CONCRETE AND METAL 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 AND METAL DRY FILTER BOX FOR SURFACE BMPS

1. AUTHORIZED PRODUCTS
   1.1. The concrete and metal dry filter box shall be a Rain Guardian Fortress 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 and metal dry filter box for surface stormwater best management practices (BMP).

4.2. Product Summary

4.2.1. A concrete and metal 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. A concrete and metal dry filter box 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 and metal dry filter box must include the components listed below and meet the standards in Table 1.

5.1.1. Internal grate

5.1.1.1. Internal 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 internal grate of the box must minimally support pedestrian foot traffic loads due to frequent positioning in the road right-of-way and to accommodate maintenance.

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 and metal 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) overflow point to reduce scouring below the box (i.e. within the aggregate base and BMP soil).

5.1.7. Top lid

5.1.7.1. Each box shall have a top lid with specifications shown in Table 1.

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

Table 1: Concrete and metal dry filter box standards.

PROPERTIES OF BOX INLET STRUCTURE	VALUE OR METHOD
Steel reinforced, cold joint secured monolithic concrete structure	3.26 CF concrete, 499 lbs, 1.36 CF storage volume
Concrete minimum compressive strength	4,500 psi at 28 days
Concrete air entrained	5-8.5% by volume
Concrete manufactured and designed standard	ASTM C858
Steel face plate, inlet	A36, galvanized, ¼" thickness
Steel face plate, outlet	A36, galvanized, ¼" thickness
Internal steel grate	19-W-4 galvanized steel grate, 39.5" x 16.75" x 1", 25 lbs, 361 lb concentrated load or 206 lb/sq-ft uniform load
Top lid, steel grate	19-W-4 galvanized steel grate, 43.5" x 16.75" x 1", 27 lbs, 361 lb concentrated load or 206 lb/sq-ft uniform load
Filter assembly	Fiberglass grid with filter and anodized aluminum frame, 38" x 4-7/8" x ¾"
Standard exterior dimensions	48" x 17.75" base, 19" total height

6. DELIVERY, STORAGE, AND HANDLING

6.1. Delivery

6.1.1. Delivery of a concrete and metal 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 ensure 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 and metal 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 and metal 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 and metal dry filter box base, and ponding depth of the bioretention practice. For example, if the ponding depth of the basin is designed to be 9” and the concrete and metal dry filter box base is 4”, then soil should be excavated to 1’-7” (9” 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 and metal 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.

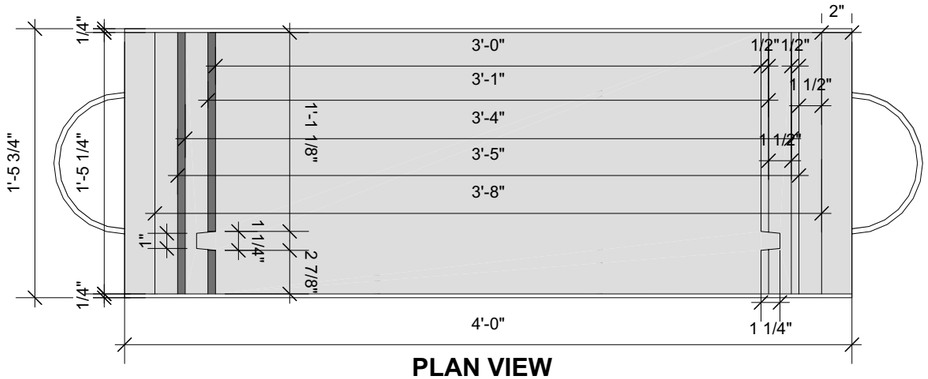
8. OPERATION
   8.1. Items below assume proper installation of the concrete and metal dry filter box based on design guidelines.
      8.1.1. Stormwater entering the box via a curb-cut or concrete inlet must pass through the internal grate. The grate provides for mechanical sorting of larger debris such 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 and metal 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 and metal 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 internal grate and sediment and fine debris from the concrete and metal 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.

