

**SECTION 07 13 54**  
**THERMOPLASTIC SHEET WATERPROOFING**

**PART 1 GENERAL**

1.01 DESCRIPTION

A. Scope:

1. Install an adhered thermoplastic PVC membrane Waterproofing System manufactured utilizing a spread coat process with fiberglass reinforcement with integral flashings and other components.
2. The work includes, but is not limited to, the following:
  - a. Substrate preparation.
  - b. Grounding screen.
  - c. Cover board.
  - d. Waterproofing membrane.
  - e. Membrane flashings and copings.
  - f. Metal flashings.
  - g. Wood blocking.
  - h. Sealants and adhesives.

B. Related Work Under Other Sections:

1. Section 32 95 00 – Extensive Vegetated Roof Cover Assembly.

1.02 QUALITY ASSURANCE

- A. The Waterproofing System shall be installed only by an Installer authorized by approved Waterproofing Manufacturer. Installer shall be certified by the Waterproofing Manufacturer prior to bid.
- B. Installation of all Waterproofing System components up to and including the waterproofing membrane shall be the responsibility of the Installer to ensure undivided responsibility.
- C. Obtain primary waterproofing, membrane, flashings, and appurtenances from a single waterproofing system manufacturer with not less than 20 years of successful experience in waterproofing applications. Provide other system components only as approved by Waterproofing Manufacturer.
- D. Pre-construction conference to be held with the owner, Engineer, Applicator's field superintendent, waterproofing foreman, Waterproofing Manufacturer's representative, landscaper, and other involved trades to discuss waterproofing practices applicable to the project.

- E. There shall be no deviation made from the contract specification or the approved shop drawings without prior written approval by the Owner or the Owner's Representative, and/or design professional, and Waterproofing Manufacturer.
- F. The Installer shall follow Manufacturer's Required Quality Assurance Procedures for Adhered Membrane. Contractor shall notify Engineer and Owner a minimum of forty-eight (48) hours in advance of its intent to commence work in order to allow the Design Professional the opportunity to examine and inspect the existing conditions prior to the application of new roofing.
- G. Waterproofing Manufacturer Representative shall inspect installation during and after roof application and submit written certification to Engineer that installation is in conformance with specifications. Waterproofing Manufacturer's Representative shall attend job meetings and submit written reports of all inspections on a weekly basis. No final payment will be made without written reports. Installation of entire assembly shall be in accordance with Factory Mutual Construction Bulletin 1-29, latest edition issue for Factory Mutual Class I Construction.
- H. Waterproofing Installers Qualifications:
  - 1. Installer shall have been roofing business continuously for a minimum of five years under the same company name.
  - 2. Installer is certified by Waterproofing Manufacturer of the roofing products prior to bid.
  - 3. Installer shall have installed the specified waterproofing system on at least three projects that are currently at least 5 years old with no workmanship failures.
  - 4. Installer shall have at least three jobs in size not less than 80% of this project size completed within past 5 years
- I. Waterproofing Manufacturer Qualifications:
  - 1. Waterproofing Manufacturer of selected Waterproofing System shall have product in use in the continental United States continuously for a period of not less than 10 consecutive years.
  - 2. Waterproofing Manufacturer of selected Waterproofing System shall have not less than five million square feet fully installed for not less than 7 years.

3. The selected Waterproofing System shall have been manufactured as submitted for not less than seven years without significant (less than 3%) chemical change or physical change of any kind. Furnish Waterproofing Manufacturer's certification.
  4. Waterproofing Manufacturer's Representative shall provide roofing inspection service by qualified technical, non-sales representative, for 1st work day of roofing for each roof and then weekly visits to site during installation to review installation procedures and to advise on procedures and precautions in use of roofing system.
- J. Electronic Leak Detection Testing (Standard Warranty) – The Waterproofing Installer shall arrange for testing through Waterproofing Manufacturer. See Section 3.11.

### 1.03 SUBMITTALS

- A. The Installer shall submit to the Owner's Representative and/or Design Professional the following:
1. A letter from Manufacturer certifying that the Installer is an approved Waterproofing Installer in good standing prior to the bid.
  2. Shop drawings and details that have been stamped and accepted by Waterproofing Manufacturer.
  3. Specimen copy of Waterproofing Manufacturer warranty.
  4. Specimen copy of warranty.
  5. Sample of Waterproofing membrane, grounding screen, thermal barrier, and cover board.
  6. Waterproofing Manufacturer's written inspection reports.
  7. Certificate of compliance of the system with Factory Mutual Construction Bulletin 1-29.
  8. Waterproofing Manufacturer's Qualifications as specified in 1.02.I.
  9. Material Safety Data Sheets (MSDSs) as required by General Specification S-018.
  10. Results of all electric leak detection testing.

### 1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Comply with General Specification S-018.
- B. All products delivered to the job site shall be in the original unopened containers or wrappings.
- C. Handle all materials to prevent damage. All materials shall be placed on pallets and fully protected from the elements with canvas tarpaulins.
- D. Membrane rolls shall be stored lying down on pallets and fully protected from moisture with canvas tarpaulins.

- E. Membrane, adhesives, and surface conditioner shall be stored at temperatures above 40 degrees F, or as per Manufacturer's recommendations.
- F. All flammable materials shall be stored in a cool dry area away from sparks and open flames. Follow precautions outlined on container or supplied by the material manufacturer/supplier.
- G. All material which the Owner's representative and/or Waterproofing Manufacturer determine to be damaged shall be removed from the job site and replaced at no cost to the Owner.

#### 1.05 JOB CONDITIONS

- A. Proceed with installation only after substrate preparation is complete. Owner's Representative and/or Design Professional and Installer must accept substrate before proceeding with membrane installation.
- B. Substrate must be clean, smooth and dry. Do not work in rain or snow or adverse weather conditions. Severe temperatures, moisture and humidity may affect the installation of products during construction. Comply with applicable installation requirements for all components. Ambient and substrate temperature must meet the minimum requirements as outlined in Manufacturer's published installation instructions.
- C. All work shall be scheduled and executed without exposing the completed waterproofing system and the building interior to the affects of inclement weather. The building and its contents shall be protected against all risks.
- D. The adequacy of the building to support the finished green roof has been verified by the Design Professional. The Installer is responsible for ensuring that the structure is not overloaded during installation.
- E. All new and temporary construction materials, including equipment and accessories, shall be secured in such a manner, at all times, as to preclude wind blow-off or damage.
- F. Liquid materials such as solvents and adhesives shall be stored and used away from open flames, sparks and excessive heat.
- G. The Installer shall take all necessary precautions when using adhesives or surface conditioner around building ventilation intakes and prevent volatile fumes or odors from entering the building ventilation system.

