Vegetated Roof Specification

Liquid Applied Membrane

[HG 2220] Semi-Intensive Native Prairie System

September 10, 2018

SECTION 07 33 63
VEGETATED ROOF ASSEMBLIES – LIQUID APPLIED

PART 1 GENERAL

I) SUMMARY

A) Furnish and install a completed Semi-Intensive vegetated roof; including, but not limited to: concrete surface conditioner, reinforced rubberized-asphalt waterproofing, flashings, Electronic Leak Detection (ELD), protection course, root barrier protection, rigid insulation, rot and pathogen protective fleece or, rot and pathogen resistant filter fabric, drainage and/or retention component, pavers and/or tiles on pedestals, vegetated roof growing media and vegetation. This section should be completed in coordination with Section 07 72 00 Roof Accessories and Section 07 59 00 Electronic Leak Detection (ELD), to maintain the total system warranty.

II) RELATED TRADES

A) Section 02 40 00 Demolition
B) Section 03 30 00 Concrete
C) Section 04 00 00 Masonry
D) Section 06 00 00 Carpentry
E) Section 07 60 00 Sheet Metal
F) Section 07 72 00 Roofing Accessories
G) Section 07 90 00 Caulking & Sealants
H) Section 22 00 00 Plumbing
I) Section 26 00 00 Electrical
J) Section 32 84 00 Landscape Irrigation
K) Section 32 90 00 Landscaping

III) REFERENCES

A) ANSI: American National Standards Institute www.ansi.org
B) ANLA: American Nursery and Landscape Association www.anla.org
C) ASTM: American Society of Testing Materials www.astm.org
D) EN-ISO: International Organization for Standardization
E) FLL (German): Guidelines for the Planning, Execution and Upkeep of Green-roof sites
F) MSA: Methods of Soil Analysis, American Society of Agronomy
G) RCSTP: Recommended Chemical Soil Testing Procedures
H) TMECC: Test Methods for the Examination of Composting and Compost
I) OSHA: Occupational Safety and Health Administration
J) Factory Mutual Insurance Co. 1-35 Green Roof Systems
K) USGBC: US Green Building Council,
    1) Leadership in Energy and Environmental Design LEED Reference Guide, Version 3.0
    2) USGBC Project Calculation Spreadsheet. www.usgbc.org.
L) Sustainable Sites Initiative
    1) SITES Rating System, version 2
    2) SITES v2 Rating Scorecard, www.sustainablesites.org

IV) DEFINITIONS

A) Biological Soil Fertility Amendments: Bio-stimulants and bio-fertilizers added to growth media to enhance, stimulate and feed microorganism populations and increase biological function of the growth media.
B) Captured Water: Water that is retained in the drainage layer of a Vegetated Roof Assembly after new water additions have ceased and that cannot escape the roof except through evaporation or plant transpiration.

C) Electronic Leak Detection (ELD): An electric 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 ELD with a specific waterproofing system must be established in advance by the vegetated roof provider.
D) Finish Elevation: Elevation of finished growing media surface of planting area.
E) Planting Area: Areas to be planted.
F) Plant, Plants, Plant Material: Vegetation in general, ornamental grasses, or herbaceous vegetation.
G) Greenformation®: A customizable maintenance service plan provided by a responsible service crew under the company direction of AD Greenroof, LLC.
H) Growth Media: Lightweight soil mixture that promotes good growing conditions for specific varieties of plants.
I) Soil Consultant: Provider of products, information and rates of biological soil fertility amendments and testing laboratory coordinator for the project. Soil consultant to be approved by Hanging Gardens, LLC (www.hanging-gardens.com).
J) Vegetated Roof Installer: A pre-certified vegetated roof installer with appropriate experience approved by the Total System Provider to maintain warranty.
K) Total System Provider: Single-source company providing and/or approving all materials including vegetated roof and waterproofing components required for installation who is responsible for coordination, inspection and offering long-term support through offering a total system warranty. This company shall be Hanging Gardens.
L) Waterproofing Installer: Company installing the waterproofing system and in some instances components in the vegetated roofing system. Installer to be approved by Total System Provider to maintain warranty (Optional: For Total System Warranty Clients).
M) Maintenance Contractor: The pre-approved entity contracted by building owner to ensure maintenance on the system is carried out through specified timeframe. Entity and contract must be pre-approved by Total System Provider prior to signing. This entity may be the Vegetated Roof Installer.