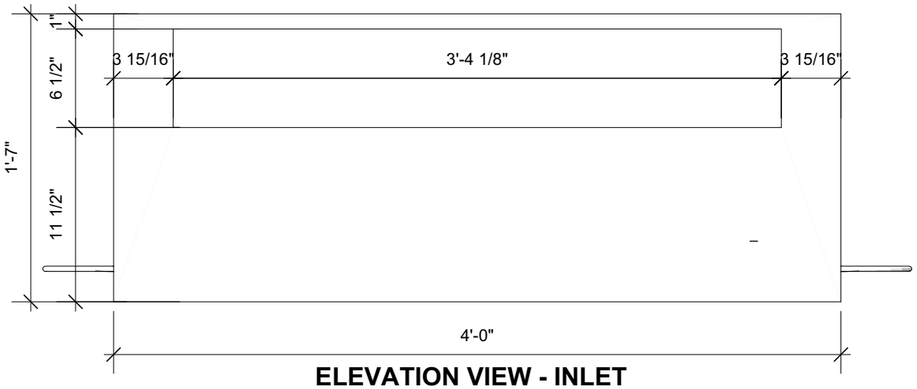
10. PAYMENT
    10.1. Payment for a concrete and metal dry filter box shall be based on a per unit price and may or may not include delivery of the box to the project site. The contractor is responsible for determining the style of box needed and total cost (including delivery fees, handling fees, and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

