

Section [_____] Stormwater Storage System

PART 1 – GENERAL

01.01.00 Purpose

The purpose of this specification is to establish generally acceptable criteria for underground stormwater storage systems for detention, retention, or infiltration of stormwater runoff. It is intended to serve as a guide to producers, distributors, architects, engineers, contractors, plumbers, installers, inspectors, agencies and users; to promote understanding regarding materials, manufacture and installation; and to identify devices complying with this specification.

01.02.00 Description

Stormwater storage systems (SWSS) are used for detention, retention, or infiltration of storm water. The SWSS is a modular precast concrete storage system composed of multiple modules comprised of a top slab, multiple support legs and walls, maintenance access ports, and optional inlet and/or outlet pipes.

Underground detention systems are used for temporarily collecting stormwater runoff and releasing it at a specified rate. Underground retention systems are used for storing a permanent volume of stormwater runoff. This water can be re-used for a variety of purposes. Underground infiltration allows collected stormwater runoff to recharge into the underlying soils. The SWSS is a precast concrete engineered system composed of interconnected modules.

01.03.00 Manufacturer

The manufacturer of the SWSS shall be one that is regularly engaged in the engineering design and production of systems developed for the treatment of stormwater runoff for at least (10) years, and which has a history of successful production, acceptable to the engineer of work. In accordance with the drawings, the SWSS shall be manufactured by Bio Clean A Forterra Company, or assigned distributors or licensees. Bio Clean A Forterra Company, can be reached at:

Corporate Headquarters:
398 Via El Centro
Oceanside, CA 92058
Phone: 760-433-7640
Fax: 760-433-3176
www.biocleanenvironmental.com

01.04.00 Submittals

- 01.04.01 Submittal drawings are to be submitted with each order to the contractor and consulting engineer.
- 01.04.02 Submittal drawings are to detail the SWSS and all components required and the sequence for installation, including:
- System configuration with primary dimensions
 - Interior components
 - Any accessory equipment called out on submittal drawings
 - Design loading
 - Maximum and minimum depth of cover
 - Seasonal high ground water level (if applicable)

- 01.04.03 Inspection and maintenance documentation submitted upon request.
- 01.04.04 Professional Engineer stamped and signed drawings available upon request and may require additional time for review.
- 01.04.05 Data sheets and installation instructions for lifting inserts, anchors, and other devices are available upon request.
- 01.04.06 Data sheets and installation instructions for accessory items, such as sealants, gaskets, pipe entry connectors, steps, racks, and other items installed after delivery shall be included with the submittal package.
- 01.04.07 Design data for loading and material specifications shall be shown on the submittal drawings. This shall include:
 - Live load used in design
 - Vertical and lateral earth loads used in design
 - Depth of soil fill on the structure
 - Water table depth used in calculations

01.05.00 Work Included

- 01.05.01 Specification requirements for installation of UrbanPond.
- 01.05.02 Manufacturer to supply components of the UrbanPond modules.

01.06.00 Reference Standards

Where applicable, the latest editions of the following standards shall form a part of this specification to the extent referenced. The publications referenced to in the text of this guide specification are by the basic designation only.

AASHTO – American Association of State Highway and Transportation Officials
 ACI – American Concrete Institute
 ASTM – American Society for Testing Materials
 AWS – American Welding Society
 CRSI – Concrete Reinforcing Steel Institute
 NPCA – National Precast Concrete Association

AASHTO	Standard Specifications for Highway Bridges
AASHTO	Standard Specification for Transportation Materials and Methods for Sampling and Testing
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 304R	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 309R	Consolidation of Concrete
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures and Commentary
ACI 517.2R	Accelerated Curing of Concrete at Atmospheric Pressure
ASTM A 36	Specification for Carbon Structural Steel
ASTM A 82	Specification for Steel Wire, Plain, for Concrete Reinforcement

