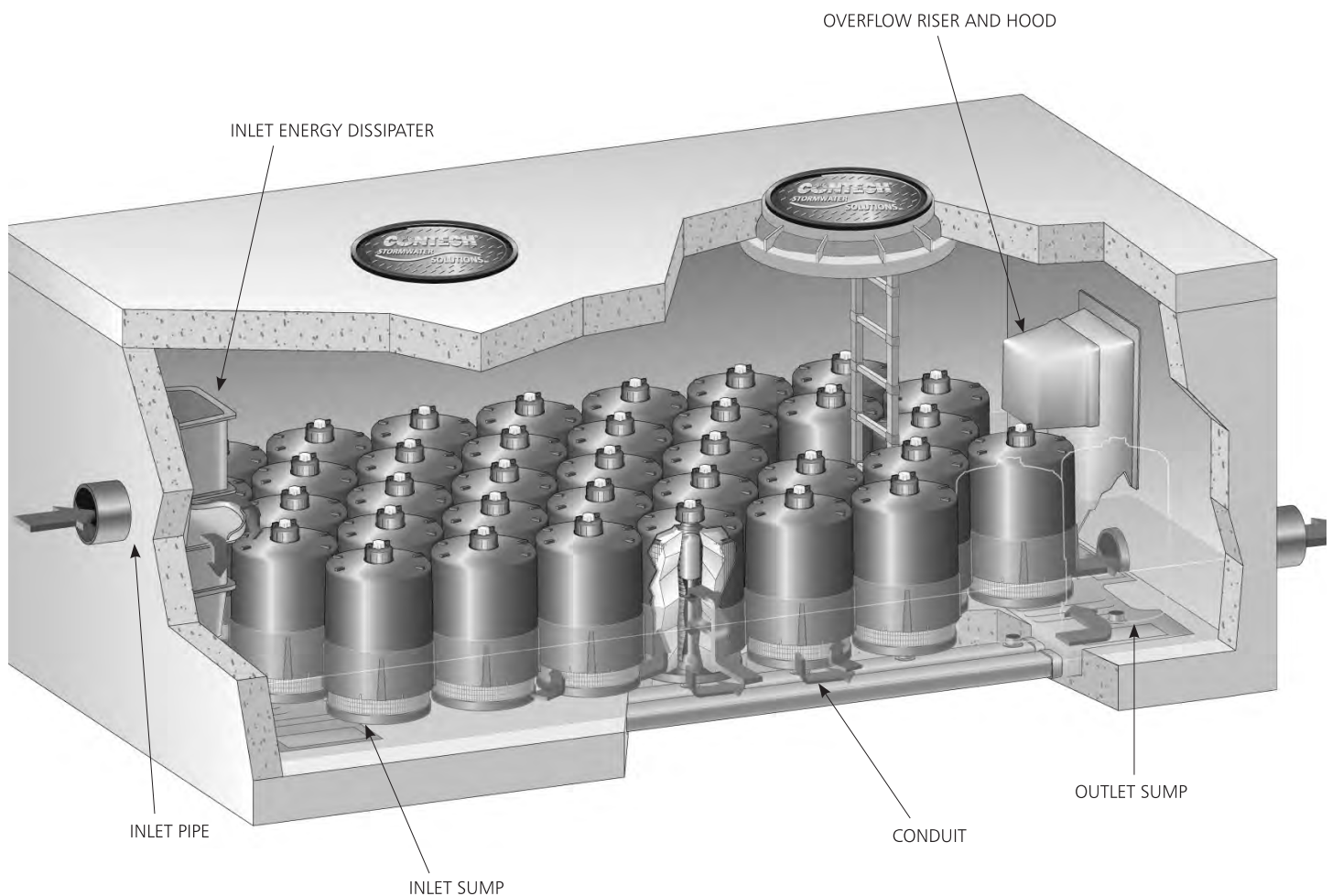
The StormFilter system comes in a variety of configurations and sizes to meet any site need. A variety of filter media is available and can be customized for each site to remove the desired pollutants.

## Basic Design

The StormFilter is sized to treat the peak flow of a water quality design storm. The peak flow or WQv is determined from calculations based on the contributing watershed hydrology and from a design storm magnitude set by the local stormwater management agency. The StormFilter system is modular and each unit is designed with the number of cartridges required to meet the peak design flow rate, WQv or cap.

The flow rate through each filter cartridge is set to meet the jurisdictional performance requirements, allowing control over the amount of contact time between the influent and the filter media. The maximum flow rate through each cartridge can be adjusted, between 0.26 gpm/ft<sup>2</sup> and 2 gpm/ft<sup>2</sup> of surface area, using a calibrated restrictor disc at the base of each filter cartridge. Adjustments to the cartridge flow rate will affect the number of cartridges required to treat the peak flow or WQv.

Please contact your local CONTECH representative for site-specific design assistance.



## Basic Operation

### Priming System Function

The system is designed to siphon stormwater runoff through the StormFilter cartridge. Stormwater enters a StormFilter cartridge, percolates horizontally through the cartridge's filter media and collects in the center tube where the float valve is in a closed (downward) position.

As water passes through the filter media and into the cartridge's center tube, the air in the cartridge is displaced by the water and purged from beneath the filter hood through the one-way check valve located in the cap. Once the center tube is filled with water, there is enough buoyant force to open the float valve and allow the treated water in the center tube to flow into the under-drain manifold. This causes the check valve to close, initiating a siphon that draws polluted water throughout the full surface area and volume of the filter. Thus, the entire filter cartridge is used to filter water throughout the duration of the storm, regardless of the water surface elevation in the unit. This siphon continues until the water surface elevation drops to the elevation of the hood's scrubbing regulators, and the float returns to a closed position. Utilizing the hydraulic potential in the cartridge, the scrubbing regulators cause the filter surface to be clean of attached sediments thus extending the filter's operational life.