RAIN GUARDIAN™ FORTRESS

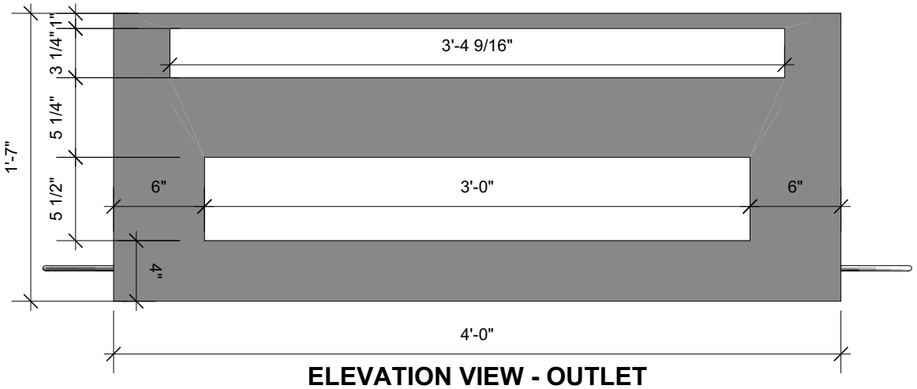
TYPICAL DETAIL



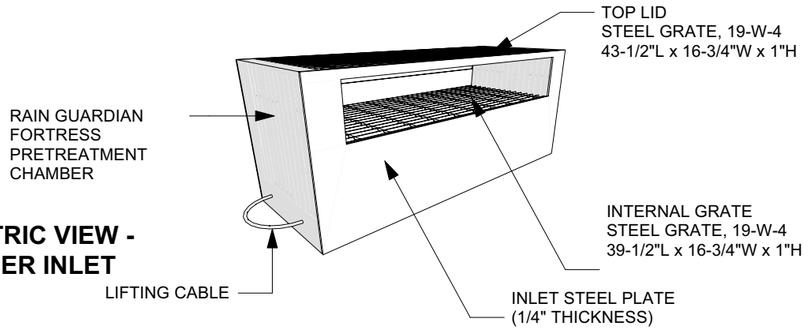
PLAN VIEW



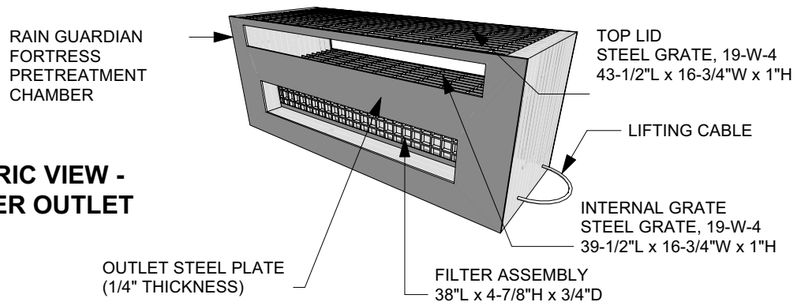
ELEVATION VIEW - INLET



ELEVATION VIEW - OUTLET



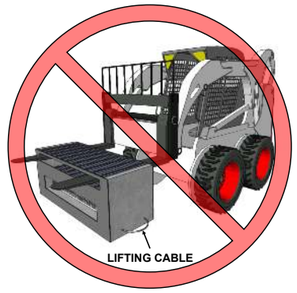
ISOMETRIC VIEW - CHAMBER INLET



ISOMETRIC VIEW - CHAMBER OUTLET

HANDLING INSTRUCTIONS

DO NOT LIFT FORTRESS BY METAL FACE PLATES



LIFT ONLY BY CABLES WITH SPREADER BAR

SPECIFICATIONS

1. STEEL REINFORCED, COLD JOINT SECURED MONOLITHIC CONCRETE STRUCTURE (3.26 CF CONCRETE, 499 LBS, 1.36 CF STORAGE VOLUME), 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. TWO-POINT PICK (EMBEDDED LIFTING CABLES)
3. INTERNAL GRATE - STEEL GRATE (25 LBS/PIECE, 1" THICK), 361 LB CONCENTRATED LOAD OR 206 LB/SQ-FT UNIFORM LOAD
4. TOP LID - STEEL GRATE (27 LBS/PIECE, 1" THICK), 361 LB CONCENTRATED LOAD OR 206 LB/SQ-FT UNIFORM LOAD
5. STEEL FACE PLATE (INLET AND OUTLET) - A36 1/4" THICKNESS
6. REMOVABLE FILTER ASSEMBLY (FIBERGLASS GRATE WITH FILTER AND ALUMINUM CHANNEL)

INSTALLATION NOTES

1. EXCAVATE AN AREA WITH DIMENSIONS OF AT LEAST 4'-6"L X 2'-0"W FOR THE RAIN GUARDIAN. 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. POSITION RAIN GUARDIAN SO PRIMARY OUTLET ALIGNS WITH TOE OF BASIN SIDE SLOPE TO AVOID SOIL INTERFERENCE WITH REMOVABLE FILTER WALL. THE EXCAVATION DEPTH SHOULD BE 1'-7" BELOW THE GUTTERLINE ELEVATION AT THE RAIN GARDEN INLET TO ACCOMMODATE THE 6" AGGREGATE BASE, 4" RAIN GUARDIAN BASE, AND 9" PONDING DEPTH.
2. INSTALL AN AGGREGATE BASE, COMPACTED TO 95% STANDARD PROCTOR, WITH DIMENSIONS OF AT LEAST 4'-6"L X 2'-0"W X 6"D. FINISHED TOP ELEVATION OF AGGREGATE TO BE PRECISELY 1'-1" BELOW THE GUTTER LINE ELEVATION AT THE RAIN GARDEN INLET.
3. SET RAIN GUARDIAN ON THE PREPARED AGGREGATE BASE. THE RAIN GUARDIAN INLET WILL BE 1-1/2" BELOW THE GUTTERLINE ELEVATION TO ACCOMMODATE A SLOPED INLET FROM THE GUTTER TO THE RAIN GUARDIAN.
4. INSTALL FRAMING FOR INLET BETWEEN RAIN GUARDIAN 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 ON THE BIORETENTION SIDE.
5. INSTALL EXPANSION/CONTRACTION JOINT MATERIAL OR A SHEET OF POLY TO SERVE AS A BOND BREAK BETWEEN RAIN GUARDIAN AND CONCRETE INLET BEFORE POURING INLET.
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. INSTALL REMOVABLE FILTER. THE FILTER SHOULD BE INSTALLED IN THE CHANNEL AT THE RAIN GUARDIAN OUTLET WITH THE FILTER FABRIC FACING THE RAIN GUARDIAN INLET.
8. INSTALL INTERNAL GRATE AND THEN TOP LID.

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 FORTRESS PRETREATMENT CHAMBER BIORETENTION PONDING DEPTH: 9" TYPICAL DETAIL

REVISION HISTORY

REV	BY	DATE	DESCRIPTION
A	MDH	11/16/22	FORTRESS
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