- H. The Installer shall verify that all drain lines are connected and un-blocked before starting work. Report all such blockages or non-connected drains to the Owner's representative and/or Design Professional in writing.
- I. The Installer is cautioned that PVC membranes are incompatible with asphalt, coal-tar, polystyrene, oil-based and plastic-based cements, creosote, penta-based materials, grease, fats, oils, and solvents. Such materials shall not come in contact with the waterproofing membrane at any time. If such contact occurs, the material shall be cut-out, discarded and patched.
- J. The adhered membrane flashing can be installed over existing residual asphalt-based waterproofing materials provided the material is fully cured, clean, sound and firmly bonded to the substrate (see Paragraph 3.02). Do not install self-adhered membrane over coal tar pitch.
- K. Arrange work sequence to avoid use of newly installed waterproofing for storage, walking surface, and equipment movement. Where such access is absolutely required, the Installer shall provide all necessary temporary protection and barriers to segregate the work area and to prevent damage to adjacent areas. Adequate protection of the membrane shall be provided for all waterproofing areas which receive traffic during construction. All damage which occurs to the waterproofing membrane and/or system shall be brought to the attention of the Owner's Representative and/or Design Professional and Waterproofing Manufacturer's Representative. All damage shall be repaired according to Waterproofing Manufacturer's recommendations. The party responsible for damage shall bear the cost of repairs.
- L. All demolished material removed for construction shall be immediately taken off the site to a legal dumping area authorized to receive such materials. Refer to Drawings for final disposition of removed ballast.
- M. If any unusual or concealed condition is discovered, stop work and notify the Owner's representative and/or design professional and Waterproofing Manufacturer's Representative immediately, in writing.
- N. Site cleanup, including both interior and exterior building areas in any way affected by the construction, shall be complete and to the Owner's satisfaction. All landscaped areas affected by construction activities shall be raked clean and seeded. All paved areas shall be swept clean. All areas stained, dirtied, discolored or otherwise damaged due to this work shall be cleaned, restored, or replaced as required to match the condition prior to the start of this work.

## 1.06 SEQUENCING OF THE WORK

- A. Do not proceed with installation of vegetative cover over the completed sections of the waterproofing without the acceptance of the Owner's Representative, Design Professional, and Waterproofing Manufacturer. A copy of the Final Inspection for Warranty is considered acceptance from Waterproofing Manufacturer.
- B. Protect the membrane and coordinate with other trades to avoid traffic over completed membrane surfaces.

## 1.07 BIDDING REQUIREMENTS

- A. Pre-Bid Meeting: Comply with P-003.
- B. Site Visit:
  - 1. Bidders shall visit the site and carefully examine the areas in question as to conditions that may affect proper execution of the work.
  - 2. All dimensions and quantities shall be determined or verified by the contractor.
  - 3. No claims for extra costs will be allowed because of lack of full knowledge of the existing conditions unless agreed to in advance with the Owner or Owner's Representative.

## 1.08 WARRANTIES

- A. General: A Waterproofing Manufacturer Representative's presence on a project regardless of reason, length, or frequency, does not imply that any additional coverage beyond that stated in the warranty is in effect.
- B. Installer's Warranty: The Installer shall supply the Owner with a minimum two-year workmanship warranty. The warranty obligation shall run directly to the Owner with a copy to Waterproofing Manufacturer.
- C. Waterproofing Manufacturer Warranty:
  - 1. Single-Source Warranty – Extensive Green Roofs (20 years). The Installer shall provide Waterproofing Manufacturer's Single-Source warranty to the Owner at the successful completion of the project.
  - 2. The Installer must be authorized and factory-trained by the Waterproofing Manufacturer prior to the project bid date and have authorization to perform installation of warranted waterproofing systems.
  - 3. The Waterproofing Manufacturer shall warrant to the Owner the vegetative cover and the repair of leaks in the waterproofing membrane resulting from defects in the membrane or workmanship for a period of 20 years. This warranty shall also guarantee 80% foliage

coverage so long as the Owner maintains a maintenance agreement approved by the Waterproofing Manufacturer and executed by a contractor accepted by the Waterproofing Manufacturer, for the duration of the warranty period. The warranty shall include provisions to repair or replace specified materials that have failed within the warranty period. System failures covered by the warranty shall include, in addition to leaks, the following:

- a. Failure of the vegetated cover system to support a robust ground cover
- b. Loss of soil permeability
- c. Development of anaerobic conditions in the profile
- d. Loss of drainage capacity
- e. Development of soil pathogens
- f. Deleterious changes in pH
- g. Slope related instability of the vegetated cover system
- h. Wind or water erosion of the vegetated cover system

## **PART 2 MATERIALS**

### **2.01 WATERPROOFING SYSTEM**

- A. Grounding Screen:
  1. Bright aluminum 18 x 16 screen mesh, supplied in 6 ft x 100 ft rolls packaged in a protective cardboard carton.
  2. Grounding screen shall be approved by the Waterproofing Manufacturer to be compatible with the waterproofing system.
  3. Grounding screen shall be installed per the roofing sections and details shown on the Drawings.
- B. Cover Board:
  1. Siliconized gypsum, fire-tested roof board with glass-mat facer.
  2. Thicknesses as noted on Project Drawings.
  3. Manufacturer:
    - a. DensDeck Prime, by Georgia-Pacific
    - b. Or approved equal.
- C. PVC Membrane:
  1. Provide self-adhered thermoplastic membrane with non-woven fiberglass reinforcing and lacquer coating.
  2. Membrane shall conform to ASTM D 4434 (latest version), "Standard for Polyvinyl Chloride Sheet Roofing". Classification: Type II, Grade I. Sarnafil G476-SA, 80 mil, thermoplastic membrane utilizing the spread coat process to include fiberglass reinforcement and lacquer coating.
  3. Waterproofing Manufacturer shall certify that the polymer thickness is of the polymer thickness specified. Certification is to be signed by the

Waterproofing Manufacturer's quality control manager. ASTM tolerance for membrane thickness is not accepted.

