

Article I. GENERAL

Section 1.01 Scope

- (a) This specification shall govern the implementation, performance, material and fabrication pertaining to the Sub-surface Stormwater Storage System. The sub-surface stormwater storage system shall be manufactured by Brentwood Industries, Inc. 500 Spring Ridge Drive, Reading, PA 19610 (610-374-5109), distributed by XXXXX, and shall adhere to the following specification at the required storage capacities.
- (b) All work is to be completed per the design requirements of the Engineer of Record and to meet or exceed the Manufacturer's Design and Installation Requirements.

Section 1.02 Reference Standards

- (a) The following apply to work in this section:
 - (i) ASTM: Specifications of the American Society for Testing and Materials latest editions.
 - (ii) AASHTO: American Association of State Highway and Transportation Officials, current published standards.

Section 1.03 Submittals

- (a) At least 10 days prior to bid, submit to Engineer the following to be considered for pre-qualification to bid:
 - (i) A list of materials to be provided for work under this Article, including the name and address of the materials producer and the location from which the materials are to be obtained
 - (ii) Three (3) hard copies of the following:
 - 1) Aggregate: sieve analysis
 - 2) Non-woven geotextile: product manufacturer specification sheets
 - 3) Impermeable liner (if required): product manufacturer specification sheets
 - 4) Modular stormwater storage units: Brentwood Industries shop drawings, specification sheets, installation instructions and maintenance guidelines

- (iii) Sub-surface Stormwater Storage System Component Samples for review:
 - 1) Aggregate: loose material in a sealed bag labeled with name of material and manufacturer to be submitted prior to placement for analysis
 - 2) Sub-surface Stormwater Storage System Modules; provide a single 36" long by 18" wide, height as specified, unit of the product for review.
 - a) Sample to be retained by Owner
 - b) Manufacturers named as acceptable herein are not required to submit samples

Section 1.04 Quality Assurance

(a) Materials

- (i) All materials, methods of construction, and workmanship shall conform to applicable requirements of ASTM and AASHTO Standards, unless otherwise specified.
- (ii) The quality of material and the finished components shall be subject to inspection by the Engineer. Such inspection may be made on-site upon delivery or at any point thereafter. The components shall be subject to rejection at any time if material fails to meet any of the specification requirements, even though sample components may have been accepted as satisfactory. Components rejected after delivery to the site shall be marked for identification and shall be removed from the site at once.

(b) Inspection

- (i) All components shall be inspected for general appearance, dimensions, soundness, etc.
- (ii) Upon completion of relevant excavation work, and prior to placement of geotextile and aggregate, the sub-base soil shall be inspected by Specifying Engineer or authorized representative and be signed off on by the Engineer of Record as acceptable and meeting manufacturer's recommendations.
- (iii) Upon completion of the placement of the sub-surface stormwater storage system (as specified) and geotextile, and prior to backfilling, the structure shall be inspected by Specifying Engineer or authorized representative and signed off on by the Engineer of Record as acceptable and meeting manufacturer's recommendations.

(c) Defects

- (i) Products with structural defects shall be immediately removed and replaced with acceptable parts. The Specifying Engineer, before final acceptance, shall carefully inspect repairs/replacements.



Section 1.05 Delivery, Storage, and Handling

- (a) Components shall be unloaded, handled and stored in an area protected from traffic and in a manner to prevent damage. All plastic wrapping from the packaging of side panels and platens should be removed and the columns shall be stored under a tarp or roof.
- (b) If stored for an extended period, additional measures should be taken to prevent UV and weathering damage.
- (c) Stored components should be checked at least once a week. A check of the stored area should be done to make any minor repairs to the cover or to restack any components that could have fallen.

Article II. Materials

Section 2.01 Aggregate

- (a) Course aggregates shall meet the following requirements:
 - (i) Maximum Wash Loss: 1% (ASTM C117)
 - (ii) Minimum Durability Index: 35 (ASTM D3744)
 - (iii) Maximum Abrasion of 10% for 100 revolutions and maximum of 50% for 500 revolutions
 - (iv) All aggregate shall be clean and thoroughly washed.
 - (v) Aggregate shall be 100% crushed material.
- (b) Unless otherwise approved by Specifying Engineer, coarse aggregate for the sub-surface stormwater storage system shall be uniformly graded as defined below:
 - (i) $\frac{3}{4}$ " angular clean stone (AASHTO #56, 57, 6, 67, 68)
- (c) Sand shall not be an acceptable substitute for coarse aggregate, unless approved by the Engineer of Record and manufacturer.