### Flow and Valve Control

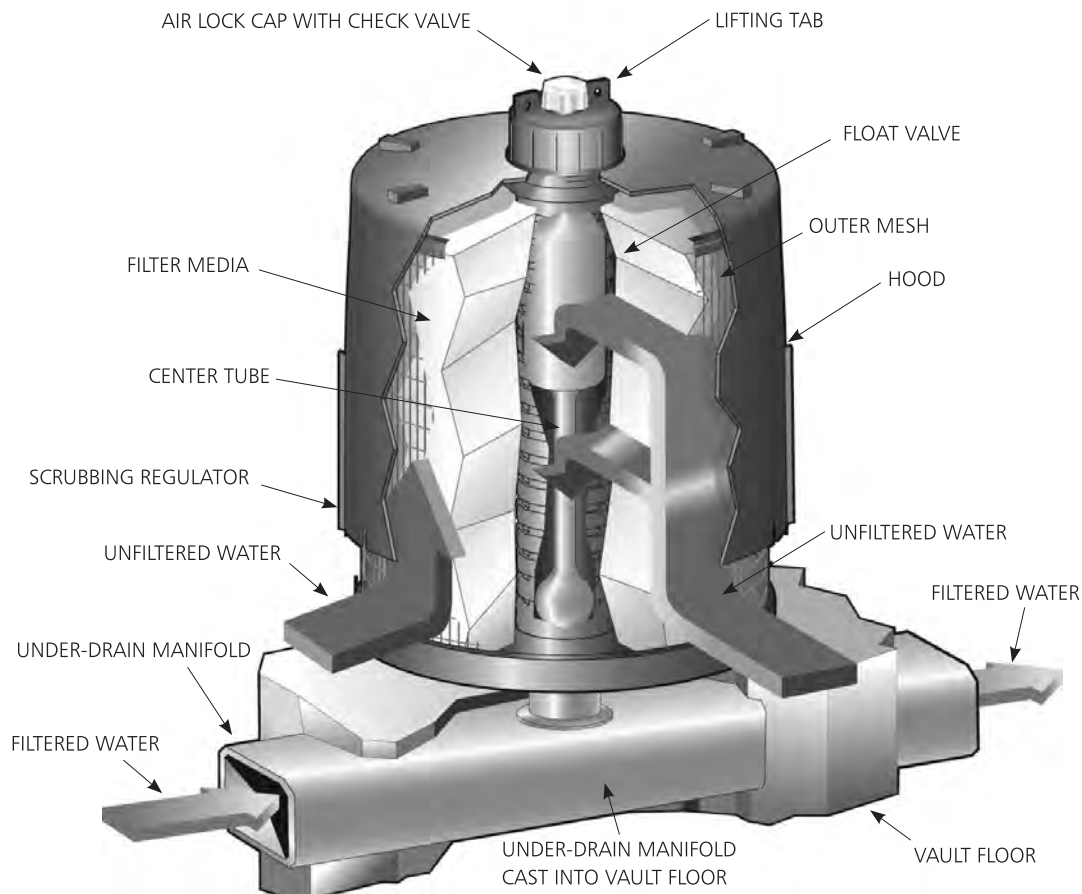
The filtration rate through a typical StormFilter cartridge can be adjusted so that it has a maximum flow rate of 2 gpm/ft<sup>2</sup> at

the design driving head. The flow rate is individually controlled for each cartridge by a restrictor disc located at the connection point between the cartridge and the under-drain manifold. Consisting of a simple orifice disc of a specific diameter, the flow rate through the cartridges can be adjusted to a level that coincides with your treatment requirements by using a disc with the appropriate orifice diameter.

A reduction in flow rate affects the performance of the StormFilter system with regards to both sediment and soluble pollutants. For solids, Stokes' Law predicts the movement of sediment in a fluid and it has been proven that a reduction in the flow velocity through the system will facilitate increased settling and capture of sediments. In addition, some media types have the ability to remove soluble pollutants through chemical processes, like ion exchange. A reduction in the flow velocity through the StormFilter cartridge will increase the contact time between the stormwater and the media, thereby increasing the removal efficiency by increasing the time for a chemical process to take place.

Media type can be changed, but flow rate adjustment requires engineering consultation to ensure hydraulic demands are satisfied.

Through routine maintenance, a media filtration system can adjust the media type to target or update the system to treating specific pollutants, new TMDLs, or changing pollutants of concern. The media change out can provide a long-term solution to changing regulatory requirements.



# StormFilter Configurations

The StormFilter technology can be configured to meet your unique site requirements.

## Downstream Treatment Configurations

Conventional stormwater treatment involves collecting, conveying and treating stormwater runoff with an end of pipe treatment system before discharging off-site. StormFilter configurations suitable for these applications are listed below and can be engineered to treat a wide range of flows.

### Vault/Manhole

The Vault/Manhole consists of one or more precast concrete structures ranging from 48" manholes to 8' x 24' vaults. The largest unit treats water quality design flows up to 3.75 cfs, and can be placed in series or in parallel to treat higher flows if needed.

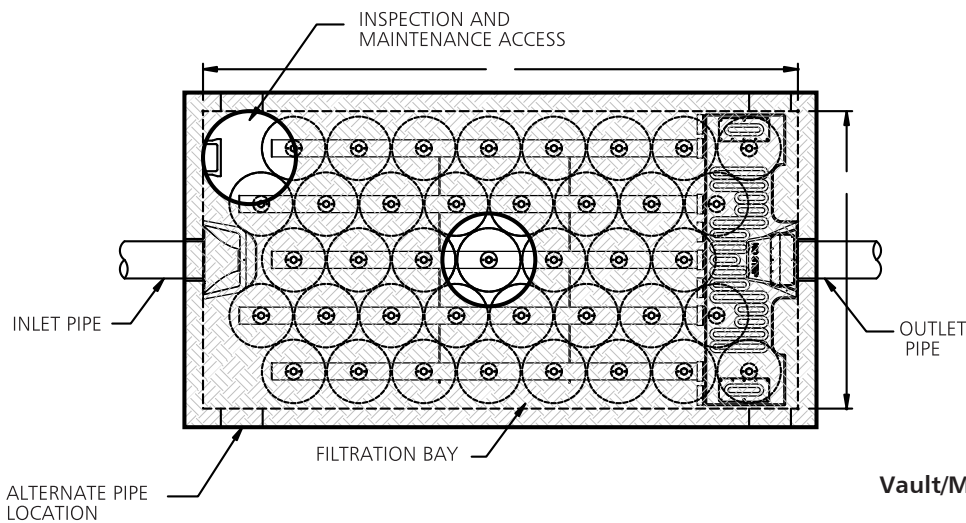
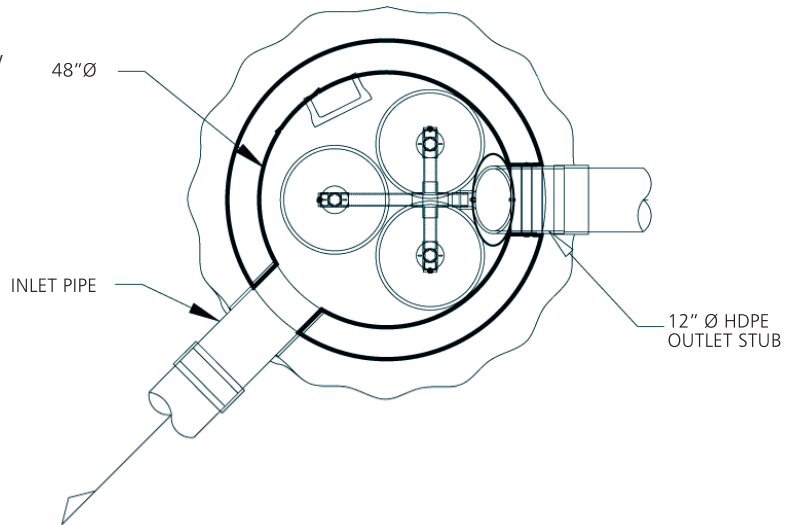
A Vault/Manhole configuration can be installed online or offline from storm system, where the unit has internal overflow bypass. These systems can also be installed offline, where high flows are bypassed around the treatment system and there is no internal overflow. However, if detention, pretreatment, or bypassing is required, it can be installed offline of the storm system.