V) QUALIFICATIONS

A) Only a contractor approved and licensed by the Total System Provider shall install the waterproofing system. Liquid Applied membrane components and all other vegetated roofing components shall be procured through the same firm to insure single-source responsibility. An independent laboratory may test materials for compliance with published physical properties and these specifications.

VI) SUBMITTALS

A) Completed Dead Load Worksheet for each Vegetated Roof System profile (ASTM E2397)
    1) Submit Total System Provider's written approval or license for contractors for waterproofing membrane and vegetated roofing system.
B) Submit most recent copy of Total System Provider's literature applicable to products and specifications to be used, as specified herein, including applicable flashing details.
C) Product Data Sheets: For each component within the Vegetated Roofing System
D) Samples for Verification: For each of the following components of Vegetated Roof Assembly:
    1) Submit three sheet samples approximately 6 x 6 inches or alternately 3 units that are representative of the following products:
        (a) Waterproofing System
            (i) RAM-Tough 250, Hot rubberized asphalt
        (b) Protection Course
        (c) Membrane Flashing and Termination Bar
        (d) Transition Flashing
        (e) Insulation
        (f) Root Barrier

(g) Protection Fleece
(h) Drainage
(i) Drainage/Retention Board
(j) Filter Fleece
(k) Edge Restraints
(l) Pavers: Send finish options for architect/owner to determine exact finish. Note on samples if certain finishes/types would include an increase in cost from original bid. Samples should be in approximately 2" x 2" blocks. Also include product data stating actual versus nominal dimensions of each paver type.
(m) Pedestals: Send a complete pedestal assembly with slope adjusting components (if applicable) along with shims and spacer tab.

2) Growth Media: 1-quart volume of each growth media specified, in sealed plastic bags labeled with content and source. Each sample shall be typical of the lots of growing media to be furnished. Provide an accurate representation of texture and composition.

E) Product Test Reports: For each growth media, including complete analysis coordinated and approved through Hanging Gardens' approved testing facility, demonstrating compliance with specified requirements.

F) Electronic Leak Detection (ELD) Shop Drawings:
1) Completed Diagram of proposed system showing complete monitored area, rooftop structures and equipment, and roof penetrations for building utilities and services. Show location of membrane leak detection system conductor cable and contact boxes.

G) Electronic Leak Detection (ELD) Quality Control Reports:
1) Diagram of proposed system showing complete monitored area, rooftop structures and equipment, and roof penetrations for building utilities and services. Show location of membrane leak detection system conductor cable and contact boxes.

H) Maintenance Data: Greenformation® plan including procedures for inspection and care of vegetated roof assembly and plants during a calendar year. Contact and submit to AD Greenroof, LLC before start of required warranty and maintenance periods. http://adgreenroof.com/2013/01/connected-generation/)

I) Electronic Leak Detection (ELD) Closeout Submittals:
1) Digital drawings, photographic documentation, and written report detailing installed location of components of membrane leak detection system.

J) Warranty: Sample of [5] [10] [15] [20] year warranty from the Total System Provider.

VII) QUALITY ASSURANCE

A) Waterproofing Installer Qualifications: The contractor and his personnel shall be currently approved by Hanging Gardens and have been certified through Hanging Gardens' training program are to apply the waterproofing system.
1) The contractor shall employ an Electronic Leak Detection (ELD) Service to survey the completed membrane application. The Total System Provider shall approve the surveyor, and:
(a) Integrate layout of membrane leak detection system with rooftop structures and equipment and roof penetrations for building utilities and services to ensure functionality of system
(b) Coordinate membrane leak detection system with work of other Sections to prevent grounding out of leak detection system.

B) Vegetated Roof Installer Qualifications: A qualified vegetated roof assembly Installer approved, authorized, or licensed by Hanging Gardens, whose work has resulted in successful establishment of vegetated roofs.
1) Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
2) Professional Membership: Installer shall be a member in good standing of the National Association of Landscape Professionals.
3) Personnel Certifications: Installer's field supervisor and personnel assigned to the work shall both have certification in the following categories from Green Roofs for Healthy Cities:

(a) Green Roof Professional (GRP)

4) Provide a list of at least 3 projects, satisfactorily completed within the past 5 years, of similar scope and complexity to this project.
5) Installer must provide at time of proposal submittal a general liability insurance certificate showing $1,000,000 in coverage.
6) The contractor shall employ an Electronic Leak Detection (ELD) Service to survey the completed membrane application. The System supplier shall approve the surveyor.

