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# **MODULAR CONCRETE DRY FILTER BOX DROP-IN SPECIFICATION**

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*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**  
**MODULAR CONCRETE DRY FILTER BOX FOR SURFACE BMPS**

1. AUTHORIZED PRODUCTS

1.1. The modular concrete dry filter box shall be a Rain Guardian Foxhole 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 205<sup>th</sup> 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 modular concrete dry filter box for surface stormwater best management practices (BMP).

## 4.2. Product Summary

- 4.2.1. A modular 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 modularity of the box (i.e. inlet, middle, and outlet sections) allows for variable box lengths to span desired distances.
- 4.2.3. The box includes a removable, load-bearing lid that allows nearby surface elevations (e.g. sidewalk, trail, or boulevard) to be maintained.
- 4.2.4. 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.
- 4.2.5. Capturing sediment within the box helps extend the life of a downstream primary treatment BMP by reducing the sediment load and internal scour/erosion.
- 4.2.6. Modular 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 modular 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 for maintenance purposes.

### 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 modular 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. Top lid
  - 5.1.7.1. Each inlet/outlet combination and each middle section shall have a fiber reinforced plastic (FRP) composite lid with concentrated load capacity of 11,200 lbs.
- 5.1.8. All components must be easy to clean without specialized equipment.

Table 1: Modular concrete dry filter box standards.

MODULAR SECTION	PROPERTY OF STRUCTURE(S)	VALUE OR METHOD
Inlet, Middle, and Outlet	Steel reinforced, cold joint secured monolithic concrete structure, weight and standard exterior dimensions	INLET - 875 lbs. 2'-8.25"L x 2'-11"W x 1'-7"H  MIDDLE - 965 lbs. 3'-0.5"L x 2'-11"W x 1'-7"H  OUTLET - 730 lbs. 2'-6"L x 2'-11"W x 1'-7"H
Inlet, Middle, and Outlet	Concrete minimum compressive strength	4,500 psi at 28 days
Inlet, Middle, and Outlet	Concrete air entrained	5-8.5% by volume
Inlet, Middle, and Outlet	Manufactured and designed standard	ASTM C858

## 6. DELIVERY, STORAGE, AND HANDLING

### 6.1. Delivery

6.1.1. Delivery of a modular 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 modular 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 modular 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 monolithic box sections (i.e. inlet, middle, and outlet) include a 4" concrete base to provide a 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, modular 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 9" and the modular concrete 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. Set inlet first, followed by middle section(s), and finally the outlet on the prepared aggregate base. Position outlet piece so primary outlet aligns with toe of basin side slope to avoid soil interference with removable filter wall.
- 7.6. Secure modular pieces at each joint using provided galvanized tie rods.
- 7.7. Install water permeable filter, top grate(s), and top lid(s).
- 7.8. 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 at the inlet to the box. Expansion joint material should be used between the concrete curb and modular concrete dry filter box.
- 7.9. Side curbs of the poured inlet must have an insurmountable profile to prevent water flow from overtopping the downstream side of the inlet.
- 7.10. 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 modular 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, modular 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, modular 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 modular 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