### Basic Operation

Vault/Manhole systems are housed in either a vault or manhole. Stormwater first enters the structure through the inlet pipe where it is directed through the energy dissipator. This gently spreads the flow to minimize re-suspension of previously captured pollutants.

Once in the filtration area, the stormwater begins to pond and percolate horizontally through the media contained in the filter cartridges. After passing through the media, treated water that has collected in the cartridge center tube is directed into the outlet sump by an under-drain manifold. The treated water in the outlet sump is then discharged through the outlet pipe.

Precast StormFilter systems have an internal bypass capability from 1.0 cfs to 2.0 cfs, depending upon the size of the system. If peak flows to the system exceed 2.0 cfs, an offline high flow bypass is needed.



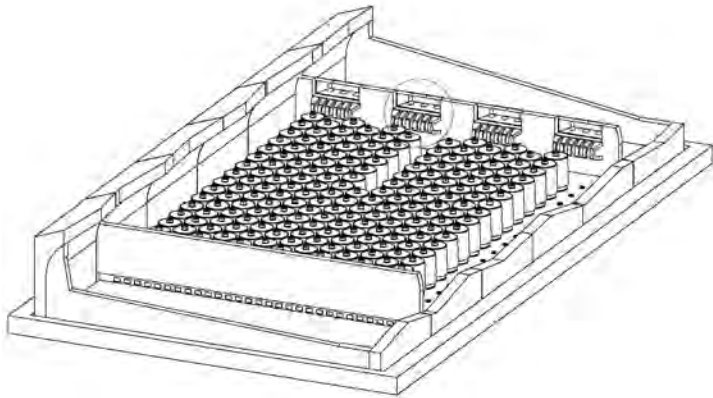
**Vault/Manhole StormFilter**

## High Flow StormFilter

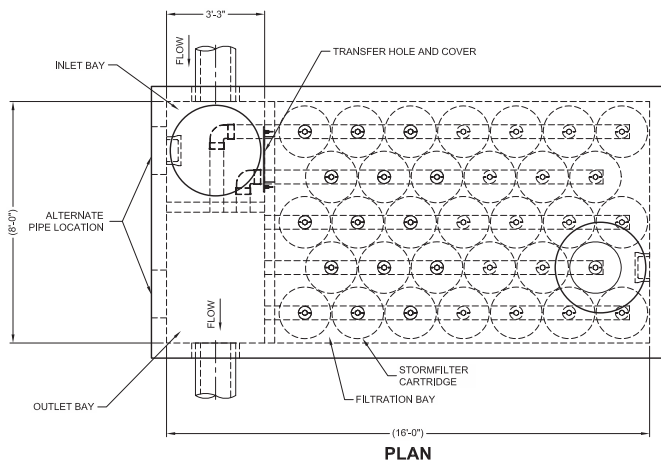
High Flow StormFilter systems can be designed within a variety of structures to meet local requirements and streamline installation. These systems are designed for large sites and large flows. Too big for standard precast structures, they are usually built from precast components that are assembled on site. The High Flow StormFilter is available in several configurations: CON/SPAN®, Panel Vaults, Box Culverts, or Cast-In-Place.

### Basic Operation

The High Flow StormFilter design has the same basic configuration and components as the Precast StormFilter but operates on a larger scale.



**High Flow StormFilter**



## Peak Diversion StormFilter

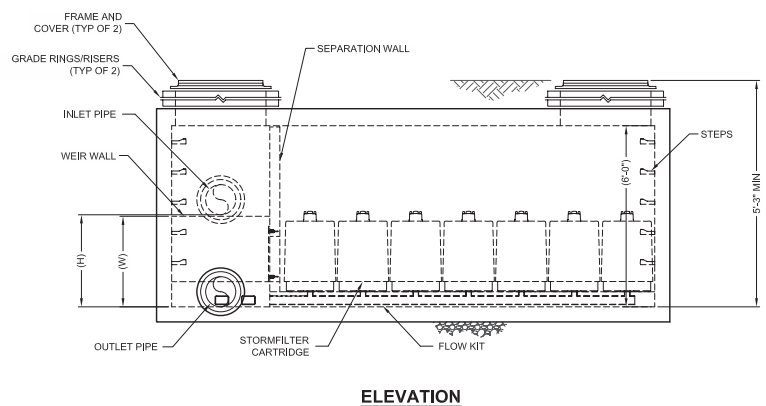
The Peak Diversion StormFilter includes a treatment chamber and offline by-pass capability in one precast vault. Sizes range from 8'x11" to 8'x24 in most areas. Larger units can treat up to 2.5cfs depending on cartridge height and the approved flow rate of regulatory jurisdiction. The integrated off-line bypass eliminates upstream flow splitters, downstream junction structures, and additional piping to save space and reduce the overall foot print. This lowers material and installation cost while reducing potential conflicts with right of way (ROW) boundaries and utilities.

