CONCRETE DRY FILTER BOX

DROP-IN SPECIFICATION

November 2022

The following specification is a sample guideline to be customized by the engineer as needed for preparing a site-specific specification. This information is provided for reference purposes only and is not intended as a warranty or guarantee.

DROP-IN SPECIFICATION

CONCRETE DRY FILTER BOX FOR SURFACE BMPS

1. AUTHORIZED PRODUCTS
   1.1. The concrete dry filter box shall be a Rain Guardian Turret Pretreatment Chamber (U.S. Patent Nos. 8,501,016 and 8,858,804).

2. AUTHORIZED SUPPLIERS
   2.1. Minnesota, Alaska, and Hawaii
      2.1.1. Anoka Conservation District
      1318 McKay Dr. NE, Suite 300
      Ham Lake, MN 55304
      (763) 434-2030 ext. 15
      AnokaSWCD.org | RainGuardian.biz
   2.2. Wisconsin
      2.2.1. Anoka Conservation District
      1318 McKay Dr. NE, Suite 300
      Ham Lake, MN 55304
      (763) 434-2030 ext. 15
      AnokaSWCD.org | RainGuardian.biz
      2.2.2. Ferguson Enterprises, LLC doing business as Ferguson Waterworks
      12500 Jefferson Avenue
      Newport News, VA 23602
   2.3. Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, and Wyoming
      2.3.1. Ferguson Enterprises, LLC doing business as Ferguson Waterworks
      12500 Jefferson Avenue
      Newport News, VA 23602

3. AUTHORIZED MANUFACTURERS
   3.1. Stoneworks Architectural Precast/Cast Stone
   11555 205th Ave. NW
   Elk River, MN 55330
   (763) 633-2200
   stoneworksap.com

4. INTRODUCTION
   4.1. Scope
      4.1.1. This specification details requirements for proper design, installation, and maintenance of a concrete dry filter box for surface stormwater best management practices (BMP).

4.2. Product Summary

4.2.1. A concrete dry filter box is a pretreatment structure installed at grade with a curb-cut or curb inlet opening that allows water to enter a high performance modular biofiltration system, bioretention, rain garden, bioswale, or similar stormwater BMP.

4.2.2. The box provides a stable inlet, reduces runoff velocities, and captures gross pollutants; therefore, simplifying the recurring sediment removal and surface erosion common with turf, rip rap, or smooth concrete inlet aprons.

4.2.3. Capturing sediment within the box helps extend the life of a downstream primary treatment BMP by reducing the sediment load and internal scour/erosion.

4.2.4. Concrete dry filter boxes can be installed on both new and existing projects where there are concerns about inlet stability and/or maintenance issues.

5. SPECIFICATIONS

5.1. Functional components of the concrete dry filter box must include the components listed below and meet the standards in Table 1.

5.1.1. Top grate

5.1.1.1. Top grate mechanically separates larger debris pieces (e.g. leaf litter and garbage) from stormwater runoff, thereby increasing storage space for sediment and finer debris within the unit. In addition, the top grate of the box must minimally support pedestrian foot traffic loads due to frequent positioning in the road right-of-way.

5.1.2. Impermeable side walls

5.1.2.1. Impermeable side walls which, when connected to a water permeable filter sidewall, create a debris and sediment trap. Chamber therefore allows heavier solids to settle and collect in an easy to clean location. The side walls also contain flow, thereby preventing inlet erosion.

5.1.3. Water permeable filter sidewall

5.1.3.1. The water permeable filter sidewall is independently connected to the impermeable side walls. The permeable filter allows for the box to dry out between runoff events, easing maintenance by preventing the need to remove sediment/debris in a slurry state. It also prevents anoxic conditions and habitat for mosquito reproduction.

5.1.4. Impermeable debris walls

5.1.4.1. Impermeable debris walls capture floatables when BMP is filled to capacity (e.g. leaf litter and seeds) and prevent transfer of floatables between the inlet and BMP.

5.1.5. High volume overflow points

5.1.5.1. The concrete dry filter box must provide for high volume overflow during large storm events such that water within the structure does not overtop the sidewalls, which would reduce the box's ability to retain floatables and maintain a stable inlet. The overflow points also ensure stormwater will not bypass the BMP until it reaches capacity.

5.1.6. Splash pad

5.1.6.1. The box should include a splash pad downstream of the principal (permeable filter wall) and emergency overflow (concrete weir) points to reduce scouring below the box (i.e. within the aggregate base and BMP soil).