C) Source Limitations: All vegetated roof assembly components including but not limited to growth media, walkway pavers and accessories are to be sourced or approved by the Total System Provider.

D) Pre-installation Conference: Conduct conference at project site.
1) After award of Contract and prior to the commencement of the Work of this Section, schedule and conduct meeting to discuss the Work of this Section and to coordinate with related work. Coordinate with pre-construction meeting specified in Section (xxxxxx). Convene pre-construction meeting to comply with requirements of Division 1 and as follows:
(a) General Contractor to notify all attendees at least two weeks prior to the conference.
(b) Require attendance of parties directly affecting Work of this Section, including, but not limited to: Owner, Contractor, Architect, System Provider, System Installer, Roofing Membrane Provider, Roofing Membrane Installer and Plumbing Installers.
(c) Review methods and procedures related to installation and operation of Work of this Section, including coordination with related Work.
(d) Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.

VIII) DELIVERY, STORAGE, AND HANDLING

A) Packaged Materials:
1) Contractor to designate Project Coordinator to be responsible for coordinating all shipments with the Total System Provider, Project Coordinator to alert Total System Provider a minimum of 3 weeks prior to delivery to ensure availability of product, additional lead time may be required for certain products or plantings, reference Total System Provider's Terms and Conditions for exact lead times.
2) Store materials under cover and elevated above ground, out of direct sunlight.
3) Store roll material lying down and on pallets. Fully protect from moisture and direct sunlight exposure.
4) Remove damaged material from job site. Report and replace damage materials.
5) Plant materials must be watched carefully. Watering the plants can be necessary during a long storage period. Ensure plants are properly ventilated to prevent overheating. Plating materials are to be installed within twenty-four hours from the time that they are received on the project site and may not remain stacked on a pallet for more than 2 hours.
6) When storing materials on the roof be sure that the load of the materials does not exceed the load of the structure. Coordinate with architect and general contractor on structural allowances for placing pallets on the roof and ensure crane is appropriately sized to reach designated areas of the roof.
7) Store materials in dry, protected areas in an upright position. Control temperature of storage areas in accordance with Manufacturer's instructions. Protect moisture sensitive materials with breathable tarps on sides and top surfaces.
8) Store and dispose of solvent based materials and materials used with solvent based materials in accordance with requirements of local authorities having jurisdiction.

B) Bulk Materials:
1) Do not dump or store bulk materials on or near structures, utilities, walkways and pavements, or existing roof areas or plants.
2) Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of debris-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

3) Accompany each delivery of bulk materials with product certificates.

IX) PROJECT CONDITIONS

A) Codes/Regulations:
   1) Follow local, state and federal regulations, safety standards and codes. When a conflict exists, use the stricter requirement.

B) Weather Limitations:
   1) Do not apply hot or cold reinforced rubberized-asphalt waterproofing when moisture in any form (i.e. rain, dew, ice, frost, snow, etc.) is present on the roof deck.
   2) Wind speeds are not to exceed 40 mph.
   3) Weekly ambient air temperature(s) to not drop below:
      (a) 20°F for RAM-Tough 250

C) Planting Constraints:
   1) Zone 3
      (a) For projects throughout Zone 3, install date should be after May 15th and completed no later than September 15th in calendar year.
   2) Zone 4
      (a) For projects throughout Zone 4, install date should be after May 1st and completed no later than September 30th in calendar year.
   3) Zone 5
      (a) For projects throughout Zone 5, install date should be after April 15th and completed no later than October 31st in calendar year.
   4) Zone 6
      (a) For projects throughout Zone 6, install date should be after March 15th and completed no later than November 30th in calendar year.
   5) Zone 7 +
      (a) No constraints if temperatures do not go below freezing for 72 consecutive hours.

D) Structural Conditions:
   1) Ensure deck is structurally sound to support the live and dead load requirements of the waterproofing system and sufficiently rigid to support construction traffic.

E) Scheduling Conditions:
   1) Sequencing and Scheduling: The work shall be scheduled in the construction sequence so that designated complete contiguous areas can be installed and completed, including overlay elements and wear courses, before other construction trades are allowed in the area. Prior to starting the Work, all drains shall be operative and all deck projections, sleeves and all other penetrations shall be installed, in place and operative.

F) Materials Conditions:
   1) Do not apply reinforced hot rubberized-asphalt waterproofing materials unless proper bitumen application temperatures (approximately 350°F-400°F) can be maintained. Do not heat bitumen above 400°F.