ASTM A 184	Specification for Fabricated Deformed Steel Mats for Concrete Reinforcement
ASTM A 185	Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 496	Specification for Steel Wire, Deformed, for Concrete Reinforcement
ASTM A 497	Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 706	Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 775	Specification for Epoxy-Coated Reinforcing Steel Bars
ASTM A 884	Specification for Epoxy-Coated Steel and Welded Wire Fabric for Reinforcement
ASTM A 1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C 31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	Specification for Concrete Aggregates
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 40	Test Method for Organic Impurities in Fine Aggregates for Concrete
ASTM C 70	Standard Test Method for Surface Moisture in Fine Aggregate
ASTM C 76	Specification for reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 117	Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 123	Standard Test Method for Lightweight Particles in Aggregate
ASTM C 125	Standard Terminology Relating to Concrete and Concrete Aggregates
ASTM C 136	Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 138	Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C 143	Test Method for Slump of Hydraulic Cement Concrete
ASTM C 150	Specifications for Portland Cement
ASTM C 172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C 192	Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete
ASTM C 403	Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance

ASTM C 494	Standard Specification for Chemical Admixtures for Concrete
ASTM C 566	Test Method for Total Evaporable Moisture content of Aggregate by Drying
ASTM C 595	Specification for Blended Hydraulic Cements
ASTM C 617	Standard Practice for Capping Cylindrical Concrete Specimens
ASTM C 618	Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 805	Test Method for Rebound Number of Hardened Concrete
ASTM C 857	Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM C 858	Specification for Underground Precast Concrete Utility Structures
ASTM C 877	Specification for External Sealing Bands for Concrete Pipe, Manholes and Precast Box Sections
ASTM C 890	Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
ASTM C 891	Practice for Installation of Underground Precast Concrete Utility Structures
ASTM C 913	Specification for Precast Concrete Water and Wastewater Structures
ASTM C 920	Specification for Elastomeric Joint Sealants
ASTM C 923	Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
ASTM C 990	Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C 1018	Test method for Flexural Toughness and First-Crack Strength of Fiber-Reinforced Concrete (Using Beam with Third-Point Loading)
ASTM C 1037	Practice for Inspection of Underground Precast Concrete Utility Structures
ASTM C 1064	Standard Test Method for Temperature of Freshly Mixed Concrete
ASTM C 1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1116	Standard Specification for Fiber-Reinforced Concrete
ASTM C 1227	Standard Specification for Precast Concrete Septic Tanks
ASTM C 1231	Standard Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Concrete Cylinders
ASTM C 1240	Standard Specification for Use of Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout
ASTM C 1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C 1293	Standard Test Method for Determination of Length Change of Concrete due to Alkali-Silica Reaction

ASTM C 1399	Test Method for Obtaining Average Residual-Strength of Fiber-Reinforced Concrete
ASTM C 1550	Standard Test Method for Flexural Toughness of Fiber Reinforced Concrete (Using Centrally Loaded Round Panel)
ASMT C 1582	Standard Specification for Admixtures to Inhibit Chloride-Induced Corrosion of Reinforcing Steel in Concrete
ASTM C 1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM C 1611	Standard Test Method for Slump Flow of Self-Consolidating Concrete
ASTM C 1613	Standard Specification for Precast Concrete Grease Interceptors
ASTM G 109	Standard Test Method for Determining the Effects of Chemical Admixtures of the Corrosion of Embedded Steel Reinforcement in Concrete Exposed to Chloride Environments
AWS D 1.1	Structural Welding Code - Steel
CRSI	Manual of Standard Practice
CRSI	Placing Reinforcing Bars
NPCA	Quality Control Manual for Precast Concrete Plants

01.07.00 General Requirements

- 01.07.01 The precast concrete modules shall be designed and produced by an experienced and acceptable concrete manufacturer.
- 01.07.02 The detention, retention, or infiltration modules shall have length and width dimensions of 8' x 8', with an adjustable inside height, and three supporting legs.
- 01.07.03 The modules shall be able to withstand H2O loading with full impact at 6" minimum cover over the top of the modules.
- 01.07.04 Groundwater at or below the invert of system.
- 01.07.05 Lateral soil pressures to be based on active earth pressure. Lateral soil pressure = 35 pcf for 120 pcf backfill unit weight.
- 01.07.06 Vertical soil pressures: Live load = HS20-44. Dead load = 120 pcf cover fill unit weight.
- 01.07.07 Engineer to verify geotechnical requirements.