### Basic Operation

Stormwater enters the structure through one or two inlet pipes into the inlet bay and low flows are directed to the filtration bay through a transfer opening. Once in the filtration area, the stormwater begins to pond and percolate horizontally through the media contained in the filter cartridges. After passing through the media, treated water that has collected in the cartridge center tube is directed into the outlet bay by an under-drain manifold. The treated water in the outlet sump is then discharged through the outlet pipe.

During large storm events greater than the treatment capacity, peak flows are diverted across the overflow weir directly to the outlet. Even during high flows the cartridges are still operating and water is entering the filtration bay from the inlet bay. This continuous flow into the filter bay helps ensure pollutants can not be washed out during high flow events.

As a general rule, the peak bypass capacity is 15 times the design flow rate, depending on the hydraulic grade line and available head loss.



**Peak Diversion StormFilter**

## Volume StormFilter

The Volume StormFilter is designed to meet volume-based regulations where a specific water quality volume (WQv) must be captured and treated. In addition to treatment, the structure can be sized to capture all or a portion of the WQv.

Restrictor discs inside each cartridge can be used to control the discharge rate from the system. The size of the disc is calibrated to provide the design filtration rate at a live storage depth. Because of these discs (and the airlock cap with a one way vent) water can be impounded above the cartridges in the treatment bay.

Structures range in size from a 48" manhole to CON/SPAN sections with a 24' x 10' cross section built to length. In many cases smaller structures are combined with outboard storage, such as pipe, to provide the WQv storage.

The Volume StormFilter can be designed with or without an internal bypass. If peak flows to the system exceed the internal bypass, or external bypass is required, a high flow bypass is needed. The system can also be installed online or offline and uses a traffic-bearing lid.

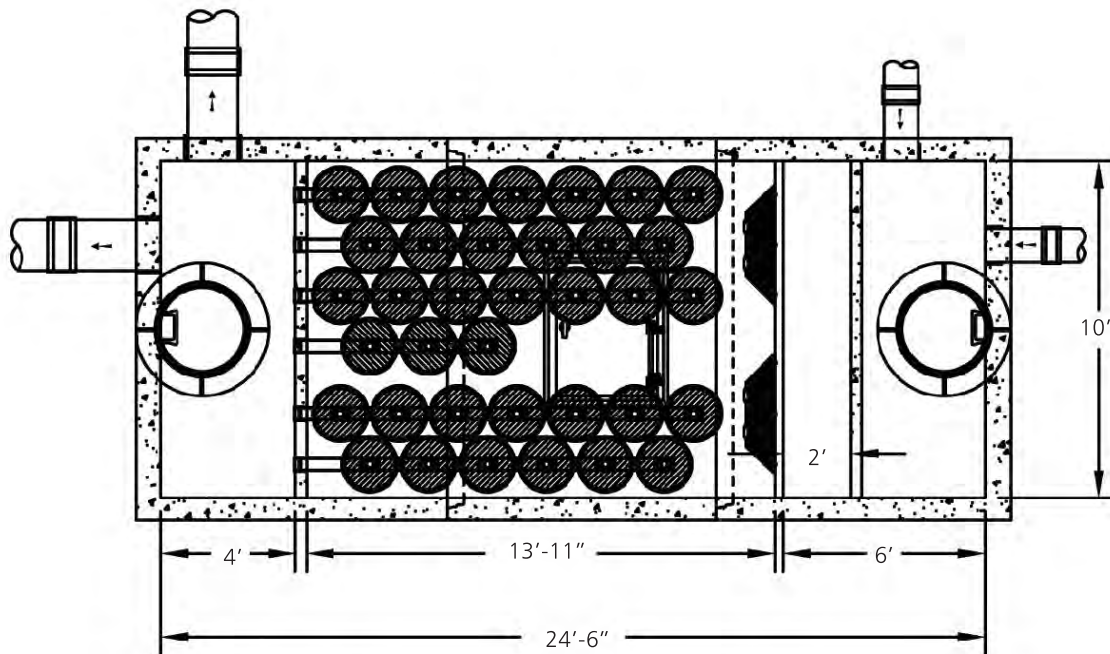
## Basic Operation

The Volume StormFilter is typically configured in one of two ways.

A three bay system that incorporates internal storage for the WQv and includes: the storage bay, the filtration bay, and the outlet bay. Water first enters the storage bay (a portion of which includes dead storage) which facilitates pretreatment (gravity separation) and storage of the WQv. The stormwater is then directed into the filtration bay for full treatment and additional storage. The storage bay can be designed with a baffle to trap floatables, oils, and surface scum. Cartridges in the filtration bay treat the stormwater and control the discharge rate. Once in the filtration bay, the stormwater percolates horizontally through the media contained in the filter cartridges. After passing through the cartridge, treated water is directed to the outlet bay by an under-drain manifold where it is discharged through an outlet pipe.

A two bay, precast vault based system similar to the Vault StormFilter where pretreatment and live storage are provided upstream.

Providing WQv storage in an outboard storage facility such as storage pipe provides the versatility to meet most footprint and elevation requirements.



Volume StormFilter



## Upstream Treatment Configurations

Low Impact Design (LID) design involves managing runoff close to the source using small, decentralized system. The following suite of StormFilter configurations are easily incorporated on sites where LID site design is recommended. These low-cost, lowdrop, point-of-entry systems also work well when you have a compact drainage area.

### CatchBasin StormFilter

The CatchBasin StormFilter (CBSF) consists of a multi-chamber steel, concrete, or plastic catch basin unit that contains up to four StormFilter cartridges. The steel CBSF is offered both as a standard and as a deep unit.

The CBSF is installed flush with the finished grade and is applicable for small drainage areas from roadways and parking lots, and retrofit applications. It can also be fitted with an inlet pipe for roof leaders or similar applications.

The CBSF unit treats water quality design flows up to 0.20 cfs, coupled with an internal weir overflow capacity of 1.0 cfs for the standard steel and concrete units and 1.8 cfs for the deep steel units. Non-traffic rated plastic CBSF units have an internal weir overflow capacity of 0.5 cfs.