X) WARRANTIES

A) The Total System Provider shall furnish its standard [5] [10] [15] [20] warranty for labor and materials, including the membrane, membrane flashings, protection course, drainage medium, insulation and all other vegetated roof components supplied by the manufacturer.

B) Warranty for Plant Growth: Installer agrees to submit growers' product guarantee. Installer and owner agree to adhere to Greenformation® maintenance plan regarding repair or replace plantings within a specified establishment warranty period after installation of vegetation. Establishment warranty shall be defined as: 2 months after vegetation installation, or otherwise known as substantial completion.
   1) Start Date: If chosen, the start date of the warranty for plant growth shall be the substantial date of completion of vegetated assembly and after Greenformation® plan has been approved by owner.

2) Coverage: Labor and Plantings
3) Failures include, but are not limited to, death and unsatisfactory growth except for defects resulting from abuse or incidents that are beyond contractor's control including, but not limited to, damage caused by other trades or foot traffic caused by others.
   (a) Visual failure will be determined as a perennial, shrub, or tree that has more than 25 percent of dead plant growth.
4) Minimum Foliage Cover: Planted materials shall grow to achieve and maintain at least:
   (a) 50 percent foliage cover over planting area commencing 12 months after planting, through the duration of this warranty.
   (b) 80 percent foliage cover over planting area commencing 24 months after planting, through the duration of this warranty.
5) Include the following remedial actions as a minimum:
   (a) Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
   (b) Installation time of replacement planting(s) to be completed by installer, at their discretion in relation to weather, by no longer than 12 months from removal of dead vegetation.
   (c) If the death of 25 percent or greater of plant materials installed occurs at a single time that is not related to an act of God or owner negligence, Hanging Gardens is to provide owner and installer a remediation plan to remedy the situation.
   (d) Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
      (i) A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.

XI) BIDDING REQUIREMENTS

A) Pre-Bid Meeting: A pre-bid meeting shall be held with the Owner's Representative and involved trades to discuss all aspects of the project. The Applicator's field representative or roofing foreman for the work shall be in attendance. Procedures to avoid rooftop damage by other trades shall be determined.
B) Site Visit: Bidders shall visit the site and carefully examine the areas in question as to conditions that may affect proper execution of the work. All dimensions and quantities shall be determined or verified by the contractor. 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.

XII) MAINTENANCE SERVICE

A) Initial Maintenance Service: Provide maintenance by skilled employees of vegetated roof assembly Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but not for less than the following maintenance period:
   1) Initial maintenance period: [30][60][90] days from date of Planting Completion.
B) Continuing Maintenance Proposal: From vegetated roof assembly Installer to Owner, provide Greenformation® a minimum of a 24-month maintenance plan, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.
   1) Maintenance Period: 24 months from date of Planting Completion.

PART 2 PRODUCTS

I) VEGETATED ROOFING SYSTEM

A) Basis of Design: Hanging Gardens, LLC, http://www.hanging-gardens.com
B) All products and services shall be approved/procured through the Vegetated Roof Provider, Hanging Gardens, in order to ensure integrity of the total system and maintain the total system warranty.

II) WATERPROOFING MEMBRANE AND ACCESSORIES

A) Hot Rubberized Asphalt waterproofing: RAM-Tough 250 SBS Kraton® fluid-applied modified bitumen shall have inert mineral stabilizer and recycled tire rubber crumb content. Waterproofing material shall comply with the following specifications:

1) Barrett Company; RAM-Tough 250:

	CGSB 37-GP-50M	TYPICAL
TEST	REQUIREMENTS	TEST RESULT
Solids Content	100%	100%
Flash Point	Min. 500˚F (260˚C)	620˚F (327˚C)
Penetration, 0.1 mm	Max. 110 @ 77˚F (25°C)	80 mm
	Max. 200 @ 122˚F (50°C)	155 mm
Flow, mm	Max. 3 @ 140˚F (60°C)	0.5 mm
Toughness, J	Min. 5.5	11.7 joules
Ratio of Toughness, J/N to Peak Load	Min. 0.040	0.059
Adhesion	Min. 1	1
Water Vapor Permeance ng/Pa.s.m²	Max. 1.7	0.18ng/Pa.m^2
	0.39ng/Pa.m^2	
Water Absorption	Loss 0.18	0.22+ grams
	Gain 0.35	
Low Temperature Crack Bridging	No delamination	No delamination
@ -13°F (-25°C)	No adhesion loss	No adhesion los
	No cracking	No cracking
Heat Stability @ 392°F (200°C)	No change in viscosity, penetration flow at a low temperature	No change in viscosity, penetration flow at a low temperature
Low Temp Flex @ -13°F (-25°C)	No delamination	No delamination
	No adhesion loss	No adhesion los
	No cracking	No cracking
Water Resistance	No delamination	No delamination
(5 days @ 122°F (50°C))	No blistering	No blistering
	No emulsification	Noemulsification
	No deterioration	No deterioration
	No pinholes	No pinholes
Viscosity @ 392°F (200°C)	Min. 2	5 seconds
	Max. 15	