01.08.00 Design

- 01.08.01 Precast concrete modules shall be designed to withstand design conditions in accordance with the applicable industry design standards. Design must also consider stresses induced during handling, shipping, and installation in order to avoid product cracking or other handling damage. Design loads for precast concrete modules shall be indicated on the submittal drawings, and designed by a licensed professional engineer.
- 01.08.02 Joints and sealants between adjacent modules shall be of the type and configuration on the submittal drawings, meeting specified design and performance requirements.
- 01.08.03 Concrete mix shall be self-consolidating to minimize bugholes and not segregate.

- 01.08.04 Selections of proportions for concrete mix shall be based on current self-consolidating concrete mix design techniques. At a minimum, ACI 211.1 shall be used.
- 01.08.05 Mix designs for each strength and type of concrete that will be used are available upon request. Submitted mix designs shall include the quantity, type, brand and applicable data sheets for all design constituents as well as documentation indicating conformance with applicable reference specifications.
- 01.08.06 Concrete modules shall have a 28-day compressive strength of 6,000 psi for self-consolidating concrete.
- 01.08.07 Concrete that will be exposed to freezing and thawing shall contain air and shall have a water-cement ratio of 0.45 or less. Concrete which will not be exposed to freezing, but which is required to be leak resistant, shall have a water-cement ratio of 0.48 or less. For corrosion protection, reinforced concrete exposed to deicer salts, brackish water or seawater shall have a water-cement ratio of 0.40 or less.
- 01.08.08 The air content of concrete that will be exposed to freezing conditions shall be within the limits given below:

Nominal Maximum Aggregate Size (in)	Air Content %	
	Severe Exposure	Moderate Exposure
3/8	6.0 to 9.0	4.5 to 7.5
1/2	5.5 to 8.5	4.0 to 7.0
3/4	4.5 to 7.5	3.5 to 6.5
1	4.5 to 7.5	3.0 to 6.0
1-1/2	4.5 to 7.0	3.0 to 6.0
For specified compressive strengths greater than 5,000 psi, air content may be reduced 1%.		

PART 2 - PRODUCTS

02.01.00 Stormwater Storage

All material shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

- 02.01.01 Size – As indicated on plans.
- 02.01.02 Concrete – Manufacturer’s approved mix design providing a minimum compressive strength of 6,000 psi at 28 days.
- 02.01.03 Reinforcing bars – per ASTM A 615 or ASTM A 706, Grade 60.
- 02.01.04 Reinforcing mesh – per ASTM A 1064, Grade 80.
- 02.01.05 Cover for reinforcing bars – per ACI 318.

02.02.00 Accessory Items

- 02.02.01 Joint Wrap – Minimum 8” wide, self-adhesive, flexible joint sealant. Recommend ConSeal CS-212 or equivalent.
- 02.02.02 Geotextile – Non-woven, 180 lb tensile strength, minimum 7.0 ounce per square yard typical weight.

02.03.00 Concrete Foundation Slab (Provided by Contractor)

When indicated on the plans, contractor shall provide a poured-in-place, reinforced concrete foundation slab.

- 02.03.01 The foundation slab shall extend a minimum of 1 foot in each direction beyond the footprint of the UrbanPond modules.
- 02.03.02 Minimum compressive strength of 4,000 psi at 28 days, or as required by site-specific geotechnical engineer recommendations.
- 02.03.03 Reinforcing bar design as indicated on the plans.

02.04.00 Membrane Liner

When indicated on the plans, a membrane liner for watertight applications is required. The liner shall be placed in between an inner and outer layer of geotextile fabric per Section 02.02.02.

- 02.04.01 Double-scrim reinforced containment liner with high puncture resistance, UV resistance, and burst strength of 1,250 psi. Recommended BTL 40 or approved equal.
- 02.04.02 Geotextile fabric of equal area shall be placed on both the interior and exterior faces of the membrane liner to prevent punctures.
- 02.04.03 Pipe boots supplied by liner manufacturer required for all pipe penetrations.
- 02.04.04 Liner size or shape may require a liner manufacturer's representative be present for field installations.
- 02.04.05 Liner to be approved by Engineer of Record.