5.1.7. All components must be easy to clean without specialized equipment.

Table 1: Concrete dry filter box standards.

PROPERTY OF BOX INLET STRUCTURE	VALUE OR METHOD
Steel reinforced, cold joint secured monolithic concrete structure, weight	1,030 lbs.
Concrete minimum compressive strength	4,500 psi at 28 days
Concrete air entrained	5-8.5% by volume
Manufactured and designed standard	ASTM C858
Standard exterior dimensions	46” x 50” base, 19.5” total height

6. DELIVERY, STORAGE, AND HANDLING

6.1. Delivery

6.1.1. Delivery of a concrete dry filter box must be from an authorized supplier.

6.1.2. Reasonable accommodations should be made to protect all materials from damage during delivery. Shipments should be inspected upon arrival to insure no damage occurred during transportation. Any damage found after delivery will be the responsibility of the contractor.

6.2. Storage and Handling

6.2.1. Storage prior to installation should occur on smooth surfaces, free from dirt, mud, and debris. Boxes are designed to persist in all seasons so temperature and precipitation should not be a problem.

7. INSTALLATION

7.1. A concrete dry filter box should rest on a level, solid base to prevent settling. A well-draining aggregate base material (minimum 6” thickness) should be compacted to 95% percent standard proctor. The aggregate base should have a surface area equal to or larger than the concrete dry filter box base.

7.2. The aggregate base location and distance behind the curb depends on site considerations but considerations should include bioretention basin side slopes and inlet slope to promote water flow into the unit.

7.3. The filter box must include a 4” base to provide a firm foundation for the chamber structure and to supply a splash pad for water entering the unit.

7.4. Excavation at the unit installation location should ensure sufficient depth for the 6” aggregate base, concrete dry filter box base, and ponding depth of the bioretention practice. For example, if the ponding depth of the basin is designed to be 1’ and the concrete dry filter box base is 4”, then soil should be excavated to 1’-10” (1’ ponding depth, 6” aggregate base, 4” filter box base).

7.5. Stormwater is most commonly directed into the box via a curb-cut or concrete inlet. Said inlet should be framed from the back of the curb to the unit inlet prior

to pouring. Top elevations of the framing should match the top of the curb on the street side and the top of the filter box on the bioretention side. Expansion joint material should be used between the concrete curb and concrete dry filter box.

7.6. Side curbs of the poured inlet must have an insurmountable profile to prevent water flow from overtopping the downstream side of the inlet.

7.7. The slope of the inlet from the gutter to the filter box must be large enough to promote the inflow of water to the filter box.

8. OPERATION

8.1. Items below assume proper installation of the concrete dry filter box based on design guidelines.

8.1.1. Stormwater entering the box via a curb-cut or concrete inlet must pass through the top grate. The grate provides for mechanical sorting of larger debris such as leaves and garbage.

8.1.2. Once in the box, the vertical, permeable filter wall allows for settling within the box and filtration of stormwater through the permeable filter screen. Should the filter screen clog or the unit fill, maintenance will be required.

8.1.3. As the box and BMP fill, the water level rises and the top debris walls of the box restrict floatable debris from entering or exiting the BMP.

8.1.4. Cold climate suitability

8.1.4.1. During winter, concrete dry filter boxes will likely become buried in snow and ice which is no different from any other inlet type. Runoff will likely continue to enter the box beneath the snow or when an open pathway is formed during snowmelt. When properly designed and installed, concrete dry filter boxes will not shift or separate from the inlet as the ground freezes and thaws.

9. MAINTENANCE

9.1. Depending on the characteristics of the contributing watershed and seasonal variation, common maintenance needs include periodic removal of accumulated leaves (and other organic debris) and garbage from the top grate and sediment and fine debris from the concrete dry filter box. Contributing watersheds with high sediment concentrations may require up to monthly or twice monthly visits to satisfy maintenance needs.

9.2. If sediment accumulates beyond an acceptable level in the system, it will be necessary to remove. This can be done by manual removal with a shovel or vacuum device. The filter screen can be cleaned manually through brushing or with pressurized water.

