

## **Rainstore3 Technical Specification**

### **With Geomembrane and Fabric Liner For Water Harvesting**

### **SECTION 33 49 23 Storm Drainage Water Retention Structures (02630 Storm Drainage Containment & Reuse)**

#### **PART 1 - GENERAL**

##### **1.01 General Provisions**

- A. The Conditions of the Contract and all Sections of Division 1 are hereby made a part of this Section.

##### **1.02 Description of Work**

###### **A. Work Included:**

1. Provide excavation and base preparation per Geotechnical Engineer's recommendations and/or as shown on drawings, to provide adequate support for project designs loads and safety from excavation sidewall collapse. See 2.02 Materials.
2. Provide Rainstore3 system products including Rainstore3 units, geomembranes, geotextiles, geogrids, inlet and outlet pipe with connections and installation per the manufacturer's instructions furnished under this section.

###### **B. Related Work:**

1. Subgrade excavation preparation under Section 31 20 00 Earth Moving (02300 – Earthwork).
2. Utilities and subsurface drainage - Section 33 40 00 Storm Drainage Utilites (02700 - Subsurface Drainage and Structures), as needed.

##### **1.03 Quality Assurance**

- A. Follow Section 01 33 23 Shop Drawings, Product Data, and Samples (01340 Shop Drawings, Product Data, and Samples) requirements.
- B. Installation: Performed only by skilled work people with satisfactory record of performance on pipe, chamber, or pond/landfill construction projects of comparable size and quality.

##### **1.04 Submittals**

- A. Submit manufacturer's product data and installation instructions.
- B. Submit a 20" x 20" section of Rainstore3 product for review. Reviewed and accepted samples will be returned to the Contractor.
- C. Submit material certificates for geomembrane, geotextile, geogrid, base course and backfill materials.

##### **1.05 Delivery, Storage, and Handling**

- A. Protect Rainstore3 cells from damage during delivery and store under tarp to protect from sunlight when time from delivery to installation exceeds one week. Storage should occur on smooth surfaces, free from dirt, mud and debris.
- B. Handling is to be performed with equipment appropriate to the size (height) of cells and site conditions, and may include, hand, handcart, forklifts, extension lifts, small cranes, etc., with care given to minimize damage to spacer bars and surrounding cells.

##### **1.06 Project Conditions**

- A. Review installation procedures and coordinate Rainstore3 work with other work affected, such as grading, excavation, utilities, construction access, erosion control to prevent all non-installation related construction traffic over the completed Rainstore3 installation, especially with loads greater than design loads.
- B. Cold weather:

1. Do not use frozen materials or materials mixed or coated with ice or frost.
  2. Do not build on frozen work or wet, saturated or muddy subgrade.
  3. Care must be taken when handling geomembrane liner and Rainstore3 cells when air temperature is at 40 degrees or below as plastic becomes brittle.
- C. Protect partially completed Rainstore3 installation against damage from other construction traffic when work is in progress, and following completion of backfill, with highly visible construction tape, fencing, or other means until construction is complete.
- D. Protect adjacent work from damage during Rainstore3 installation.

## PART 2 - PRODUCTS

### 2.01 Availability

- A. Manufacturer: (Rainstore3) Invisible Structures, Inc., 1600 Jackson Street, Suite 310, Golden, Colorado 80401. Call from USA and Canada 800-233-1510 toll free, (International 303-233-8383), Fax 800-233-1522 (International 303-233-8282).
- B. Distributor:

### 2.02 Materials

- A. Base of Excavation: Shall be smooth soil, level and free of lumps or debris. Compact to at least 90% or as required by Engineer. Structural fill material may be used to amend the structural capacity of the soil, and should be placed on top of the geogrid layer if needed. Materials that can not be stabilized by compaction, such as sand and/or drainage rock, should be avoided.
- B. Geogrid: Use geogrid product, such as Tensar TriX 160, or equal, to overlay the excavation floor, the assembled cells, and above the completed liner, extending at least twice the width of side backfill, with geogrid joints overlapped by at least 12”.
- C. Geotextile: Shall be non-woven PP or PET with a weight of at least 8 oz per square yard, appropriate for the soil type and depth conditions, placed in two layers sandwiching the geomembrane on the floor of the excavation, the sides of the chamber, and chamber top.
- D. Geomembrane Liner: Shall be a minimum of 40 mil PVC, or thicker, or of a material suitable for project specific design criteria selected by the Engineer, placed upon the bottom of the Rainstore3 structure, wrapped up the sides of the structure, and across the top of the structure, with all joints suitably welded by heat, or other means as directed by the Membrane manufacturer, to create a water-tight enclosure.
- E. Rainstore3 Cells: Injection molded plastic units (layers) 1x1x0.1 m (Approximately 40"x40"x4"), (0.1 m<sup>3</sup> each) assembled into vertical columnar cell structures of variable height (custom for each project) with each layer consisting of hollow rings rising from a strong open grid Unit weight = 6.4 kg (14.2 lb.), volume = 6% solid. DO NOT cut Rainstore3 Cells – Cells must be installed whole. Cutting of Rainstore3 is only permitted for installation of maintenance ports. DO NOT disassemble, reassemble, or reconfigure the height (stacks) of Rainstore3. Stacks must be assembled at Invisible Structures manufacturing facility.
- F. Side Backfill: Structural fill free from lumps and debris or any other sharp materials to backfill along the sides of the cellular structure, taking care to compact with powered mechanical compactor, in lifts that do not exceed 12”, to provide a settlement free-surface over the top and sides of the structure. Fill material should NOT consist of high percentage of clay or silt materials. Fill material should increase in shear strength when compacted; thus, no drain rock or pure open-graded rock allowed.
- G. Top Backfill: Use 12” minimum to 36” maximum depth of 3/4” minus sandy/gravel roadbase material (with fines less than 3%). If backfill mixture must be custom mixed, use a ratio of 2 parts clean 3/4” drainage rock to 1 part clean sharp sand.
- H. Utility Marker: Use metallic tape at corners of install to mark the area for future utility detection.