4. Membrane Properties:

<u>Parameters</u>	<u>ASTM Test Method</u>	<u>ASTM D-4434 Spec. Requirement</u>	<u>Typical Physical Properties</u>
Reinforcing Material	-	-	Fiberglass
Overall Thickness(1), min., inches (mm)	D638	0.045 (1.14)	[0.080 inches]
Thickness Above Scrim	-	-	0.023 (avg.)
Tensile Strength, min., psi (MPa)	D638	1500 (10.4)	1600 (11.1)
Elongation at Break, min. (machine / transverse)	D638	250% / 220%	250% / 220%
Seam strength(2), min. (% of tensile strength)	D638	75	80
Retention of Properties After Heat Aging	D3045	-	-
Tensile Strength, min., (% of original)	D638	90	95
Elongation, min., (% of original)	D638	90	90
Tearing Resistance, min., lbf (N)	D1004	10 (45.0)	14 (63.0)
Low Temperature Bend, -40° F (-40° C)	D2136	Pass	Pass
Accelerated Weathering Test (florescent light, uv exposure)	G154	5,000 Hours	10,000 Hours
Cracking (7x magnification)	-	None	None
Discoloration (by observation)	-	Negligible	Negligible
Crazing (7x magnification)	-	None	None
Linear Dimensional Change	D1204	0.10 % max.	0.02%
Weight Change After Immersion in Water	D570	± 3.0% max.	2.5%
Static Puncture Resistance, 33 lbf (15 kg)	D5602	Pass	Pass
Dynamic Puncture Resistance, 7.3 ft-lbf (10 J)	D5635	Pass	Pass
Initial Solar Reflectance	E903	-	0.83
Emissivity	E408, C1371, Other	-	0.90
Solar Reflective Index (SRI)	E1980	-	104
Recycled Content (5 & 10 ft. sheets only)	8 to 12% Pre-Consumer / Up to 1% Post Consumer.		

Notes:

- (1) Typical Physical Properties data is applicable for 0.048 in (1.2 mm) membrane thickness and greater.
- (2) Failure occurs through membrane rupture not seam failure.

5. Color of Membrane: Orange.

## 2.02 SYSTEM FLASHING PRODUCTS AND ACCESSORIES

### A. Flashing:

1. Protection Membrane:
  - a. 60 mil PVC membrane.
  - b. A fiberglass reinforced membrane adhered to approved substrate using approved adhesive. Consult Waterproofing Manufacturer's Product Data Sheets for adhesive options and additional information.
  - c. Manufacturer:
    - 1) G410-20 EnergySmart by Sarnafil.
    - 2) Or approved equal.
2. PVC clad metal flashing:
  - a. A PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. This shall be a minimum 24 gauge, G90 galvanized metal sheet with a 20 mil (0.5 mm) unsupported membrane laminated on one side. Consult Waterproofing Manufacturer's Product Data Sheet for additional information.

### B. Parapet Coping:

1. Coping system shall be aluminum coping cap with galvanized steel anchor cleats and gutter support chairs.
2. Systems shall be watertight and not require exposed fasteners or sealant
3. Joints: butt-type with concealed splice plates.
4. Performance:
  - a. Coping sections shall expand and contract freely while mechanically locked in place on anchor cleats.
  - b. Coping sections shall lock to anchor cleats by mechanical pressure from support chairs.
  - c. All coping cover joints shall be underlain with gutter/support chairs capable of draining water.
5. Material: 0.050" thick aluminum.
6. Coping Cap:
  - a. Length: 10'-0".
  - b. Width: As shown on the drawings. Field-verify and coordinate fabrication.
7. Coping Vertical Face and Back Leg: Field-verify and coordinate fabrication.
8. Internal Splice Plates: Concealed with finish matching coping cap.
9. Gutter/Support Chair: Metal gutter chair in color and finish to match coping cap.
10. Finish:
  - a. Standard precoated Kynar-500.
  - b. Color: selected by Owner through submittal process.

11. Accessories: Corners, end caps, pier caps, etc shall be fabricated by the coping manufacturer.
12. Manufacturer:
  - a. Permasnap, by W.P. Hickman.
  - b. Or approved equal.

## 2.03 ATTACHMENT COMPONENTS

### A. Fastening Components:

1. Fastening Plate: Used with various fasteners to attach cover board to roof deck. 3 inch square or round, 26 gauge stamping of SAE 1010 steel with an AZ 55 Galvalume coating.
2. Fasteners:
  - a. No. 12 corrosion-resistant fastener used with fastening plates to attach insulation boards to steel or wood roof decks. Shall have modified buttress thread, a minimum shank diameter of 0.168 inch and a thread diameter of approximately 0.214 inch.
  - b. A drive-pin expansion type fastener for attachment of membrane, flashing, termination bars, and expansion joints to concrete, masonry, and brick with zinc sheaths and stainless steel pins.
  - c. A threaded fastener with a rubber gasket used with termination bar to terminate flashings into masonry substrates such as concrete and concrete block.
3. Termination Bar:
  - a. An extruded aluminum, flat low profile bar used to terminate flashing membrane.

### B. Accessories:

1. Aluminum tape: A pressure-sensitive aluminum tape used as a separation layer between small areas of asphalt contamination and as a bond-breaker.
2. Hot-air welder: 220 volt, self-propelled, hot-air welding machine used to seal long lengths of Sarnafil membrane seams.
3. Solvent: Solvent cleaner, approved by Waterproofing Manufacturer, for general cleaning of residual asphalt, scuff marks, etc., from the membrane surface.
4. Sealant used at flashing terminations.
5. Reglet: A heavy duty, surface mounted aluminum flashing termination reglet used at walls.

## 2.04 RELATED MATERIALS

### A. Wood Nailer:

1. Wood nailers shall be treated for fire and rot resistance (ACQ treated) and be No. 2 quality or better lumber.

2. Creosote or asphalt-treated wood is not acceptable.
  3. Wood nailers shall conform to Factory Mutual Loss Prevention Data Sheet 1-49.
  4. All wood shall have a maximum moisture content of 19% by weight on a dry-weight basis.
- B. Plywood:
1. When adhering the flashing membrane directly to plywood, a minimum 1/2 inch (13 mm) CDX (C side out), smooth-surfaced exterior grade plywood with exterior grade glue shall be used.
  2. Rough-surfaced plywood or high fastener heads will require the use of felt behind the flashing membrane.
  3. Plywood shall have a maximum moisture content of 19% by weight on a dry weight basis.
- C. Miscellaneous Fasteners and Anchors:
1. Fasteners are to be compatible with materials in contact with fasteners.
  2. All fasteners and anchors shall have a minimum embedment of 1-1/4 inches and shall be approved for such use by the fastener manufacturer.
  3. Fasteners for attachment of metal to wood blocking shall be annular ring nails.
  4. Fasteners for attachment of metal to masonry shall be all-metal expansion type fasteners.
  5. All fasteners shall meet Factory Mutual Standard 4470 for corrosion resistance.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine all surfaces scheduled to receive waterproofing membrane and flashing for roughness, contaminants, unsound structural substrates or other conditions that may impair the waterproofing application. Notify the owner and copy Waterproofing Manufacturer in writing of all such conditions. Do not commence work until all defects are remedied.
- B. Installer shall be responsible for acceptance or provision of proper substrate to receive new waterproofing materials.
- C. Installer shall verify that the work done under related sections meets the following conditions:
  1. Roof drains and/or scuppers have been reconditioned and/or replaced and installed properly.

