PRECAST CONCRETE URBAN RAINGARDEN SYSTEM

NOTE: This guide specification shall govern the materials, methods of installation and performance of the Urban RainGarden System (System & Components) supplied by Porous Technologies, LLC, 163 Thadeus Street, South Portland, ME 04106 (telephone 888-357-1161) in all applications. The Precast Concrete Urban RainGarden System includes precast concrete tapered wall elements, inlet aprons, pretreatment basins, underdrains and stormwater overflow devices. System installations may also include crushed stone and biofiltration media and mulch, as may be specified by the project design professional.

PART 1 GENERAL

Section Includes:

1.1 Related Requirements

A. Section 01 33 00 – Submittals: Shop Drawings, Product Data and Samples
B. Section 01 57 13 – Temporary Erosion and Sediment Control
C. Section 31 00 00 – Earthwork: Excavation, Trenching, Backfill and Compaction
D. Section 32 12 00 – Rigid Paving
E. Section 32 16 00 – Curbs, Gutters, Sidewalks and Driveways
F. Section 32 31 19 – Decorative Metal Fences and Grates
G. Section 32 91 00 – Planting Preparation
H. Section 32 93 00 - Plants
I. Section 32 94 00 - Planting Accessories
J. Section 33 40 00 – Storm Drainage Utilities
K. Section 33 46 00 - Subdrainage

1.2 Summary

1. The Precast Urban RainGarden shall consist of modular precast concrete wall sections that are assembled in a designed configuration, filled with a storage media; either aggregate or plastic, a specified biofiltration media and, when specified, provided with inlet, overflow and underdrain components.
2. The Precast Urban RainGarden shall be sized and installed per plan and local LID requirements and shall be intended to treat the identified runoff volume for pollutants of concern such as TSS, gross pollutants, bacteria, dissolved metals, nutrients, and hydrocarbons.

3. The Precast Urban RainGarden shall be equipped with a "dry filter" pretreatment chamber with a top grate able to support pedestrian traffic and able to mechanically separate larger debris from stormwater runoff. The inlet structure shall also include a lower permeable filter wall that allows the unit to dry out between storm events. Additionally, the dry filter inlet shall be capable of allowing high volume overflows during large storm evens such that water within the structure does not overtop the sidewalls. All discharges from the inlet structure shall be directed toward a splashpad to reduce scour within the Precast Urban RainGarden.
4. The Precast Urban RainGarden shall include the ability to partition flows, causing all runoff to be diverted into the biofiltration cell during low-flow conditions. Flows exceeding the treatment capacity of the unit shall be diverted from the biofiltration cells to prevent re-suspension and washout of previously trapped pollutants.
5. The Precast Urban RainGarden shall be equipped with baffle walls as necessary to equalize flow and infiltration when installed on longitudinal slopes.
6. For the Precast Urban RainGarden components [exclusive of the biofiltration soil media and the underdrains], the Contractor shall furnish all labor, materials, equipment and incidentals required for setting in accordance with the plans and these Specifications.
7. Biofiltration soil media shall conform to the requirements of [1002-7] "Bioretention Soil Media."
8. Underdrains shall conform to the requirements of [Section 33 46 00] – "Subdrainage."
9. The Contractor shall furnish all labor, materials, equipment and incidentals required and install base materials, precast concrete tapered wall units, concrete aprons, biofiltration media, inlet basket, underdrain and associated overflow structure as shown on the drawings and as specified herein.

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1.3 Reference Standards

A. American Society for Testing and Materials (ASTM) and other testing standards, in any case the Current Edition shall be the reference:

a) ASTM A48, Class 30 M Standard Specification for Gray Iron Castings
b) ASTM A185 Steel Welded Wire Reinforcement, Plain for Concrete
c) ASTM A615 Deformed and Plain, Carbon Steel Bars for Concrete Reinforcement.
d) ASTM B209 – Aluminum, Aluminum Alloy Sheet and Plate
e) ASTM C33/C33M Standard Specification for Concrete Aggregates
f) ASTM C150 – Portland Cement
g) ASTM D698 – Standard Test Method for Laboratory Compaction of Soil (Standard Effort)
h) ASTM C857 Minimum Structural Design Loading for Underground Precast Utility Structures
i) ASTM C858 Underground Precast Utility Structures
j) ASTM C891 Installation of Underground Precast Utility Structures
k) ASTM C990 Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants
l) ASTM C923 Standard Specification for Resilient Connectors Between Reinforced

Concrete Manhole Structures, Pipes and Laterals

m) ASTM D1557 - Standard Test Method for Laboratory Compaction of Soil (Modified Effort)

n) ASTM D2940 Standard Specification for Graded Aggregate Material for Base or Subbases for Highways or Airports

1.4 Submittals

The following shall be submitted by the contractor in accordance with [Section 01 33 00] submittal requirements:

A. Shop drawings; showing layout of modular RainGarden components. Drawings shall indicate all component dimensions, in plan and elevation.