## PART 3 - EXECUTION

### 3.01 Inspection

- A. Examine prepared excavation and conditions for smoothness, compaction and level. Do not start Rainstore3 installation until unsatisfactory conditions are corrected. Check for presence of seasonal high water table, which must be kept at levels 3 feet below the bottom of the Rainstore3 structure at all times. Different municipalities have different regulations regarding the required distance between the bottom of an underground infiltration structure and the top of the seasonal high water table. Please check with your local regulations to ensure compliance.
- B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance. If existing conditions are found unsatisfactory, contact Project Manager for resolution.

### 3.02 Preparation

- A. Place geogrid over prepared grade, with any joints overlapped by a minimum of 12", extending over the entire excavation bottom.
- B. Place the first layer of geotextile fabric on the geogrid extending the excess portion of the rolls up the sides of the excavated area. Overlap the geotextile joints 12" or per manufacturer's recommendations.
- C. Place the geomembrane liner extending the excess portion of the rolls up the sides of the excavated area. The excess liner will later be brought up and around to encompass the sides and top of the Rainstore<sup>3</sup> cells. Seams should overlap a minimum of 12 inches or per manufacturer's recommendations. The seams of the geomembrane liner should be sealed, per manufacturers specifications, to ensure impermeability.
- D. Place a second layer of geotextile fabric over the chamber bottom/geomembrane prior to placement of the cells also extending the excess portion of the rolls up the sides of the excavated area. It is helpful to identify the outline of the Rainstore3 cell placement on the fabric, using spray paint or chalk line, to ensure squareness.
- E. The two geotextile layers and the "sandwiched" geomembrane liner will later be brought up and encompass all sides and the top of the Rainstore3 units.

### 3.03 Installation of Rainstore3 Cells

- A. Install Rainstore3 cells by placing side by side, with grid side down. Place sides of cells without damaged bumpers along outside of structure to resist backfill forces against fabric and liner materials. DO NOT cut Rainstore3 Cells – Cells must be installed whole. Cutting of Rainstore3 is only permitted for installation of maintenance ports. DO NOT disassemble, reassemble, or reconfigure the height (stacks) of Rainstore3. Place metallic tape on top corners of install to mark the area for future utility detection. Place a layer of geogrid directly over the top of the cells to bridge columns and joints and provide a secure walking surface. Place geotextile fabric layer over the top and sides to prevent soil entry into the chamber. Take great care to avoid damage to fabric liner material during placement.
- B. After placement of Rainstore3 cells, bring fabric/geomembrane/fabric liner materials up the sides and over the top of the structure, overlapping and sealing joints per manufacturer's recommendations. Fold excess liner materials at corners to lay flat against sides of structure, securing folds and seams with tape, adhesives, heat, or similar methods.
- C. Identify locations of inlet, outlet, inspection ports, and any other penetrations of the liner, securing pipe into prefabricated boots with stainless steel pipe clamps. Support pipe in trenches and during backfill operations to prevent damage to liner or pipe.
- D. With chambers greater than 1.2 meters (4 feet) deep, place piles of cover material over closed chamber top surface along the edge of the chamber to provide vertical load on perimeter cells. This will ensure compression of the columns and aid in resistance to side pressures from backfill operations.
- E. Use a powered mechanical compactor to conduct backfill operations on structure sides with care to

- avoid damage to liner while providing required compaction forces to the top level of the structure.
- F. Place a geogrid layer over the top of the structure, extending beyond the outside edge of the excavation by at least 40". Any joints must be overlapped by a minimum of 12".
  - G. Place sufficient sandy gravel backfill material over geogrid to ensure support of design loads. Place cover backfill in 6" lifts and compact with vibrating plates or walk-behind rollers (do not use drivable rolling compactors) to a minimum of 95%, with a minimum depth of 12" and a maximum depth of 36". Take care to place backfill on top of structure and avoid damage to structure or liner, using low pressure tire or track vehicles.
  - H. Ensure that all non-chamber construction traffic be kept away from the limits of excavation until the project is complete and final surface materials are in place.
  - I. Place surfacing materials, such as groundcovers (no shrubs or trees), or paving materials over the structure with care to avoid displacement of cover fill and damage to surrounding areas.
  - J. Any slopes creating additional overburden above the Rainstore3 system should be carefully located. The toe of said slope should be 10' away from the closest edge of the Rainstore3 system. This will prevent any additional earth pressure on the Rainstore3 system.

#### 3.04 Cleaning

- A. Perform cleaning during the installation of work and upon completion of the Work. Remove from site all excess materials, debris, and equipment. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

END OF SECTION

If you have any questions regarding this specification, please call  
Invisible Structures, Inc. 1-800-233-1510

Version 10/2011