2. Roof curbs, nailers, equipment supports, vents and other roof penetrations are properly secured and prepared to receive new waterproofing materials.
3. All surfaces are smooth and free of dirt, debris and incompatible materials.

### 3.02 SUBSTRATE PREPARATION

- A. Green Roof Waterproofing over existing Roofing:
  1. General Criteria:
    - a. Remove all gravel ballast. Slice EPDM in rough 10-foot sections. Do not slice more roof than can be waterproofed in a work day. Grounding screen shall be installed directly over existing EPDM membrane. Install 1/2-inch cover board shall be installed attached to structure with fasteners and plates.
    - b. Install Waterproofing Membrane. Membrane shall be adhered to cover board complete with all flashings. Perimeter edge shall be removed and reinstalled to allow for proper flashing of Green Roof waterproofing system.
    - c. Residual material of most products, including those that are asphalt based, may remain with the exception of coal tar. All coal tar pitch residue must be completely removed.
  2. Steel Deck:
    - a. All rusted or deteriorated decking shall be brought to the attention of the Owner's Representative to determine method of treatment or replacement. Surface-only rusted metal shall be sanded and treated with rust-inhibiting paint. Sections that have rusted deeper than the surface or are not structurally sound shall be removed and replaced with matching deck type.

### 3.03 WOOD NAILER INSTALLATION (where required)

- A. Install continuous wood nailers at the perimeter of the entire area and around projections and penetrations as shown on the Drawings. Thickness shall be as required to match substrate and/or insulation height to allow a smooth transition.
- B. Nailers shall be anchored to resist a minimum force of 300 pounds per linear foot in any direction. Individual nailer lengths shall not be less than 3 feet long. Nailer fastener spacing shall be at 12 inches on-center or 16 inches on-center if necessary to match the structural framing. Fasteners shall be staggered 1/3 the nailer width and installed within 6 inches of each end. Two fasteners shall be installed at ends of nailer lengths. Nailer attachment shall also meet the requirements of the current Factory Mutual Loss Prevention Data Sheet 1-49.

- C. Stainless steel, corrosion resistant, fasteners are required when mechanically attaching any product to wood nailers and wood products treated with ACQ (Alkaline copper Quaternary). When ACQ treated wood is used on steel roof decks or with metal edge detailing, a separation layer must be placed between the metal and ACQ treated wood.

### 3.04 GROUNDING SCREEN AND COVER BOARD INSTALLATION

- A. Grounding Screen Installation:
  - 1. Lay the grounding screen over existing EPDM, as shown.
  - 2. Overlap adjacent grounding screen edges a minimum of 3 inches. Positive contact between adjacent sheets is required at both side and end laps. Adjacent sheets may be taped together using duct or aluminum tape to prevent shifting.
  - 3. Connect the grounding screen to a conductive part of the structure at several separate locations – examples: metal deck or metal curb, metal vent stack, etc. Use 2 inch wide strip of the grounding layer extended from the grounding layer to the structure, and tape it into place. Extend 2 inch strips behind wall flashing and under counterflashing periodically for future connection as described in Waterproofing Manufacturer grounding screen installation instructions.

Cover Board Installation: The cover board shall be mechanically fastened to the structure through the grounding screen

### 3.05 ADHERED THERMOPLASTIC WATERPROOFING MEMBRANE INSTALLATION

- A. Comply with Waterproofing Manufacturer's most current quality assurance requirements, installation instructions, specific recommendations, and approved shop drawings for this project.
- B. All surfaces shall be dry and free of dirt, dust, and debris.
- C. Apply adhered PVC waterproofing membrane only in dry weather, and when the membrane, air, and substrate temperature is a minimum of 25 degrees F and a minimum 40 degrees F over unprimed cover boards.
- D. Workers and all others that walk on the waterproofing shall wear clean, soft-soled shoes so as not to damage materials. Heed all Manufacturer's cautions and warnings in regard to product use. Membrane is slippery when wet or covered with frost, snow, and ice. Take proper precautions.
- E. Lay out work to minimize traffic over installed areas.

### 3.06 HOT-AIR WELDING OF LAP AREAS

#### A. General:

1. All surfaces to be welded shall be clean and dry. No contaminants shall be present within lap areas.
2. Adjacent sheets shall be hot-air welded in accordance with Waterproofing Manufacturer's instructions. All seams shall be hot air welded. Lap area shall be a minimum of 2-1/2 inch wide. Overlaps shall be with the flow of water where possible.
3. Patch all 3-way membrane overlaps (T joints) with a minimum 60 mil thick, 4 inch round or square patch.
4. Welding equipment shall be provided by or approved by Waterproofing Manufacturer's.

#### B. Machine Welding:

1. Machine welded seams are achieved by the use of automatic welding equipment. When using this equipment, Waterproofing Manufacturer's instructions must be followed and local codes for electric supply, grounding and over current protection observed. A dedicated portable generator (30 A, 220 V, and recommended min. 7,500 Watts) is required. No other equipment shall be operated off the generator.

#### C. Quality Control of Welded Seams:

1. All completed welded seams shall be checked by the Waterproofing Installer after cooling for continuity using a rounded screwdriver or other suitable blunt object.
2. On-site evaluation of welded seams shall be made daily by the Waterproofing Installer.
3. Cross-section samples shall be taken a minimum of three times a day through completed seams and evaluated immediately.
4. Each test cut shall be patched by the Waterproofing Installer.

### 3.07 MEMBRANE FLASHINGS

- A. All flashings shall be installed concurrently with the waterproofing membrane according to Waterproofing Manufacturer approved details as the job progresses. Flashings shall be adhered to compatible, dry, smooth, and solvent-resistant surfaces. All masonry joints shall be struck flush. Rough or incompatible surfaces may be covered with minimum 1/2 inch (13 mm) CDX plywood. (Do not apply surface conditioner to plywood flashing substrates). Flashing may be self-adhered waterproofing membrane or waterproofing membrane with field-applied adhesive installed according to Waterproofing Manufacturer's printed instructions.