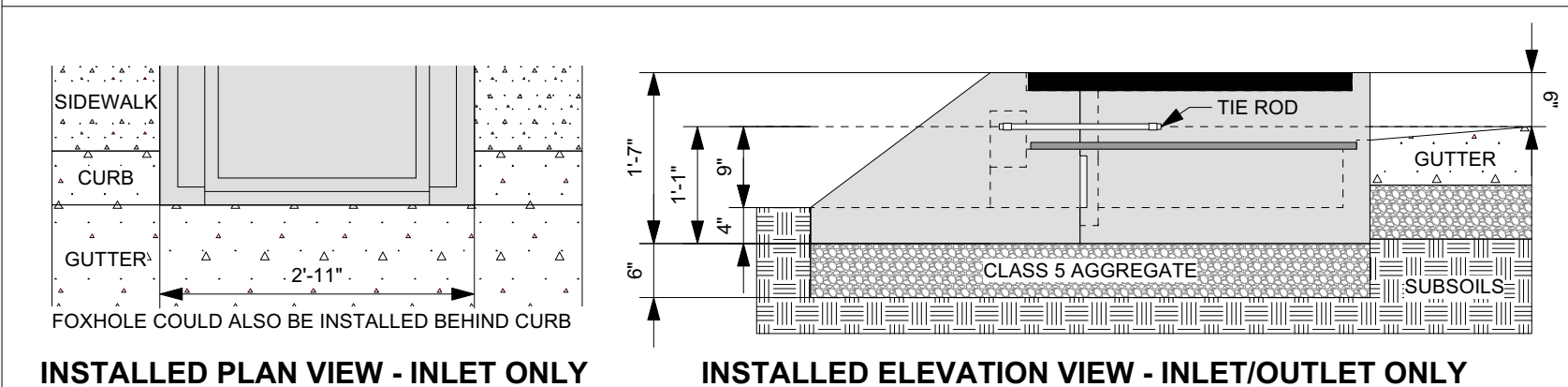
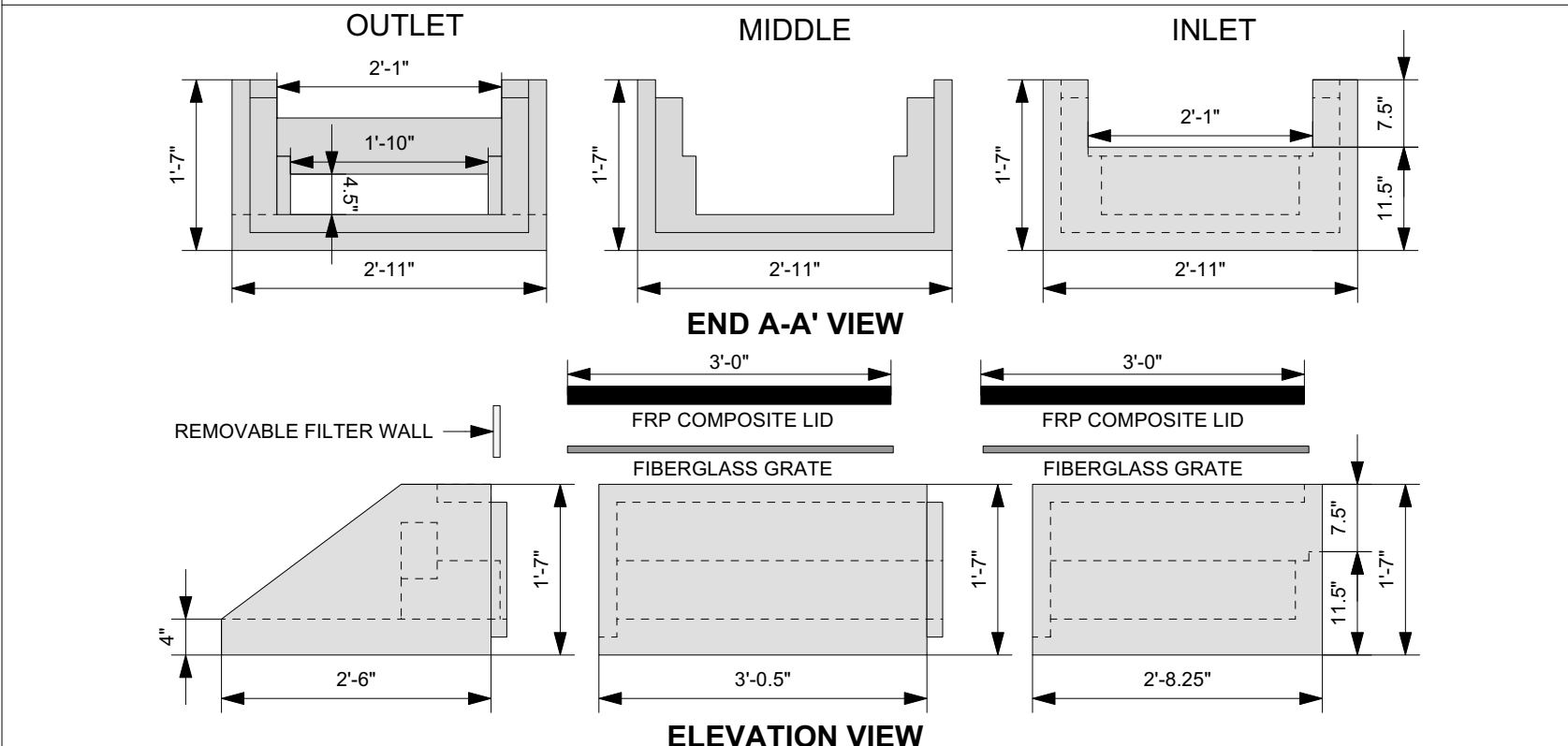
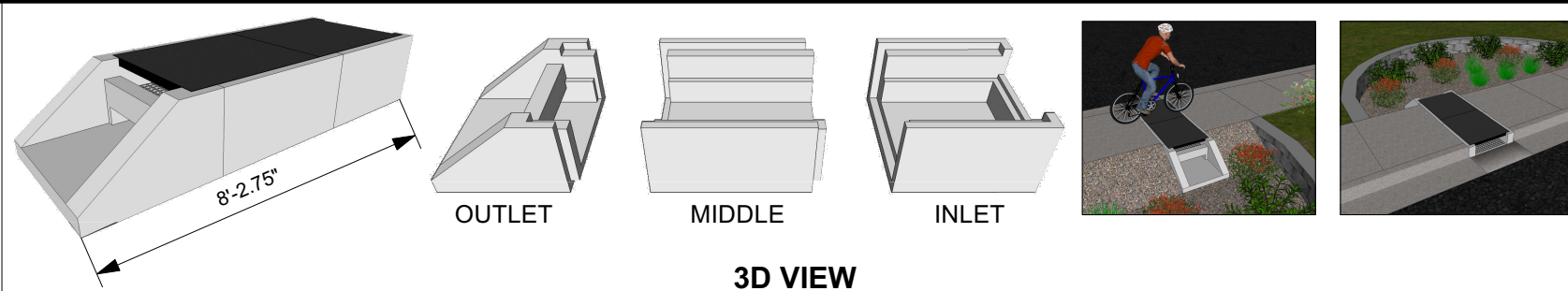
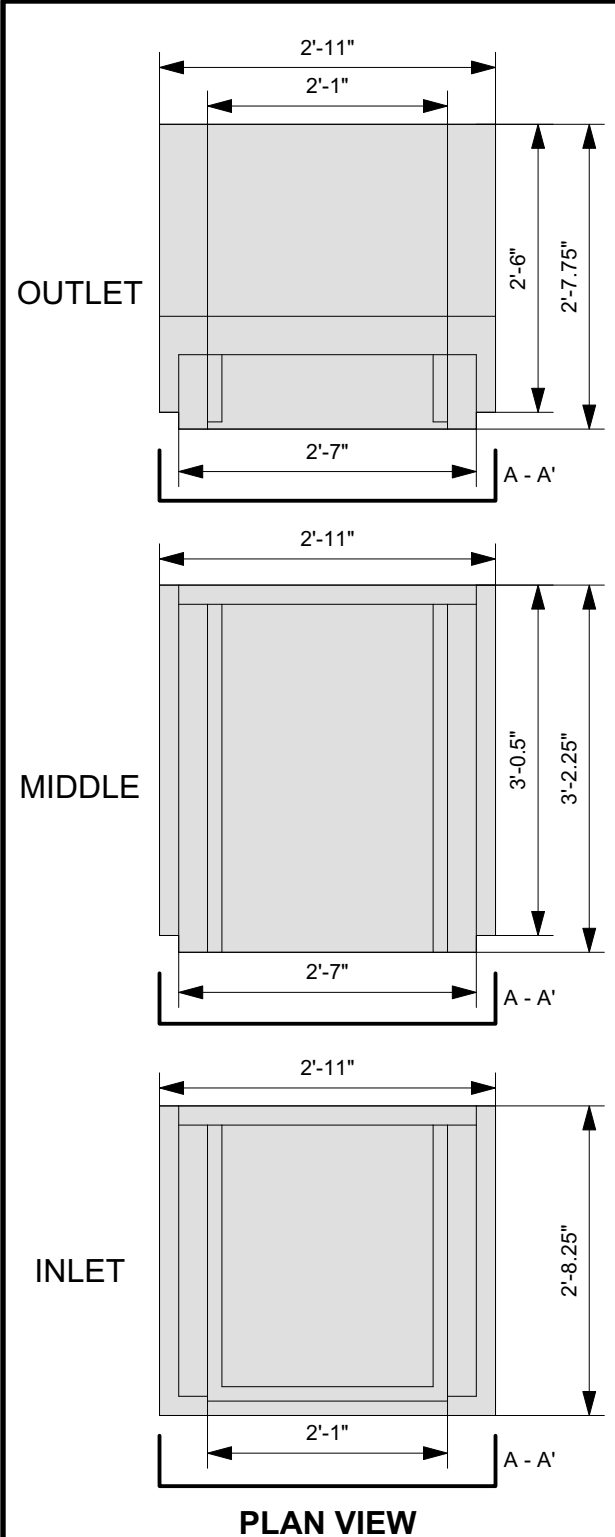
- 10.1. Payment of modular concrete dry filter boxes shall be based on a per unit price and may or may not include delivery of the box to the project site. The contractor is responsible for determining the style/configuration of box needed.
- 10.2. Total cost will be provided by the distributor based on unit costs requested delivery fees, handling fees, and associated taxes.