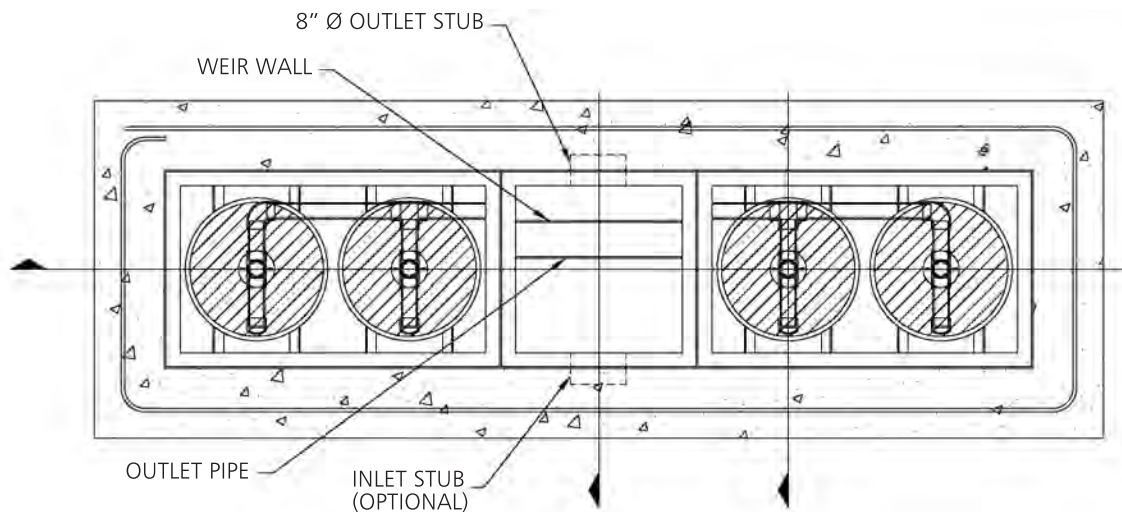
### Basic Operation

The CBSF acts as the primary receiver of runoff, similar to a standard, grated catch basin. The steel and concrete CBSF units each have an H-20 rated, traffic-bearing lid that allows the filter to be installed in parking lots and take up no land area. Plastic CBSF units can be used in landscaped areas and for other non-traffic bearing applications.

The CBSF consists of a sumped inlet chamber and cartridge chamber(s). Runoff enters the sumped inlet chamber either by sheet flow from a paved surface or from an inlet pipe discharging directly to the unit. The inlet chamber's internal baffle traps debris and floating oil, and houses an overflow weir. Heavier solids settle into the deep sump, while lighter solids and soluble pollutants are directed under the baffle and into the cartridge chamber through a port between the baffle and the overflow weir. Once in the cartridge chamber, polluted water ponds and percolates horizontally through the media in the filter cartridges. Treated water collects in the cartridge's center tube from where it is directed by an under-drain manifold to the outlet pipe on the downstream side of the overflow weir and discharged.

When flows into the CBSF exceed the water quality design value, excess water spills over the overflow weir, bypassing the cartridge bay, and discharges to the outlet pipe.

The CBSF is particularly useful where small flows are being treated or for sites that are flat and have little available hydraulic head to spare. The unit is ideal for applications in which standard catch basins are to be used. Both water quality and catchment issues can be resolved with the use of the CBSF.



**CathBasin StormFilter**

## Curb Inlet StormFilter

The Curb Inlet StormFilter consists of a precast concrete vault ranging from 6'x8' to 8'x16' in size. These units treat peak water quality design flows up to 1.05 cfs. The system is installed online and includes an internal offline overflow bypass around the filtration chamber. The internal bypass capability is based on depth of the structure. The standard bypass capacity is 15 cfs but is larger for deeper units. A traffic-bearing lid is placed underneath the median or sidewalk adjacent to the roadway.

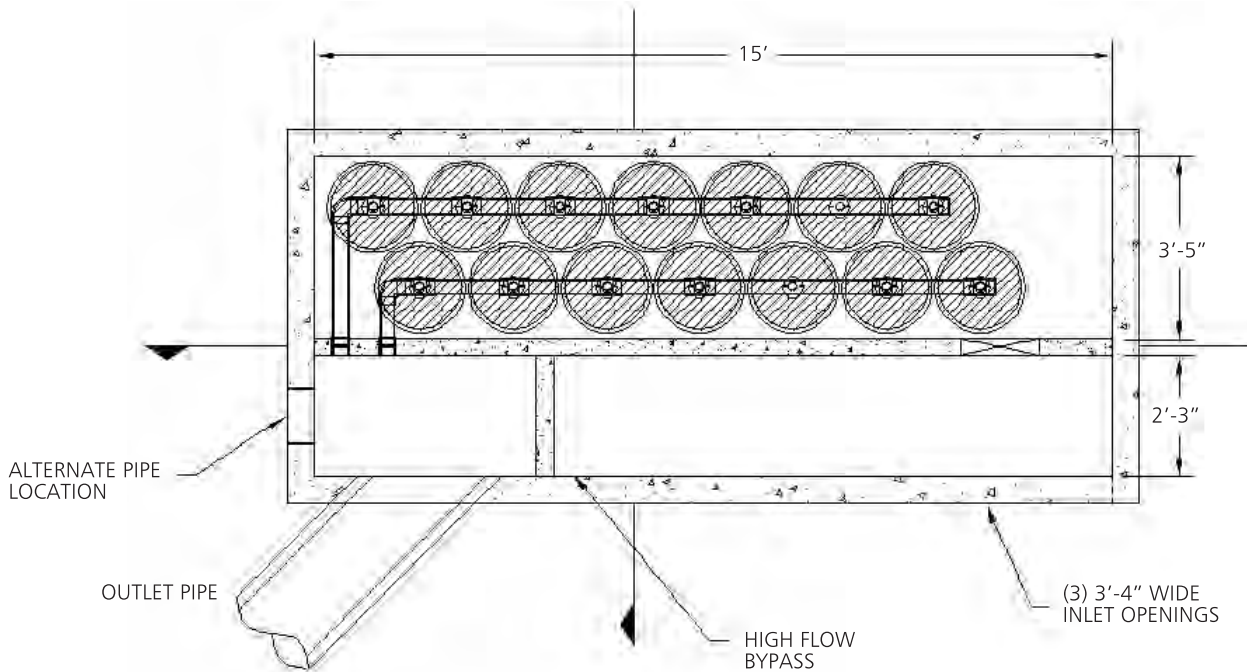
### Basic Operation

The Curb Inlet StormFilter is composed of three bays: the inlet bay, the filtration bay, and the outlet bay. Stormwater enters the inlet bay through the curb inlet opening. The design flow is directed through a transfer opening to the filtration bay for full treatment.