PART 3 – PERFORMANCE

03.01.00 General

- 03.01.01 Function - The SWSS is a pre-engineered storage device capable of capturing and retaining stormwater for an extended period of time and is designed to be installed sub-surface and handle various surface load conditions.
- 03.01.02 Loading - The SWSS must be tested in the field using a full scale stacked internal modules at its maximum height of 14' (ID) and applying loads consistent with AASHTO HL93 requirements and pass all tests as followed without any signs of cracking or failure:
 - Single wheel center of slab at 2' fill distributed – 28,000 lbs test load
 - Single wheel center of slab at 2' fill – 35,000 lbs test load
 - Single wheel center of slab at 8' fill distributed – 98,800 lbs test load
 - Single wheel "edge" of slab at 2' fill distributed – 28,000 lbs test load
 - Edge loading – 70,000 lbs load test
- 03.01.03 Storage Capacity of SWSS as indicated on the plans.

PART 4 - EXECUTION

04.01.00 General

The installation of the SWSS shall conform to all applicable national, state, state highway, municipal and local specifications.

04.02.00 Installation

The Contractor shall furnish all labor, equipment, materials and incidentals required to install the UrbanPond modules and appurtenances in accordance with the drawings and these specifications.

- 04.02.01 Grading and Excavation – Site shall be properly surveyed by a registered professional surveyor, and clearly marked with excavation limits and elevations. After site is marked it is the responsibility of the contractor to contact local utility companies to check for underground utilities. All grading permits shall be approved by governing agencies before commencement of grading and excavation. Soil conditions shall be tested in accordance with the governing agencies requirements. All earth removed shall be transported, disposed, stored, and handled per governing agencies standards. It is the responsibility of the contractor to install and maintain proper erosion control measures during grading and excavation operations.
- 04.02.02 Joint Wrap – Seal exterior vertical and horizontal seams with joint wrap in accordance with ASTM C 891. Prepare surfaces and install joint wrap in accordance with manufacturer’s instructions.
- 04.02.03 Field modifications to the modules will invalidate the product warranty and are strictly prohibited without prior written consent from Bio Clean.
- 04.02.04 Backfill shall be placed according to a registered professional soils engineer’s recommendations, and with a minimum of 6” of gravel under all concrete structures.
Deposit backfill equally around all sides of modules at the same time and same elevation.
Prevent wedging action against modules by stepping or serrating slopes.
- 04.02.05 Compaction – All soil shall be compacted per registered professional soils engineer’s recommendations prior to installation of SWSS.
Compact in even lifts.
Do not disrupt or damage joint wrap during backfilling and compaction.
- 04.02.06 Concrete Structures – After backfill has been inspected by the governing agency and approved, the concrete structures shall be lifted and placed in proper position per plans.

04.03.00 Shipping, Storage and Handling

- 04.03.01 Shipping – SWSS shall be shipped to the job site, and are the responsibility of the contractor to offload the units and place in the exact site of installation.
- 04.03.02 Storage and Handling– The contractor shall exercise care in the storage and handling of the SWSS and all components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor. SWSS shall always be handled with care and lifted according to OSHA and NIOSA lifting recommendations and/or contractor’s workplace safety professional recommendations.

04.04.00 Inspection and Maintenance

- 04.04.01 Inspection – After installation, the contractor shall demonstrate that the SWSS has been properly installed at the correct location(s), elevations, and with appropriate components. The contractor shall demonstrate that the SWSS has been installed per the manufacturer’s specifications and recommendations. All components shall be inspected by a qualified person once at least once per year and results of inspection shall be kept in an inspection log.

- 04.04.02 Maintenance – The manufacturer recommends cleaning and debris removal maintenance of at least once a year or as site conditions require. The maintenance shall be performed by someone qualified.
- 04.04.03 Material Disposal - All debris, trash, organics, and sediments removed from the UrbanPond system shall be transported and disposed of at an approved facility for disposal in accordance with local and state requirements. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

PART 5 – QUALITY ASSURANCE

05.01.00 Warranty

The Manufacturer shall guarantee the UrbanPond modules against all manufacturing defects in materials and workmanship for a period of (3) years from the date of delivery to the job site. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period. The SWSS is limited to the recommended application for which it was designed.

[End of This Section]