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**RAIN GUARDIAN™ FOXHOLE**  
**TYPICAL DETAIL**

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- SPECIFICATIONS**
1. STEEL REINFORCED, COLD JOINT SECURED MONOLITHIC CONCRETE STRUCTURES (INLET 875 LBS, MIDDLE 965 LBS, AND OUTLET 730 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. 2-POINT PICK USING RECESSED LIFTING POCKETS WITH A STANDARD HOOK.
  3. FIBERGLASS GRATE (11 LBS/PIECE).
  4. FRP COMPOSITE LID (38 LBS/PIECE) WITH CONCENTRATED LOAD CAPACITY OF 11,200 LBS.

**INSTALLATION NOTES**

1. INSTALL A CLASS 5 BASE (COMPACTED TO 95% STANDARD PROCTOR). IT IS CRITICAL THAT THE CLASS 5 BASE IS EVEN TO ENSURE THE FOXHOLE PIECES ALIGN VERTICALLY SUCH THAT THE TOP LIDS LAY FLUSH WITH THE TOP OF THE FOXHOLE PIECES AND ADJACENT BOULEVARD, SIDEWALK, OR PATH. THE DISTANCE FROM THE BACK OF THE CURB MAY VARY BASED ON SITE CONDITIONS. EXCAVATE 1' 7" BELOW THE GUTTERLINE ELEVATION (I.E. THE BIORETENTION OVERFLOW ELEVATION) TO ACCOMMODATE THE 9" PONDING DEPTH, 6" CLASS 5 AGGREGATE, AND 4" RAIN GUARDIAN FOXHOLE BASE (INCLUDED). THEREFORE, THE TOP OF THE CLASS 5 COMPACTED BASE IS PRECISELY 1' 1" BELOW THE GUTTERLINE ELEVATION. THE TOP OF THE RAIN GUARDIAN FOXHOLE INLET POINT WILL BE 7-1/2" 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 FOXHOLE.

2. SET RAIN GUARDIAN FOXHOLE INLET FIRST, FOLLOWED BY MIDDLE SECTION(S), AND FINALLY THE OUTLET ON THE PREPARED CLASS 5 BASE. POSITION RAIN GUARDIAN FOXHOLE OUTLET PIECE SO PRIMARY OUTLET ALIGNS WITH TOE OF BASIN SIDE SLOPE TO AVOID SOIL INTERFERENCE WITH REMOVABLE FILTER WALL.

3. SECURE MODULAR FOXHOLE PIECES AT EACH JOINT USING PROVIDED GALVANIZED TIE RODS.

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

5. REMOVABLE FILTER WALL SHOULD BE INSTALLED WITH FILTER FABRIC FACING THE RAIN GUARDIAN FOXHOLE INLET.



**RAIN GUARDIAN FOXHOLE  
MODULAR PRETREATMENT CHAMBER  
BIORETENTION PONDING DEPTH: 9"  
TYPICAL DETAIL**

REVISION HISTORY			
REV	BY	DATE	DESCRIPTION
A	MDH	11/16/2022	MODULAR FOXHOLE
SCALE		VARIABLE	
U.S. PATENT NOS.		8,501,016 AND 8,858,804	

DEVELOPED BY:

MANUFACTURED BY:

ARCHITECTURAL PRECAST / CAST STONE  
NATIONAL PRECAST CONCRETE ASSOCIATION  
CERTIFIED PLANT