Once in the filtration bay, the stormwater percolates horizontally through the media in the filter cartridges to the center tube. Treated water in the cartridge center tube is directed into the outlet bay by an under-drain manifold and discharged through the outlet pipe. Outlet pipes can be placed parallel, perpendicular, or up to 45° to the roadway. Overflow is directed over a weir wall between the inlet bay and the outlet bay, bypassing the filtration bay leaving accumulated pollutants undisturbed.

### Curb Inlet Openings

Every Curb Inlet StormFilter is designed to meet local regulations governing the geometry of the curb inlet. This can be accomplished in two ways. One way is with an integrated face plate – the vault lid includes the face plate which is tied into the curb. Another way is with a cast-in-place face plate – the entire face plate is constructed by the contractor pouring the curb. Curb inlet openings can be 4', 7', or 10' in length.



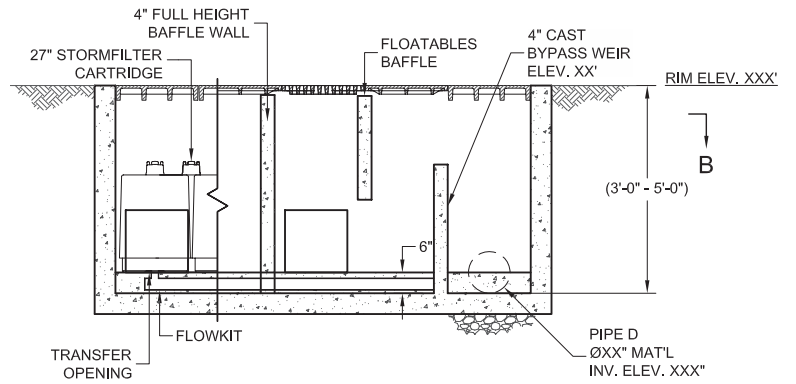
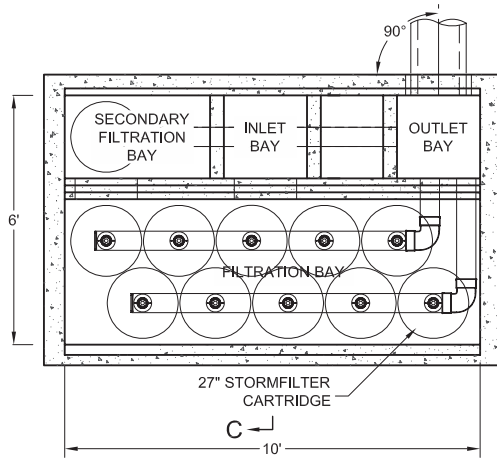
Curb Inlet StormFilter

## Linear Grate StormFilter

The Linear Grate StormFilter is a precast vault that acts as the primary receiver of runoff, similar to a standard grated catch basin. The unit has H-20 rated traffic-bearing lids that allow the filter to be installed under parking lots. The system consists of an inlet bay, filtration bay, and an outlet bay. Providing treatment as it enters the conveyance system reduces the overall head loss because the vertical drop from the finished grade into the conveyance system is also used to provide hydraulic pressure on the filter cartridges.

### Basic Operation

Runoff enters the inlet bay by sheet flow from a paved surface or from an inlet pipe discharging directly to the unit. The inlet bay's internal baffle traps debris and floating oil and denser pollutants are directed into the filtration bay. Once in the cartridge chamber, polluted water ponds and percolates through a radial media filter cartridge. Treated water collects in the cartridge's center tube where it is directed by an under-drain manifold to the outlet pipe on the downstream side of the overflow weir. When flow rates exceed the water quality design value, excess water spills across the overflow weir, bypassing the cartridge bay and proceed directly to the outlet pipe. This integrated offline bypass ensures pollutants captured in the filtration bay are not washed downstream during peak flow events.



**Liner Grate StormFilter**

### Grated Inlet Openings

The number of inlet grates and the size of the inlet bay are designed to capture the peak flow rates from the drainage area. The remaining area is devoted to the filtration bay and the outlet bay which are covered with removable plates for access during maintenance. The entire inlet bay, filtration bay, and outlet bay can be opened at one time allowing full access. In many cases, due to the shallow nature of the design, confined space entry is not required for maintenance.

### Linear StormFilter

The Linear StormFilter consists of one or two precast concrete channels that are 10' or 20' in length and 2' 9" in width.

The Linear StormFilter is installed flush with the finished grade, functioning similar to a catch basin or trench drain. The top of the unit has either covers or doors for easy access. The Linear StormFilter is typically installed online like the precast StormFilter.

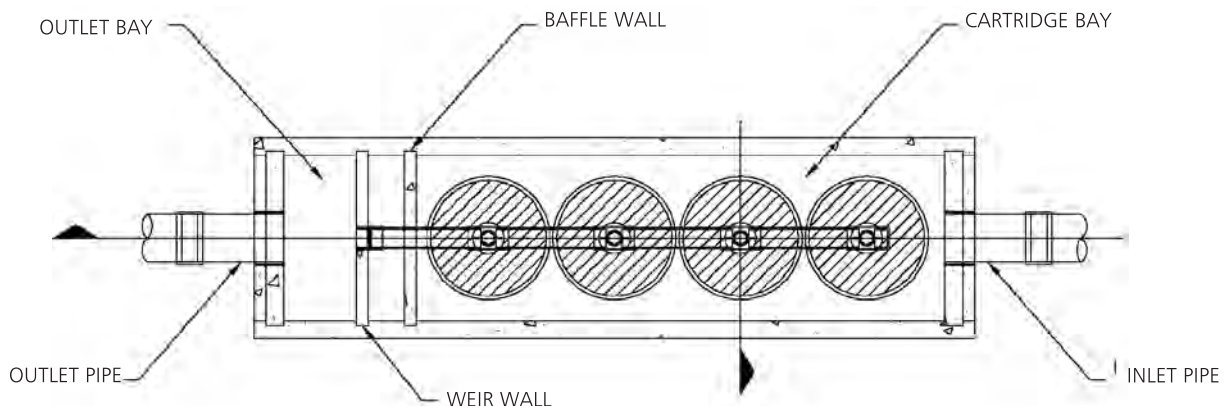
The Linear StormFilter unit treats water quality design flows up to 0.27 cfs.