2) All components shall be obtained or approved by a single source membrane manufacturer to ensure total system compatibility and integrity. Subject to architects and Vegetated roof Provider's written approval for compliance with requirements, products from the following manufacturers may be acceptable:
   (a) Barrett Company; RAM-Tough 250
   (b) Carlisle Coatings & Waterproofing Inc; CCW-500R
   (c) Tremco Incorporated; Tremproof 150
   (d) Henry Company; 790-11

B) Flashing Sheet Metals:

1) Elastomeric Flashing Sheet: 60 Mil (1.55mm) minimum thickness, uncured sheet neoprene with the following specifications:

(a) Tensile Strength: 1500 psi (10.2 MPa) minimum; ASTM D-412
(b) Elongation: 250 percent minimum; ASTM D-412
(c) Tear Resistance: 120 psi (825 kPa) minimum; ASTM D-294
(d) Brittleness: Does not break at minus 30˚F (34˚C); ASTM D-746
(e) Hardness, Curometer, A: 60 +/- 10
(f) Flame Resistance: ASTM C-542 – Pass
(g) Resistance to Heat Aging: ASTM D – 573 - +/- 10%
(h) Resistance to Oil Aging - Change in Volume, max after 70 h Immersion in ASTM Oil #3 at 212°F: ASTM D-471 - + 80%
(i) Resistance to Water Change in Mass, max, after 7 days Immersion at 158°F: ASTM D-471 - + 80%
(j) Water Vapor Permeance: ASTM-96 - .07 Perms

C) Auxiliary Waterproofing Materials:
1) Primer
(a) ASTM D-41, asphaltic primer
(b) ASTM D-6769, elastomeric primer
(c) Conductive Primer
(i) Material Properties:
(i) Odor: Odorless
(ii) Solids by Volume: 23.2%
(iii) Solids by Weight: 13%
(iv) Weight per Gallon: 8.2 lb.
(v) VOC: Less than 100 grams/liter (0.000 lb/gal)
(vi) Tints (pigments) carbon black
(vii) Primary Material: water-based epoxy resin
2) Ply Sheet: Poly-Felt spun bond polyester fabric, heat set with heat resistant resin binder, shall comply with ASTM-D 3776, 4830, 1777-64 & 8B.
3) Nails and Mechanical Fasteners: As specified by the Manufacturer for specific applications and approved by the membrane Manufacturer.
4) Protection Course: shall comply with ASTM-D 412 & 461
(a) Flashing Sheet: Ram 306 Granular surfaced SBS sheet shall comply with ASTM-D 6164, Type I, Grade G specifications
5) Electronic Leak Detection (ELD) Materials
(a) Per chosen service providers applicable material selection.
6) Root Barrier: To prevent root penetration into the waterproof membrane.
(a) Type: 30 Mil HDPE Root Barrier [HG 3230]
(i) Properties: 30 MIL HDPE root barrier
(ii) Weight: 15.4 lbs/100 ft²
7) Protective Fleece: To protect membrane from paver pedestals and vegetated roof assembly
(a) Type: Semi-Intensive Protective Fleece [HG 3320]
(i) Properties: 15 oz Polypropylene, Polyester and Recycled Acrylic Thread
(ii) Water Holding Capacity: 20.16 in³/ft²
(iii) Total Saturated Weight: 0.82 lbs/ft²
8) Drainage Layer
(a) Type: Semi-Intensive Flow Drain [HG 3511]
(i) Properties: 0.40” “zig-zag” geometric patterned core drainage mat designed to eliminate hydrostatic pressure.
(b) Type: Intensive Flow Drain [HG 3512]
(i) Properties: 0.75” “zig-zag” geometric patterned core drainage mat designed to eliminate hydrostatic pressure.
9) Board Insulation: 10, 25, 40 and/or 60 psi Extruded Polystyrene or Expanded Polystyrene Geofoam complying with IBC requirements for foam and plastic insulation.