- B. When adhering to vertical surfaces greater than 30 inches in height, provide intermediate fastening of the flashing membrane according to Waterproofing Manufacturer's requirements.
- C. Complete the entire waterproofing assembly and flashing in a single working day; avoid exposure of any components to rain, snow, or dew. If rain threatens during the day, or in an emergency, protect the unfinished exposed waterproofing and flashing components. Waterproofing Installer is solely responsible for complete water-tightness of the roof during the course of the work.
- D. All flashing membranes shall be mechanically fastened along the top edge according to approved Waterproofing Manufacturer details. Acceptable fasteners shall be used to secure flashings to substrate. Seal top of termination with an acceptable sealant.
- E. All flashings shall extend a minimum of 8 inches above the overburden (green roof media) unless previously accepted by the Owner's representative and/or Engineer and Waterproofing Manufacturer, in writing.
- F. A minimum 8 inch wide cover strip shall be used where self-adhered flashing membranes meet at end laps, butt joints, and all non-selvedge edges. Butt adjoining sheets closely, center the cover strip over both membranes and hot-air weld. Complete inside and outside corner flashing details with prefabricated corner patches
- G. No bituminous residue shall be in contact with the underside of the membrane flashing, unless self-adhered membrane or asphalt resistant membrane is used. Flashing substrates contaminated with coal-tar shall be completely cleaned, or overlaid with minimum 1/2 inch thick CDX plywood or minimum 24 gauge stainless steel sheet metal.

### 3.09 PVC CLAD METAL FLASHINGS

- A. Complete all metal work in conjunction with waterproofing and flashings so that a watertight condition exists daily.
- B. Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.
- C. Metal joints shall be watertight.
- D. Metal flashings shall have a 4 inch minimum nailing flange and shall be fastened into solid wood blocking 4 inches on center staggered, or into concrete with acceptable concrete anchors 6 inches on center staggered.

Fasteners shall penetrate the wood nailer a minimum of 1-1/4 inch or into concrete a minimum of 1 inch.

- E. Adjacent sheets of PVC clad metal shall be spaced 1/4 inch apart. The end joints of the metal shall be fastened 6 inches on center. The joints shall be covered with 2 inch wide aluminum tape. A 4 inch wide membrane flashing strip shall be hot air welded over the joint.

### 3.10 TEMPORARY CUT-OFF

- A. All flashings shall be installed concurrently with the membrane in order to maintain a watertight condition as the work progresses. Provide temporary cut-offs around exposed edges and at incomplete flashing areas from the new membrane to the structural deck or existing waterproofing. Remove the cut-offs completely before proceeding with subsequent work.
- B. If inclement weather occurs while a temporary cut-off is in place, the Applicator shall provide the labor necessary to monitor the situation to maintain a watertight condition.

### 3.11 ELECTRIC LEAK DETECTION TESTING

- A. Provide electric leak detection testing over the completed waterproofing membrane for testing of capillary defects and/or breaches in the membrane prior to the installation of subsequent layers.
- B. Should leaks be discovered, the Waterproofing Installer shall locate leak source(s) and make repairs. Re-test to assure watertightness. All costs associated with the repairs shall be borne by the Waterproofing Installer.
- C. Testing shall be conducted at end of installation and prior to vegetated roof cover assembly.

**END OF SECTION**

**SECTION 32 95 00**  
**EXTENSIVE VEGETATED ROOF COVER ASSEMBLY**

**PART 1 GENERAL**

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Construction Management Agreement and Division 01 Specification Sections, apply to this Section.
- B. Related requirements specified elsewhere include:
  - 1. Thermoplastic Sheet Waterproofing – Section 07 13 54.

1.02 SUMMARY

- A. Section specifies all labor, materials, transportation, equipment and services necessary to assemble a complete vegetated roof cover assembly and shown on the Drawings and described herein. This system shall be installed in conjunction with a compatible Waterproofing System that has been certified as root resistant by the Waterproofing Manufacturer.

1.03 REFERENCES

- A. Referenced standards and abbreviations:
  - 1. System Provider's specifications and recommendations.
  - 2. American Standard Testing Method Standards – abbreviated as "ASTM."
  - 3. ASTM E2396: Standard Testing method for Saturated Water Permeability of Granular Drainage Media [Falling-Head Method] for Green Roof Systems
  - 4. ASTM E2399: Standard Testing Method for Maximum Media Density for Dead Load Analysis
  - 5. ASTM D5199: Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
  - 6. ASTM D4833-e1: Standard Test Method for Index Puncture resistance of Geotextiles, Geomembranes, and Related Products
  - 7. ASTM D5261: Standard Test Method for Measuring Mass per Unit Area of Geotextiles
  - 8. ASTM E2397: Standard Practice for Determination of Dead Loads and Live Loads Associated with Green Roof Systems
  - 9. ASTM C131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

10. ASTM C88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
11. ASTM C29M: Standard Test Method for Bulk Density (Unit Weight) and Voids in Aggregate
12. ASTM C136-06: Standard Test Method for Sieve analysis of Fine and Coarse Aggregates
13. ASTM D3776: Standard Test Methods for Mass per Unit Area (Weight) of Fabric
14. ASTM D4632: Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
15. ASTM D4491-a: Standard Test Methods for Water Permeability of Geotextiles by Permittivity
16. ASTM D422: Standard Test Method for Particle-Size Analysis of Soils
17. ASTM D5035: Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
18. ASTM D1777: Standard Test Method for Thickness of Textile Materials
19. ASTM D4716: Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
20. ASTM D3786-e1: Standard Test Method for Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method
21. ASTM D1621-a: Standard Test Method for Compressive Properties of Rigid Cellular Plastics
22. ASTM C40: Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
23. ASTM C140: Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
24. ASTM C67- a: Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
25. UL Inc.: Class a Classification for use in Ballasted Systems.
26. Methods of Soil Analysis, American Society of Agronomy (1996) - abbreviated as "MSA."
27. Test Methods for the Examination of Composting and Compost (latest) – abbreviated as "TMECC."
28. Recommended Chemical Soil Testing Procedures, North Central Region Publication #221 – abbreviated as "RCSTP."
29. USDA Handbook #60 – abbreviated as "USDA."
30. Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e.V. [The Landscaping and Landscape Development Research Society], methods to be based on the latest English edition – abbreviated as "FLL."
31. National Concrete Masonry Association, Design Manual for Segmental Retaining Walls (latest) – abbreviated "NCMA".

## 1.04 DEFINITIONS

- A. Drain Conduit: Perforated or slotted conduit installed in the drainage layer that is used to intercept and drain away percolating rainfall during design storm events.
- B. Drainage Layer: A granular mineral material, synthetic geocomposite, or synthetic mat used to: 1) promote aerated conditions in the overlying growth media layer, and 2) manage rainfall runoff and convey it to the roof drains. Granular drainage layers will also augment the root volume for the plants.
- C. Drawings: Plans, sections and details included in the contract documents of which this Specification is a part.
- D. Growth Media Layer: An engineered soil-like material designed to retain moisture, manage plant nutrients, and support vigorous growth of the foliage.
- F. EFVM® (Electric Field Vector Mapping®): A leak location technique that relies on the electrical conductivity of the cover material (moist media) and electrical insulating properties of the waterproofing membrane. The compatibility of EFVM® with a specific waterproofing system must be established in advance by the EFVM® service provider.
- G. Manning formula for conveyance (ft<sup>3</sup>/s):  $K = (1.49 \times A \times R^{(2/3)})/n$ ; A=area (ft<sup>2</sup>), R=hydraulic radius (ft), n=Manning's roughness coefficient (dimensionless).
- I. System Provider: Company that provides or certifies all materials required for installation of the vegetated roof cover assembly, furnishes on-site coordination and inspection, and offers long-term support and warranty protections for the completed vegetated roof cover assembly. This company may, but is not required to be, identical with the Waterproofing Provider.
- J. Waterproofing Manufacturer: Company that provides or certifies all materials required for installation of the building waterproofing, furnishes on-site coordination and inspection, and offers long-term support and warranty protections for the completed waterproofing, including flashings, counter-flashings, coping, and deck drains.