B. Components drawings shall detail reinforcement and component-to-component connections as well as manufacturer recommended subgrade materials.

C. Handling and installation materials including installation details and narrative description.

D. Product Data Sheets shall be provided for the following:

1. Cementitious materials.
2. Aggregate sources
3. Admixtures
4. Reinforcement
5. Threaded Inserts
6. Mechanical Fasteners
7. Dry Filter Inlet Structure

E. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

2. Product Data for Credit MR 5: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.

1.03 Quality Assurance

A. Installation Contractor (Superintendent and Foreman) shall fully familiarize themselves with Precast Concrete Urban RainGarden Handling and Installation Details and Procedures and shall be experienced in the installation of precast concrete components.

B. The installation contractor shall use appropriate resources including equipment and skilled workers. Workers shall be trained and experienced in the necessary crafts and completely familiar with the specified methods needed for proper performance of this Specification.

C. Installation shall include planning the work, horizontal and vertical layout, fine grading of subgrades, installing membrane and/or geotextile in accordance with the respective

manufacturer's recommendations, placing and compacting gravel crushed stone leveling course (base), placement of required underdrains, placement of precast concrete tapered RainGarden walls and placing precast concrete aprons as well as associated repaving and curb installations.

D. All materials, methods of installation and workmanship shall conform to requirements of ASTM, ACI, Department of Transportation, or other applicable Standards.
E. The contractor shall obtain all applicable Federal, State and/or Municipal permits and/or approvals that may be required for this project.
F. Contractor's installation plan shall be reviewed in a pre-construction meeting with the Contractor, the Precast Concrete Urban RainGarden manufacturer's representative and project design professional.

1.05 Delivery, Handling and Storage

A. Delivery shall be coordinated so as not to interfere with other construction and to avoid delays.
B. Precast Concrete Urban RainGarden components shall be offloaded by a forklift or other machine of required capacity operated by a trained and certified operator.
C. Safe load capacity of forklift shall be in accordance with Occupational Safety & Health Administration (OSHA) recommended practices. Forklift capacity shall be verified to ensure that the machine is operating at a safe load capacity.
D. Place and store components so that all labels and identifying markings are visible.
E. Store components on top of non-staining dunnage placed on level ground.
F. Components shall be stored such that they are kept free from contact with soil and to prevent distortion, cracking or other physical damage.
G. Precast Concrete Urban RainGarden components shall be handled with equipment recommended by manufacturer and in such a manner to avoid excessive stresses that would cause cracking or damage.
H. Use only provided, or recommended inserts and lifting clutches to lift and set components.

PART 2 PRODUCTS

Section Includes:

2. 1 Precast Concrete Urban RainGarden System and Accessories

2.1.1 Description

The Contractor shall furnish all labor, materials and equipment and accessories

necessary to install the Precast Urban RainGarden System in accordance with the Drawings and these Specifications. The Precast Urban RainGarden System shall consist of Precast Concrete Walls, Precast Concrete Aprons, Precast Concrete Inlet Basins, Stainless Steel Inlet Basket, Underdrains and Overflows, biofiltration media, and vegetation and irrigation as may be specified.
The Precast Concrete Urban RainGarden System shall be sized and installed per plan and local design requirements and shall be intended to trap and retain pollutants such as TSS, gross pollutants, bacteria, dissolved metals, nutrients, and hydrocarbons.

The Precast Concrete Urban RainGarden System shall be sized at a hydraulic loading rate of no more than five inches/hour and provide a treatment to impervious area ratio of no less than 4%.

2.1.2 Materials and Design

A. Concrete for Precast Urban RainGarden System shall comply with ASTM C478, C857 and C858 and meet the following additional requirements:
B. Cement shall be Type 1, II or III Portland Cement conforming to ASTM C150.
C. In all cases the Precast Urban RainGarden components shall have wall thicknesses no less than the minimum required to support HS20-44 (MS18) loading requirements as determined and certified by a Professional Engineer licensed in the State of product use.
D. Each precast component of the Urban RainGarden System shall include a minimum of (2) imbedded lifting permanent lifting points in the surface of the unit.
E. Precast concrete components shall be thoroughly cured before delivery and shall attain a compressive strength of 5,000 p.s.i. before shipment
F. Dry filter inlet structure shall be the “Rain Guardian – Bunker Pretreatment Chamber” as manufactured by the Anoka Conservation District.
G. All pipe connections shall be made using flexible pipe connectors meeting ASTM C923 installed in the field.
H. All components shall be provided with a self-stick adhesive label which includes the date of manufacturer and the piece designation.
I. Aggregates shall conform to ASTM C33, except that the requirements for gradation shall not apply.
J. Reinforcement shall consist of wire conforming to ASTM A82 or A496, wire mesh conforming to ASTM A185 or Grade 40 steel bars conforming to ASTM A615
K. Precast Concrete Urban RainGarden Systems shall be provided with a permanent placard at the surface level identifying that they are stormwater treatment devices.
L. Soils used for biofiltration media must meet two objectives:

a. They must be sufficiently permeable to infiltrate runoff at a minimum rate of 5” per hour over the life of the system, and
b. They shall have sufficient moisture retention to support healthy vegetation.