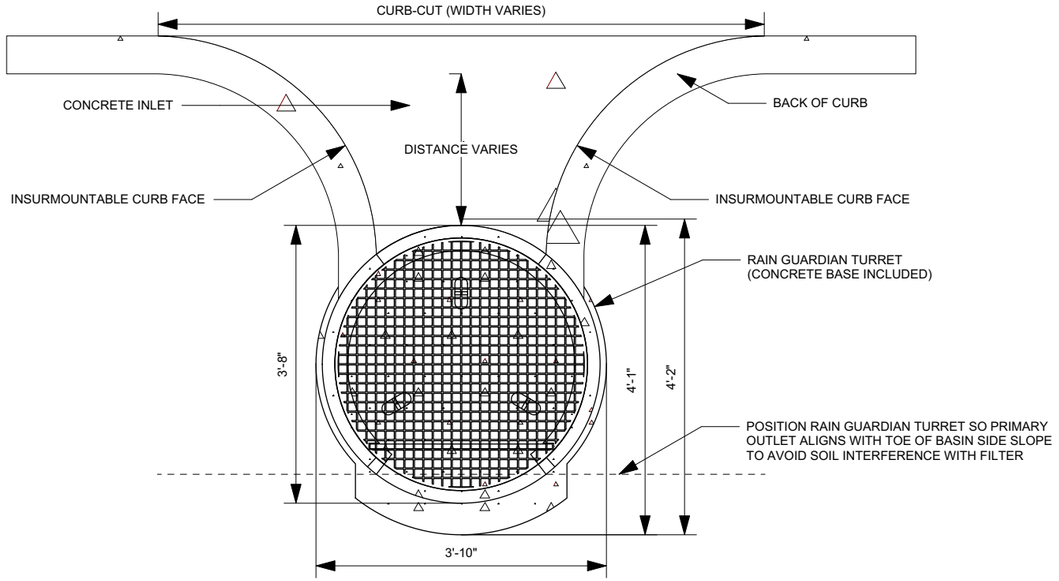
10. PAYMENT

10.1. Payment of concrete dry filter boxes shall be based on a per unit price and may or may not include delivery of the box to the project site. The contractor is responsible for determining the style of box needed and total cost (including delivery fees, handling fees, and any associated taxes).

RAIN GUARDIAN™ TURRET

TYPICAL DETAIL

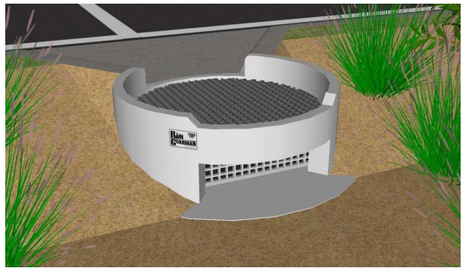
PLAN VIEW



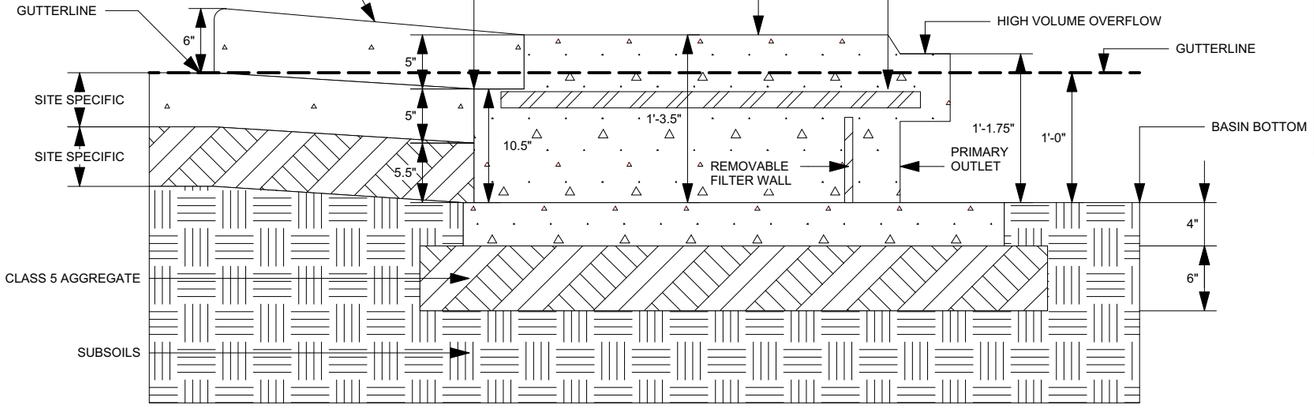
PLAN VIEW NOTES

1. INLET WIDTH AND DISTANCE BETWEEN BACK OF CURB AND RAIN GUARDIAN TURRET MAY VARY WITH SITE CONDITIONS.
2. CONCRETE BASE EXTENDS BEYOND THE FILTER WALL OF THE RAIN GUARDIAN TURRET TO SERVE AS A SPLASH DISSIPATOR.