## 1.05 SYSTEM DESCRIPTION

### A. Design Requirements:

1. The vegetated cover assembly shall be a single-media system, consisting of an average thickness, after moderate compaction, of 3 inches, plus or minus 1/2- inch (including pre-grown mat) of growth media layer installed over a synthetic sheet drain.
2. This assembly is suitable for roofs with pitches ranging from 1/8:12 (0.6 degrees) to 6:12 (26 degrees).
3. Assembly shall be installed without permanent irrigation.
4. This assembly is not compatible with pedestrian access other than for maintenance activities.

### B. Performance Requirements: Vegetated roof covering system shall:

1. Support a perennial vegetated ground cover.
2. Provide efficient drainage of moisture that is in excess of that required for the vigorous growth of the installed vegetation.
3. Protect roof waterproofing materials from damage caused by exposure to ultraviolet radiation, physical abuse, and rapid temperature fluctuations.
4. Retain at least 1 inch of moisture at Maximum Water Capacity, in accordance with the referenced ASTM E 2397 standard.
5. The dry dead weight of this system shall not be less than 13 pounds per square foot (ASTM E 2397)
6. The wet dead weight of this system shall not exceed 22 pounds per square foot (ASTM E 2397).
7. Continue to perform as designed for the duration of the warranty period, without a requirement to amend or refresh the media.
8. Resist wind and water erosion

## 1.06 SUBMITTALS

### A. Product Data:

1. System Provider's technical literature showing compliance of all components with specified requirements. Documents shall be clearly marked to indicate all technical information which specifies full compliance with requirements of this section and Contract Documents.
2. System Provider's statement indicating that proposed use is appropriate for each product.
3. System Provider's statement that It has reviewed and approved the details for the associated waterproofing system, including deck drains, flashings, penetrations, and copings.
4. Certified laboratory report demonstrating compliance of the proposed media with the specification.

- B. Shop Drawings:
1. Final layout for the internal drain conduit.
  2. Details of installation, showing conditions at terminations, transitions, drains, scuppers, and penetrations (if different from or supplemental to the Drawings).

C. Samples:

<u>Item No.</u>	<u>Quantity</u>	<u>Size</u>	<u>Description</u>
S1	6	4x4"	Synthetic sheet components, including fabrics, sheet drains, reinforcing materials, and wind protection materials
S2	6	12"	Drainage conduit.
S3	6	6 oz	Growth media for initial approval of the Architect.
S4	1	full paver	Sample of concrete 'turf paver,' for approval by the Architect
S5	6	12"	Sample of each type of landscape edge that will be used on the project.

- E. System Certification: Signed by the System Provider, certifying that the submitted vegetated roof covering system:
1. Complies with the specified system requirements (See 1.4 System Description)
- F. Waterproofing Certifications: Signed by the Waterproofing Manufacturer, certifying that:
1. The waterproofing system is fully compatible with the vegetated roof cover system, and is eligible for the specified warranty required of the Waterproofing Manufacturer. *Submit prior to installation of the waterproofing.*
  2. The finished waterproofing has been tested under the direction of the Waterproofing Manufacturer and is certified as watertight. *Submit prior to installation of the vegetated roof cover assembly.*
- G. Maintenance Program: Shall clearly describe the procedures for maintaining the vegetated roof assembly, including a maintenance schedule for the first 24 months. The schedule must include a minimum of ten documented maintenance visits.

- H. Affidavit: Signed by the System Provider, stating that the installation contractor is certified by the System Provider to install the assembly.
- I. Final Plant List: For approval by the Architect.
- J. Completed Dead Load Worksheet (ASTM E 2397).
- K. Report results of the electric leak detection activity prior to installation of green roof.

1.07 DELIVERY, HANDLING, STORAGE

- A. Comply with General Specification S-018.
- B. Pre-grown sedum mats shall be delivered in rolls (Bid Alternate 1). They shall be stored in a shaded area for no longer than 24 hours and lightly watered once during this time period as needed. A listing of each plant variety in the pre-grown Sedum mats shall be preserved and included with the project documents.
- B. Bulk earth materials shall be laid down on a tarp and covered with a tarp to minimize contamination, protect them from weed seed infiltration and maintain them in a dry condition.
- C. Synthetic components shall be accompanied by identifying labels. They shall be stored out of direct sunlight.
- D. Pavers and masonry materials shall be palletized, shrink-wrapped, and in a safe and secure location.

1.08 QUALITY ASSURANCE

- A. Warranties:
  - 1. The Waterproofing Manufacturer shall furnish to the Owner a 20-year single-source comprehensive warranty covering the waterproofing system and the vegetated roof cover assembly, described in this section (see Section 07 54 19). This warranty shall guarantee 80% foliage coverage so long as the the Owner maintains a maintenance agreement approved by the Waterproofing Manufacturer and executed by a contractor accepted by the Waterproofing Manufacturer, for the duration of the warranty period. The warranty shall include provisions to repair or replace specified materials or work of this section that has failed within the warranty period. System failures covered by the warranty shall include, but are not limited to, the following:

- a. Failure of the vegetated cover system to support a robust ground cover
  - b. Loss of soil permeability
  - c. Development of anaerobic conditions in the profile
  - d. Loss of drainage capacity
  - e. Development of soil pathogens
  - f. Deleterious changes in pH
  - g. Slope related instability of the vegetated cover system
  - h. Wind or water erosion of the vegetated cover system
- B. The work of this section shall be performed by a company which specializes in the vegetated roof cover assembly installation work and is approved by the System Provider. This company is required to document the successful completion of at least 5 previous extensive vegetated roof projects.
- C. System Provider's Field Supervision:
1. The System Provider shall furnish a quality control specialist to observe critical aspects of the installation.
- D. Laboratory:
1. Tests of media shall be conducted by an independent laboratory with the experience and capability to conduct the tests indicated. These may include, but are not limited to:
    - a. A& L Great Lakes Laboratories, Inc. 3504 Conestoga Drive, Fort Wayne, IN 46808-4413 [260-483-4759]
    - b. *For specified FLL and ASTM test procedures:* Agricultural Analytical Services Laboratory, Penn State University, Tower Road, University Park, PA 16802 [814-863-0841]
    - c. *For specified FLL and ASTM test procedures:* Turf Diagnostics & Design, 613 E. 1<sup>st</sup>, Linwood, KS 66052 [913-723-3700] [www.turfdiag.com](http://www.turfdiag.com)
- E. Coordination with Waterproofing Manufacturer: Before commencement of the waterproofing installation, the Roofing Applicator and Vegetated Roof Cover Installation Contractor shall meet with the Owner's representative to discuss project sequence and methods for protecting and controlling access to the work and to review shop drawings to establish compliance with the specifications. At this time, the parties to this meeting shall specifically determine how the waterproofing will be protected between the time it is certified by the Waterproofing Provider as watertight and the time that installation of the vegetated cover system can begin.