M. Modular plastic storage media providing 90% void ratio, a compressive strength of 240.2 psi and HS-20,25 load ratine with a minimum of 6" of cover.
N. Geotextile microgrid shall have a Unit Weight of 0.5 lbs./s.y., a Rib Pitch of 32 mm., a Rib Thickness of 3.3 mm, a minimum Radial Stiffness @ 0.5% Strain of 321 kN/M (22,000 lbs./s.f.) when tested in accordance with ASTM D 6637, and a Flexural Stiffness of 2,100,000 mg-cm when tested in accordance with ASTM D 7748. It shall have an Ultraviolet Resistance of 100% when tested in accordance with ASTM D 4355.

2.1.3 Quality Assurance

The materials provided which constitute the Precast Concrete Urban RainGarden System shall comply with the project Plans and these Specifications. Imperfections observed on any components may be repaired subject to the approval by the Owner, or Owner's representative.

A. System components shall be place on a compacted granular levelling base and secured to each other with manufacturer supplied fasteners and 5/8" diameter steel pins.
B. Granular Base Leveling Course: Natural or artificially graded mixture of natural or crushed gravel, crushed stone and natural or crushed sand, conforming to ASTM D2940; with at least 95 percent passing a ¾" sieve and not more than 10 percent passing a No. 200 sieve.
C. Granular Base shall be compacted using a mechanical plate compactor to 95% Standard Proctor or 90% Modified Proctor of maximum soil density.
D. Urban RainGarden Walls shall be installed with a maximum out of plumb tolerance of ¼" in 4'.

2.1.4 Manufacture

Precast Concrete Urban RainGarden System shall be as manufactured by Porous Technologies, LLC, 163 Thadeus Street, South Portland, ME 04106, Tel. 888-357-1161

PART 3 EXECUTION

Section Includes:
3.00 General
3.01 Inspection
3.02 Site Preparation
3.03 Trench Excavation
3.04 Dewatering
3.05 Examination
3.06 Precast Urban RainGarden Component Installation
3.07 Jointing
3.08 Dy Filter Inlet Structure
3.09 Underdrain
3.10 Plastic Storage Media
3.11 Geotextile Microgrid
3.12 Backfilling
3.13 System Activation

3.00 General

All Precast Urban RainGarden Components shall be inspected prior to installation and any damaged or defective products shall be repaired to the Owner's satisfaction or replaced.

3.01 Inspection

Precast Urban RainGarden Components

A. Any Component with chipped joints or top sections shall be rejected and replaced.
B. Any component with a fracture or crack greater than 0.10 inches in length or 0.01 inches in width shall be rejected and replaced.
C. Any component that has not had at least Seven (7) days curing time or is out of square shall be replaced at the Owner's discretion.
D. Any section with indications of imperfections in mixing and/or molding, honeycombed, or open textured surfaces, shall be rejected and replaced.
E. Any section with indications of patches or repairs shall be replaced at the Owner's discretion.
F. Any section with exposed reinforcing steel shall be rejected and replaced.

3.02 Site Preparation

A. Protect surrounding structures, sidewalks, utilities and pavements from damage caused by

undermining or washout from adjacent excavation activities.

B. Install and maintain erosion and sediment control measures until all surrounding disturbed areas are vegetated or stabilized.

C. The subgrade areas between erected Precast Urban RainGarden components shall not be compacted or permanently covered with geotextile unless approved by the project design professional.

D. Where erosion has caused accumulation of sediment or ponding on the subgrade, remove sediment with light equipment [and/or manually]. Scarify the underlying soils to a minimum depth of 6 inches with a York rake, or equivalent equipment, and a small/light tractor.

E. Restore any subgrade areas damaged by erosion, ponding, or traffic compaction to design line and grades prior to installation of [underdrain,][filter fabric,] [filter sand layer or] biofiltration media.

3.03 Trench Excavation

A. Excavate trenches to ensure that sides will be stable under all working conditions. Slope trench walls or provide supports in conformance with all local and national standards for safety. Open only as much trench as can be safely maintained by available equipment. Backfill all trenches as soon as practicable, but not later than the end of each working day.