Section 2.02 Geotextiles

- (a) Non-woven geotextile, minimum 6 oz., or alternative fabric approved by Engineer of Record.
- (b) Impermeable liner, when required, shall be either LLDPE, PVC or EPDM selected by the Engineer of Record in conjunction with liner manufacturer.

Section 2.03 Sub-surface Stormwater Storage System Modules

- (a) The stackable sub-surface stormwater storage system modules indicated on the construction plans, capable of exceeding earth loads produced by the required backfill. The module under the required 2.0 ft. cover must withstand, at a minimum live loading consisting of the design truck (HS-20) as well as the HS-25 loading in accordance with AASHTO LRFD Bridge Design Requirements, without geogrid. The modules shall be made from 100% virgin polypropylene and 100% recycled PVC to meet the following requirements:



- (i) 100% Virgin High Impact Polypropylene Copolymer Material
 - 1) Injection molded, top/bottom platens and side panels formed to a dimension of 36" (914 mm) long x 18" (457 mm) wide [NOMINAL].
 - (ii) 100% Recycled PVC Material
 - 1) PVC Conforming to ASTM D-1784 Cell Classification 12344 b-12454 B
 - 2) Extruded, rigid, and 100% recycled PVC columns sized for applicable loads as defined by AASHTO HS-25 Loading and manufactured to the required length per engineer approve drawings.
 - (iii) The top/bottom platens and columns are assembled on-site to create modules, which can be uniformly stacked, up to two modules high, in vertical structures of variable height as indicated in the Construction Plans.
 - (iv) Modular stormwater storage units must have a 95% void space and be continuously open in both length and width, with no walls or partitions, except for the debris collection area.
- (b) Testing
- (i) Live Load Testing
 - 1) Manufacturer shall make available testing data from a 3rd party.
 - 2) Testing should be completed on units in a manner matching installation recommendations, including aggregate bed, sides and top. Steel press data is not acceptable.
 - a) Test load should be applied to a 10" x 20" load pad via a hydraulic or pneumatic ram, to simulate fully factored (LL + Dynamic Load Allowance + Multiple Presence Factor + Live Load Factor) HS-25 load on the minimum recommended cover.
 - b) Test load applied via test vehicle are not acceptable.
 - 3) Testing should include instrumentation to measure displacement and strain.
 - (ii) Lateral Load Testing
 - 1) Manufacturer shall make available testing data from a 3rd party.
 - 2) Testing should be completed on units in a manner matching installation recommendations, including aggregate bed, sides and top. Steel press data is not acceptable.
 - 3) Testing should include instrumentation to measure displacement and strain.
 - (iii) Long Term Creep Testing (Dead Load Testing)
 - 1) Manufacturer shall make available testing data from a 3rd party.
 - 2) Testing should be completed on units in a manner matching installation recommendations, including aggregate bed, sides and top. Steel press data is not acceptable.

- a) Test load is a uniform factored (DL + Dead Load Factor) load, based on maximum burial recommendations.
 - b) Time temperature superposition or other acceptable physical testing methods shall be utilized.
 - c) Simulations or FEA (finite element analysis) are not acceptable
- 3) Testing should include instrumentation to measure displacement and strain.

(c) Rejection

- (i) The Sub-surface Stormwater Storage System may be rejected for failure to meet any of the requirements of this specification.

Article III. EXECUTION

Section 3.01 General Conditions

- (a) Coordinate the installation with the product distributor, as specified in Section 1.01, to have the distributor on-site during product installation, or at minimum a preconstruction meeting.
- (b) Review manufacturer's installation procedures and coordinate Sub-surface Stormwater Storage System installation with other work affected, such as grading, excavation, utilities, construction access, erosion control, etc.
- (c) Cold weather installation or assembly of modules should not be undertaken when temperatures are below 40° F (4.44° C), without utilization of a heated facility.
- (d) Assembled modules may be walked on, but vehicular traffic is prohibited until properly backfilled and covered per Manufacturer's recommendations. Protect personnel and the installation against damage with highly visible construction tape, fencing, or other means until construction is complete.

Section 3.02 Cleaning

- (a) Perform cleaning during the installation of work and upon completion of the work.
- (b) 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



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