## PART 2 MATERIALS

### 2.01 CAPILLARY FABRIC

- A. Composite fabric complying with the following:
  - 1. Capillary rise: greater than or equal to 7".
  - 2. Moisture retention (ASTM E 2397): greater than or equal to 0.016" (0.10 gal per sq ft).
  - 3. Density (ASTM D 5261): greater than 18 oz / sq yd.
- B. Manufacturer:
  - 1. Huesker, Inc.
  - 2. Or approved equal.

### 2.02 DRAIN CONDUIT

- A. Slotted low-profile conduit.
- B. Properties:
  - 1. Height:  $\leq 2.25''$
  - 2. Open area (sides and top):  $\geq 15\%$ .
  - 3. Slot or perforation size:  $1/16'' - 1/8''$
  - 4. Hydraulic conveyance (K):  $\geq 0.09$  cu ft/sec
- C. Manufacturer:
  - 1. Triangle Conduit, by Optigreen International, AG
  - 2. Or approved equal.

### 2.03 SHEET DRAIN LAYER

- A. Sheet drain shall be a three-dimensional mesh formed from tangled filaments with a polypropylene or polyester fabric bonded to one side.
- B. Sheet drain shall have an adhered polypropylene, non-woven separation fabric.
- C. Properties:
  - 1. System Thickness (ASTM D 1777):  $\leq 0.45$  in
  - 2. Transmissivity (ASTM D 4716): 10-12 gal/min/ft @500 psf confining pressure and  $i=1$
  - 3. Fabric:
    - a. Permittivity (ASTM D 4491):  $\geq 1.8 \text{ sec}^{-1}$
    - b. Puncture Resistance (ASTM D 4833):  $\geq 35$  lb
    - c. Grab Tensile (ASTM D-4632):  $\geq 120$  lb
- D. Manufacturer:

1. Colbond 3601
2. Or approved equal.

## 2.04 GROWTH MEDIA LAYER

- A. Growth media shall be a mixture of mineral and organic components complying with these specifications:
- B. Properties:
1. Non-capillary pore space at maximum water capacity:  $\geq 6\%$  (ASTM E 2399).
  2. Maximum water capacity (ASTM E 2399):  $\geq 35\%$  (vol).
  3. Density at maximum water capacity (ASTM E 2399):  $\leq 75$  lb/cu ft.
  4. Saturated Hydraulic Conductivity (ASTM E 2399): 0.10 – 1.0 in/min
  5. Alkalinity, CaCO<sub>3</sub> equivalents (MSA):  $\leq 2.5\%$
  6. Total Organic Matter, loss on ignition method: 4-8% (dry wt.) (MSA)
  7. pH (RCSTP): 6.5 – 8.0.
  8. Soluble Salts (DPTA saturated paste extraction):  $\leq 6$  mmhos/cm (RCSTP).
  9. Organic Supplements (compost, peat moss, etc.):  $\leq 2$  mg CO<sub>2</sub>/g TOM/d combined respiration rate (TMECC 05.08, B).
  10. Cation exchange capacity (MSA):  $\geq 10$  meq/100g.
  11. Grain-size distribution of the mineral fraction (ASTM-D422):
    - a. Clay fraction (2 micron):  $\leq 2\%$ .
    - b. Pct. Passing US#200 sieve:  $\leq 5\%$ .
    - c. Pct. Passing US#60 sieve:  $\leq 10\%$ .
    - d. Pct. Passing US#18 sieve: 5 – 50%.
    - e. Pct. Passing 1/8-inch sieve: 30 – 80%.
    - f. Pct. Passing 3/8-inch sieve: 75 – 100%
- C. Thoroughly blend at a batch facility. Moisten, as required, to prevent separation and excessive ‘dusting’ during installation.
- D. Quality control samples shall be collected for each 100 CY provided to the job. These samples shall be sealed in 2 gallon water-tight containers and held by the Contractor for inspection by the Owner’s representative.

2.05 PRE-GROWN SEDUM MATS (BID ALTERNATE 1)

- A. Sedum mats shall be suitable for the climate and application. The mats shall be 90% covered when delivered to the project.
- B. Properties:
  - 1. Plant list 11 species, minimum, as approved by Engineer.
  - 2. Media thickness: 0.75 - 1.0 inches.
  - 3. Size: 4 ft x 6.25 ft rolls.
  - 4. Saturated weight:  $\leq 5$  lb/sq ft.
  - 5. Biodegradable foundation fabric:
    - a. Wide Width Tensile (DIN 10319):  $\geq 1.1$  kN/m [MD] (dry).
    - b. Permittivity (ASTM D 4491)  $\geq 1.5$  sec<sup>-1</sup>
    - c. Manufacturer:
      - i. Sempergreen
      - ii. Or approved equal.

2.06 PERMANENT WIND SCOUR REINFORCEMENT

- A. Install as shown on the drawings. Plant roots shall integrate the reinforcement with the mats within 7 days. The mesh shall be PVC-coated mesh fabricated from high-tenacity polyester yarn. Multi-filament yarns shall be knitted into a dimensionally stable, uniform network of apertures.
- B. Properties:
  - 1. Aperture width: 0.5-1.0 in.
  - 2. Ultimate tensile strength (ASTM D 6637):  $\geq 2,000$  lb/ft (MD).
  - 3. Creep Limited Strength (ASTM D5262):  $\geq 1,200$  lb/ft (MD).
  - 4. Long Term Design Strength (NCMA 97):  $\geq 1,000$  lb/ft (MD).
- C. Manufacturer:
  - 1. Stratagrid, 200 by Strata Systems, Inc.
  - 2. Or approved equal.