### Basic Operation

The Linear StormFilter can be installed either as the primary receiver of runoff, similar to a grated catch basin, or with an inlet stub and doors to receive runoff collected upstream.

The system is equipped with an internal overflow weir to ensure that there is no local flooding for storm events in excess of the design treatment flow. Maintenance costs for the unit are typically less because there are no confined space entry requirements, and access is quick and easy.

The Linear StormFilter is particularly useful where small flows are being treated or where the site is very flat and there is little available hydraulic head to spare.



**Linear StormFilter**

# Infiltration Configuration

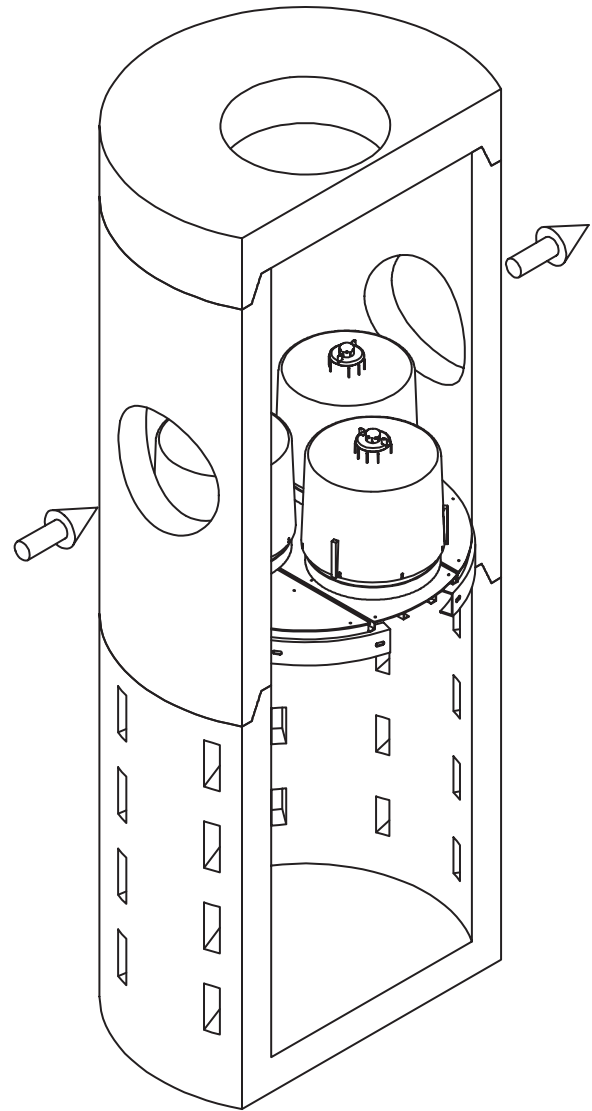
## Dry Well StormFilter

The Dry Well StormFilter provides treatment, infiltration and groundwater protection in a single structure. The system is designed to treat conveyed flow or sheet flow from small drainages. Multiple units can be installed to treat any size site. Because it provides treatment and infiltration in a single unit, the total number of structures and the amount of pipe required for the stormwater system are reduced.

The Dry Well StormFilter system is available in 48", 60" and 72-" pre-cast manhole top sections that are designed to be stacked on top of dry well infiltration risers. The StormFilter portion of the unit arrives fully assembled and ready to install, including an integrated concrete deck for the StormFilter cartridges. The system can also be retrofitted into existing 48" manhole dry wells.

### Basic Operation

Stormwater enters the dry well unit through one or more entry pipes or channels at its top. It then percolates through the media in the StormFilter cartridge to the center tube. Treated water in the cartridge center tube is discharged to the infiltration section below, and then infiltrates into the surrounding soils through a number of small exit openings at the sides and bottom.



**DryWell StormFilter**

# Roof Runoff Treatment Configuration

## Downspout StormFilter

The Downspout StormFilter is an aboveground configuration that can be easily integrated into existing gutter systems to eliminate pollution from rooftop runoff. It typically occupies 2.5'x 5' footprint, and can fit most downspout configurations and sizes. Each unit holds two StormFilter cartridges, and single- and dual-stage options are available. It treats up to 14,000 square feet of rooftop area per dual-cartridge system.

## StormFilter Cartridges

There are three cartridge heights available for StormFilter systems: 27", 18", and Low Drop. The most economical is the 27" tall cartridge. It can treat the highest flow rate per cartridge, which creates the smallest system with the lowest installed cost. The 27" cartridge requires 3.05' of driving head to operate. For sites with less driving head available, the 18" cartridge is the next best option. Lower flow rates per cartridge increase the footprint of the overall system but only 2.3' of driving head is required. For sites with very limited drop, the Low Drop cartridge only requires 1.8" of driving head.

**Cartridge Flow Rates**

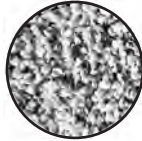
Cartridge Type	Hydraulic Drop	Treatment Capacity (gpm)	
		1 gpm/ft <sup>2</sup>	2 gpm/ft <sup>2</sup>
StormFilter 27"	3.05'	11.25	22.5
StormFilter 18"	2.30'	7.5	15
StormFilter Low Drop	1.80'	5	10

## StormFilter Media

The removal of site-specific pollutants can be maximized with the variety of filtration media available. In many cases, different media types can be combined so as to target a wide spectrum of pollutants. This ability to combine and use various media types allows the system to be easily adjusted to meet ever-changing site conditions and increasingly stringent regulatory requirements.

### PhosphoSorb™

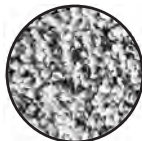
PhosphoSorb, a lightweight media comprised of Perlite (a heat-expanded volcanic rock) and activated alumina, removes total phosphorus (TP) by adsorbing dissolved-P and filtering particulate-P simultaneously. The Perlite provides the capability to remove suspended solids while the activated alumina adsorbs soluble phosphorus adsorption.