B. Where trench walls are stable or supported, provide a width sufficient, but no greater than necessary, to ensure working room to properly and safely place and compact side wall backfill and other embedment materials. The space between the Precast Urban RainGarden System and the trench walls must be wider than the compaction equipment used.

C. When supports such as trench sheeting, trench jacks, trench shields or boxes are used, ensure that support of the Precast Urban RainGarden system and its connections is provided throughout the installation process. Ensure that sheeting is sufficiently tight to prevent debris to wash into the trench excavation from behind the sheeting. Provide tight support of trench walls below any obstructions to sheeting.

D. Rock in either ledge of boulder form shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between exposed rock and the component section of at least 12 inches (0.3m). Rock excavation shall be as specified and defined under Section 02300 “Earthwork”.

E. Wet, organic or otherwise unstable soil incapable of providing a proper foundation for the components shall be excavated and removed to a depth of 24” below the bottom of the structure and replaced with granular material compacted as directed by the Engineer. When removal of material is due to the fault or neglect of the Contractor while performing shoring or dewatering work, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Owner.

3.04 Dewatering

A. Prevent surface and ground water from entering excavations, from ponding on prepared

subgrades and from flooding project site and surrounding areas.

B. Protect Subgrades from softening, undermining, washout and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations.

3.05 Examination

A. Examine areas indicated to receive Precast Urban RainGarden System, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that the granular levelling base is in suitable condition to begin installation according to manufacturer's written instructions.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.06 Precast Urban RainGarden Component Installation:

A. Install Precast Urban RainGarden System in compliance with all manufacturer's directions unless directed otherwise.

B. A stable and uniform bedding shall be provided for all components. Bedding shall be compacted to 90% of maximum density per AASHTO T99, or as shown on plans. Structure bedding shall be a minimum of 6" in thickness. The bedding surface for the components shall provide a firm and uniform density along its entire perimeter length.

C. Lift components with manufacturer recommended hardware.

D. Tolerance: Install components with no greater than a 1/8" offset from piece-to-piece and with no more than a ¼" in 10 ft. variance from level or from the slope indicated on the plans. Components shall be installed with a maximum out of plumb tolerance of ¼" in 4'

3.07 Jointing

A. Joints shall be constructed as described herein and in accordance with the manufacturer's installation instruction.
B. Installed wall sections shall be connected with manufacturer supplied 1" x 24" threaded rod placed in pre-formed bolt pockets.
C. Exterior wall surfaces shall be covered with 6" butyl mastic joint wrap from the bottom of the component to just below required finished grade elevation.
D. Place temporary bracing across the inside of the System to prevent movement of components during backfill.

E. For wall corners and for wall sections placed on a curve joints shall be fastened together with 1" bolts in bolt pockets and by 3/8" thick 5" x 6" Aluminum Angle Brackets.

3.08 Dry Filter Inlet Structure

A. Dry Filter Inlet Structure shall be assembled and installed per manufacturer's instruction. In all cases structure be installed on a foundation prepared as described in 3.10 Backfilling E.1. of these specifications.

3.09 Underdrain

A. Drainage Aggregate: Place [Geotextile if specified] at the bottom of the assembled Precast Urban RainGarden.
B. Lay subsurface drainage pipe at grades indicated on plans in in accordance with Section 33 46 00 "Subdrainage".
C. Cover underdrain with washed crushed stone to the depth indicated on plans.
D. Place [Geotextile if specified] over crushed stone drainage layer and protect from intrusion of fine sediment.

3.10 Plastic Storage Media

If required plastic storage media shall be placed in the locations shown on the design plans, at the correct elevations.

A. Storage media shall be placed in accordance with manufacturer's instructions and with a minimum of 3" of No. 57 Stone bedding beneath it.
B. After storage media is installed top and sides of media shall be covered with Geotextile Microgrid to providing separation between stone and storage media.
C. Install any connections required between underdrain and storage media.

3.11 Geotextile Microgrid

If plastic storage media is used geotextile microgrid shall be placed over installed plastic storage media to separate media from stone.

3.12 Backfilling

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
B. Backfill shall be brought up evenly on all sides of the System to required elevations.
C. Backfill shall be placed alternately on the inside and outside of the System to avoid displacing Component walls.
D. Remove temporary bracing only after backfilling is complete.

E. Compact soils to not less than the following percentages of maximum dry unit weight according to [ASTM D698] [ASTM D1557]:
    1. Under Components, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
    2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil to 90 percent.
    3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.

3.13 System Activation

A. The Precast Urban RainGarden shall be delivered without the soil media, internal irrigation and plants installed. The Contractor shall take any and all necessary actions to protect the System and pre-treatment structures from sediment, debris and other pollutants during the period of construction. Contractor shall procure approved biofiltration media and place it to the depth and grades indicated on plans.