2.07 TEMPORARY COIR BIO-DEGRADABLE WIND SCOUR BLANKET (*NOT REQUIRED FOR ALTERNATIVE A*).

- A. This product should be used when plants will be established from cuttings or plugs.
- B. This blanket shall be secured using a method approved by the System Provider.
- C. Properties:
  - 1. Tensile Strength (ASTM D 5035):  $\geq 100$  lb/ft.
  - 2. Unit Weight (dry):  $\geq 8$  oz/SY.

- D. Manufacturer:
  - 1. Landlok C2, by Propex Geosynthetics, Inc.
  - 2. Or approved equal.

2.08 ALUMINUM PAVER EDGING

- A. Aluminum paver edging shall be made from mill-finish 1/8-inch thick sheet aluminum (as shown in the Drawings). Fabricate according to the Drawings. Both straight and 'punched' edging shall be provided. Edges shall be designed to bolt where they join using 3/16-inch stainless steel bolts.

2.09 STONE BALLAST

- A. Non-carbonate washed rounded river stone satisfying the grading requirements of AASHTO No. 3.

2.10 LEADING EDGE WIND STABILIZATION SYSTEMS

- A. This assembly shall be installed where shown on the Drawings.
- B. Stone ballast, as specified herein.
- C. Concrete Turf Pavers:
  - 1. Unit pavers with rectangular apertures.
  - 2. Properties:
    - a. Length:  $\geq 23$  in.
    - b. Width:  $\geq 15$  in.
    - c. Thickness:  $\geq 3$  in.
    - d. Weight:  $\geq 20$  lb/sq ft
    - e. Open Space:  $\geq 40\%$
    - f. Manufacturer:
      - i. Turfstone, by Interlock Paving Systems, Inc.
      - ii. Or approved equal.

## 2.11 SEPARATION FABRIC

- A. Root-permeable needled non-woven polypropylene or polyester separation fabric.
- B. Properties:
  - 1. Unit Weight (ASTM D 3766):  $\leq 6.0$  oz/yd<sup>2</sup>.
  - 2. Permittivity (ASTM D 4491):  $\geq 1.5$  sec<sup>-1</sup>.
  - 3. Puncture Resistance (ASTM D 4833):  $\geq 55$  lb.
  - 4. Mullen Burst Strength (ASTM D 3786):  $\geq 160$  lb/sq in.
  - 5. Grab Tensile (ASTM D 4632):  $\geq 95$  lb.
- C. Manufacturer:
  - 1. Geotex NW311, by SI Geosolutions.
  - 2. Or approved equal.

## 2.12 SEDUM CUTTINGS

Freshly cut Sedum, harvested before May 15 or after September 15. Ship so that the cuttings are enclosed for no more than 30 hours.

# **PART 3 EXECUTION**

## 3.01 INSTALLATION

- A. Install each component of the vegetated cover system in accordance with the System Provider's published instructions and Contract Documents.

## 3.02 INSPECT WATERPROOFING

- A. Examine the completed waterproofing system, with the Roofing Installer present, for compliance with drawings, installation tolerances, and other conditions affecting performance.
  - 1. For the record, prepare a written report, endorsed by the Roofing Installer and the Vegetated Cover Installer. As appropriate, list conditions that may be detrimental to the performance of the work.
  - 2. Proceed only after unsatisfactory conditions have been corrected.

## 3.03 PREPARE SURFACE

- A. The surface of the waterproofing system shall be swept and washed.
- B. Until the sheet drain is installed, traffic over the working area shall be strictly controlled and limited to essential personnel, only.

- C. Laydown areas and heavily traveled areas (e.g., corridors for transporting media to the working areas) must be protected using 1/2-inch plywood or particle board over 1-inch sheets of expanded polystyrene (EPS), or similar sheathing material.

#### 3.04 INSTALL CAPILLARY FABRIC

- A. Roll out the fabric.
- B. Overlap seams a minimum of 6 inches.
- C. At parapets, walls and terminations extend the fabric at least 6 inches up the face of the vertical surface. The fabric may be trimmed after the green roof installation is complete.
- D. Hold in place using water-filled bags, or equivalent. If work is discontinued over night, stabilize using water-filled ballast bags or equivalent.

#### 3.05 INSTALL SHEET DRAIN LAYER

- A. Roll out the drainage system on top of the foundation fabric. Do not overlap or interlock adjacent panels. Install with non-woven fabric facing up.
- B. Seams should be covered by fabric with a minimum 2-inch overlap on each panel. As necessary, cut 2-foot wide strip of separation fabric in order to close all seams.

#### 3.06 INSTALL DRAIN CONDUIT

#### 3.07 INSTALL LEADING EDGE STABILIZATION AT MID-FIELD TERMINATIONS

- A. Place aluminum Edge:
  - 1. Install on top of sheet drain.
- B. Place turf pavers edge to edge with the longest side in contact with the aluminum edge.

#### 3.08 INSTALL STONE BALLAST

- A. Place 24-inch wide strip of separation fabric along the parapets.
- B. Fill stone to width of 15 inches.

- C. Fold fabric back over stone to protect from media infiltration during construction

### 3.09 INSTALL GROWTH MEDIA

- A. Place the growth media layer. The media shall be dispensed at the roof level in a manner that will not suddenly increase the load to the roof. It shall be immediately spread to the specified thickness, plus ten percent, after moderate compaction. Unless otherwise approved, compaction shall be using a 4-foot wide lawn roller with a total load of not less than 200 lbs and not more than 300 lbs.
- B. Thoroughly soak with water using a sprinkler or hand sprayer.

### 3.09 DISTRIBUTE SEDUM CUTTINGS

- A. Cuttings may be installed between May 1 and June 1 and between September 1 and October 1. Installation outside this window requires approval by the Architect and temporary irrigation will be required through the first growing season.

### 3.10 PLACE TEMPORARY WIND BLANKET

- A. Cover cuttings with temporary wind blanket.
- B. Secure using method approved by the System Provider.

### 3.11 PROVIDE 2-YEAR MAINTENANCE SERVICE

- A. The vegetated roof assembly installer shall offer a two-year maintenance service. This service will include:
  - 1. Hand weeding and/or chemical weeding and fertilization, as required to maintain the health and vigor of the plants.
  - 2. Provide temporary surface irrigation, as required to achieve the cover requirement.

### 3.12 PERMANENT WIND SCOUR REINFORCEMENT

- A. Overlap at all seams by 6 inches.
- B. Install cuttings and temporary wind blanket on top of the permanent wind scour reinforcement.

**BID ALTERNATE 1: INSTALL PRE-GROWN SEDUM MATS -ADDITIONAL WORK  
SCOPE**

**3.13 INSTALL PRE-GROWN SEDUM MATS**

- A. Place the mats on top of the permanent wind scour reinforcing (if combined with Bid Alternate 1). Otherwise, place mats directly on prepared media layer.
- B. Temporary wind scour blanket is not required.

**END OF SECTION**