PhosphoSorb is composed of a slightly finer media gradation than the field proven ZPG™ (Zeolite, Perlite, Granular Activated Carbon) media and will provide equivalent - or even better - removal of suspended solids. Initial field tests have indicated an increase in the TSS removal efficiency up to 10% over the field-proven ZPG media. The StormFilter with ZPG media has already received a General Use Level Designation for basic treatment in the State of Washington.

### Perlite

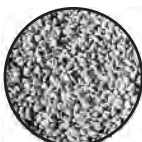
Perlite is a natural, volcanic ash, similar in composition to glass and similar in appearance to pumice. To use perlite as a filter medium, it must first go through a heating process to yield a lightweight, multicellular, expanded form. This expanded form has a coarse texture, very low-density, high surface area, and stable, inert chemistry, all of which make perlite an excellent physical filtration medium.



Perlite has proven to be our media of choice for sediment and oil removal. The multicellular nature of expanded perlite is the key to its excellent ability to trap sediments and adsorb oil. The coarse texture of the expanded perlite creates a bed of material with a very high porosity, which allows perlite to have the highest sediment and oil storage capacity of all of the available media options.

### Zeolite

The term zeolite defines a family of both natural and synthetic, hydrous aluminosilicate materials with a highly porous mineral matrix that holds light, alkali metal cations (ideally sodium ions).



Zeolite has the ability to use a cation exchange reaction that removes other cations such as zinc, copper, lead, and ammonia from water. In the cation exchange reaction, the light metal cations in the zeolite matrix are displaced by the heavier metal cations, such as copper, in the water.

The zeolite used in our system is clinoptilolite, which has a cation exchange capacity (CEC) of approximately 100 to 220 meq/100 g. Clinoptilolite has inert characteristics that make it an excellent metals removal media option when CSF media cannot be used. It can be combined with other media such as GAC and perlite when metals are not of exclusive concern.

### CSF® Leaf Media

CSF Leaf Media is a patented filtration media composed of composted deciduous leaves originating from the City of Portland, Oregon. CONTECH Stormwater Solutions purchases the mature, stable, deciduous leaf compost and then processes it into an odorless, pelletized compost product with physical and chemical characteristics desirable for stormwater filtration.



The patented compost process creates a material with excellent flow-through characteristics and stability in water. Not only do CSF Leaf Media consist of 100% recycled, all natural materials, but it also provides good removal of sediments and excellent removal of a wide range of toxic contaminants.

CSF Leaf Media provides the multitude of beneficial water treatment properties typical of soil in a form that is compatible with the compact, modular, media-based design of the StormFilter system. In addition to the physical filtration provided by the granular nature of the CSF Leaf Media, the complex chemistry of the compost also provides chemical filtration as well.

Sediment and total nutrients are removed through physical filtration. Oil, complexed metals, and anthropogenic organic contaminants such as herbicides and pesticides are removed through adsorption, the physical partitioning of organic compounds, such as pesticides, to carbon-rich materials, such as the compost.

Soluble metals are removed by cation exchange, as well as by complexation of metal ions to the organic chelating agents present in compost. CSF Leaf Media is an excellent, cost-effective, all-purpose media that epitomizes the potential value of recycled materials.

### GAC

GAC (Granular Activated Carbon) is a widely accepted water filtration media used for the removal of organic compounds. It consists of pure carbon (originating from coal or charcoal) whose micro-porous structure has been enhanced through steam or acid "activation."



The high carbon content and porous nature of GAC accounts for its excellent ability to remove organic compounds through adsorption. Since adsorption is the physical partitioning of organic compounds to high carbon surfaces, the "activation" of the carbon (which creates GAC) endows it with an enormous surface area upon which adsorption can take place.

In situations where anthropogenic organic contaminants are of exclusive concern, GAC media provide the highest level of stormwater treatment compared to other available media options. However, because it is not very often the case that anthropogenic organic contaminants are of exclusive concern, GAC is usually combined with another media such as perlite or zeolite for the treatment of additional contaminants.

Combination of GAC with perlite constitutes the most cost-effective configuration, as the effectiveness of GAC is drastically reduced if it is coated with high concentrations of heavy oil or sediment, which can restrict access via surface pores to the interior of the GAC granules.

### ZPG™ (Zeolite, Perlite, GAC blend)

This proprietary blend of zeolite, perlite, and granular activated carbon media is used to provide an alternative for CSF media for installations where leaf media cannot be used.



## Laboratory and Field Testing

The StormFilter system is designed to meet the most stringent regulatory requirements. The field-proven performance of the StormFilter has led to hundreds of regulatory agency approvals nationwide as a standalone BMP.

The Stormwater Management StormFilter® is the first manufactured BMP to receive stand-alone approval through field testing and satisfying the total suspended solids treatment requirements in Washington and New Jersey.

Log on to [www.contechstormwater.com/stormfilter](http://www.contechstormwater.com/stormfilter) to view the following reports in full.

## Field Monitoring Reports

Field Proven Performance of the StormFilter using the Technology Assessment Protocol - Ecology (TAPE) and Technology Acceptance Reciprocity Partnership (TARP) Tier II Protocol

1. Washington
  - a. Washington State Department of Ecology General Use Level Designation for Basic Treatment
  - b. Technical Evaluator Engineering Report (TEER). Gary Minton, Ph.D., P.E.
2. New Jersey
  - a. New Jersey State Department of Environmental Protection Final Certification
  - b. New Jersey Corporation for Advanced Technology (NJCAT) Field Verification Report

## Laboratory Reports

### ***Total Suspended Solids (TSS) Removal Using Different Particle Size Distributions with the Stormwater Management StormFilter.***

#### ***Influences on TSS removal efficiency***

Influence of analytical method, data summarization method, and particle size on total suspended solids (TSS) removal efficiency of the StormFilter

#### ***StormFilter removal efficiency with coarse/fine perlite media***

Evaluation of the removal of silt loam TSS using coarse/fine perlite at 28 L/min (7.5 gpm).

#### ***StormFilter removal efficiency with ZPG media***

Evaluation of the removal of SIL-CO-SIL 106 using ZPG media at 28 L/min (7.5 gpm)

#### ***StormFilter removal efficiency with coarse perlite***

Evaluation of the removal of sandy loam TSS using coarse perlite at 57 L/min (15 gpm)

#### Support

- Drawings and specifications are available at [www.contechstormwater.com](http://www.contechstormwater.com).
- Site-specific design support is available from our engineers.

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