3D VIEWS



ELEVATION VIEW



ELEVATION VIEW NOTES

1. THE TOP OF THE CLASS 5 BASE (COMPACTED TO 95% STANDARD PROCTOR) IS PRECISELY 1' 4" BELOW THE GUTTERLINE ELEVATION.

SPECIFICATIONS

1. STEEL REINFORCED, COLD JOINT SECURED MONOLITHIC CONCRETE STRUCTURE (1,030 LBS). CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,500 PSI AT 28 DAYS. CONCRETE AIR ENTRAINED (5% TO 8.5% BY VOLUME). MANUFACTURED AND DESIGNED TO ASTM C858.

2. THREE-POINT PICK USING RECESSED LIFTING POCKETS WITH A STANDARD HOOK.

3. FIBERGLASS TOP GRATE (32 LBS, 1-1/2" THICK) - 1,760 LB CONCENTRATED LOAD OR 409 LB/SQ-FT UNIFORM LOAD.

INSTALLATION NOTES

1. INSTALL THE CLASS 5 BASE (COMPACTED TO 95% STANDARD PROCTOR). THE DISTANCE FROM THE BACK OF THE CURB MAY VARY BASED ON SITE CONDITIONS, BUT CONSIDERATIONS SHOULD INCLUDE SLOPE OF THE INLET AND BASIN SIDE SLOPES ADJACENT TO THE RAIN GUARDIAN TURRET. POSITION RAIN GUARDIAN TURRET SO PRIMARY OUTLET ALIGNS WITH TOE OF BASIN SIDE SLOPE TO AVOID SOIL INTERFERENCE WITH REMOVABLE FILTER WALL. EXCAVATE 1' 10" BELOW THE GUTTERLINE ELEVATION (I.E. THE BIORETENTION OVERFLOW ELEVATION) TO ACCOMMODATE THE 1' PONDING DEPTH, 6" CLASS 5 AGGREGATE, AND 4" RAIN GUARDIAN TURRET BASE (INCLUDED). THEREFORE, THE TOP OF THE CLASS 5 COMPACTED BASE IS PRECISELY 1' 4" BELOW THE GUTTERLINE ELEVATION. THE INLET TO THE RAIN GUARDIAN TURRET WILL BE 10-1/2" ABOVE THE TOP OF THE CONCRETE BASE AND 1-1/2" BELOW THE GUTTERLINE ELEVATION TO ACCOMMODATE A SLOPED INLET FROM THE GUTTER TO THE RAIN GUARDIAN TURRET.

2. SET RAIN GUARDIAN TURRET ON THE PREPARED CLASS 5 BASE.

3. INSTALL FRAMING FOR INLET BETWEEN RAIN GUARDIAN TURRET AND BACK OF CURB. TOP ELEVATIONS OF THE FRAMING SHOULD MATCH THE TOP OF THE CURB ON THE STREET SIDE AND THE TOP OF THE RAIN GUARDIAN TURRET ON THE BIORETENTION SIDE.

4. INSTALL EXPANSION/CONTRACTION JOINT MATERIAL OR A SHEET OF POLY TO SERVE AS A BOND BREAK BETWEEN RAIN GUARDIAN TURRET AND CONCRETE INLET BEFORE POURING INLET.

5. SIDE CURBS OF THE POURED INLET MUST HAVE AN INSURMOUNTABLE PROFILE TO PREVENT WATER FLOW FROM OVERTOPPING THE DOWNSTREAM SIDE OF THE INLET.

6. REMOVABLE FILTER WALL SHOULD BE INSTALLED WITH FILTER FABRIC ON THE INTERIOR SIDE OF THE RAIN GUARDIAN TURRET.

RAIN GUARDIAN
U.S. PATENT NOS. 8,501,016 AND 8,858,804
PRETREATMENT FOR BIORETENTION
Rain Gardens • Swales • Filtration Basins • Infiltration Basins
www.RainGuardian.biz

RAIN GUARDIAN TURRET
PRETREATMENT CHAMBER
BIORETENTION PONDING DEPTH: 1'
TYPICAL DETAIL

REVISION HISTORY

REV	BY	DATE	DESCRIPTION
A	MDH	11/16/2022	TURRET - 1'
SCALE		VARIABLE	
U.S. PATENT NOS.		8,501,016 AND 8,858,804	

DEVELOPED BY:
ANOKA CONSERVATION DISTRICT

MANUFACTURED BY:
Stoneworks
ARCHITECTURAL PRECAST / CAST STONE
NATIONAL PRECAST CONCRETE ASSOCIATION
CERTIFIED PLANT