10) Composite Drainage Layer
    (a) Type: Pedestrian Paving Drain [HG 3530]
        (i) Properties: 0.40” composite drainage layer consisting of a three-dimensional drainage core and filter fabric bonded to the core.
        (ii) Application: For projects that require less than 11,000 psf of compressive strength.
    (b) Type: Vehicular Paving Drain [HG 3540]
        (i) Properties: 0.40” composite drainage layer consisting of a three-dimensional drainage core and filter fabric bonded to the core.
        (ii) Application: For projects that require between 11,000 – 33,000 psf of compressive strength

III) VEGETATED ROOFING MATERIALS

A) Drainage / Retention Board: To provide stormwater retention while simultaneously allowing for continuous drainage.
    1) Type: 1.6” Semi-Intensive DR Board [HG 3616]
        (a) Properties: High-density polyethylene, double sided form of interlocking cups with depth 1.6". Perforated holes on top surface for continuous aeration. High load bearing capacity, excellent water retention, passive distribution and drainage properties.
        (b) Water Holding Capacity: 48.96 in^3/ft^2
        (c) Compressive Strength: 20.88 lbs/in^2 (unfilled), 40.61 lbs/in^2 (filled)
B) Filter Fleece: Filter separation layer between drainage and substrate layers.
    1) Type: Semi-Intensive Filter Fleece [HG 3720]
        (a) Properties: 6 oz system filter, rot and pathogen resistant, non-woven, polymeric, geotextile fabric.
        (b) Tensile Strength: 2.54 lbs/in^2
        (c) Total Saturated Weight: 0.06 lbs/ft^2
C) Edge Restraints: Self-supporting vertical separation between paver and growing media and contain exposed vegetated roof edge.
    1) Type: Semi-Intensive Aluminum Edge [HG 3930]
        (a) Properties: L-shaped self-supporting 12 GA Aluminum with perforations along the manifold for continuous drainage. Male & female pieces allow for ease in installation and minimize cutting. Inside and outside corners also manufactured to create seamless corners.
        (b) Size: 9” height x 6” flange x 8’ sections. Can be ordered in customized dimensions if variation in finish elevation.
    2) Type: Intensive Aluminum Edge [HG 3940]
        (a) Properties: L-shaped self-supporting 12 GA Aluminum with perforations along the manifold for continuous drainage. Male & female pieces allow for ease in installation and minimize cutting. Inside and outside corners also manufactured to create seamless corners.
        (b) Size: 12” height x 6” flange x 8’ sections. Can be ordered in customized dimensions if variation in finish elevation.
    3) Custom Edge [HG 3990]
        (a) For any custom edges or corners request inquiry from Total System Provider.
D) High Wind Stabilization Grid
    1) A geogrid reinforcement constructed of high molecular weight and high tenacity polyester yarns utilizing a complex knitting process and polymeric coating to provide superior engineering properties.
    2) Tensile strength of netting 55 kN/m
    3) ASTM Standards:
        (a) D5262: Standard test method for evaluating the unconfined tension creep and creep rupture behavior of geosynthetics.
        (b) D6637: Standard test method for determining tensile properties of geogrids by the single or multi-rib tensile method.
E) Drain/Access Box: Control shaft for use as roof outlet inspection units.
    1) Type: Drain/Access Box [HG 3550]
        (a) Properties: UV Resistant ABS Plastic with inlet slots in shaft walls and cover.

(b) Size: 14.5” x 14.5” x 4”
(c) Components: Includes a lockable lid and stainless-steel filter to prevent debris from entering the drainage system.
(d) System comes in increments of 4” to achieve desired height.
(e) Metal Access Box Cover available upon request from Total System Provider.

F) Growth Media: Vegetated roof assembly supplier’s lightweight, custom manufactured soil mixture designed for project location and plant pallet.
1) Type: Semi-Intensive Growth Media [HG 4210]
(a) Properties: Formulated growth media to meet European FLL Guidelines for particle size gradation, dry vs saturated bulk density, porosity, water retention hydraulic conductivity, pH balance and organic matter content.
(b) Plantings: Expanded plant palettes

G) Perennial Plugs
1) Type: Perennial Plugs [HG 6200]
(a) Perennial Plugs shall be healthy vigorous plants and may include the following container sizes that will provide rapid root development:
(i) 72 cell
(ii) 32 cell
(iii) Quart pot
(iv) Gallon pot
(b) Perennial Plugs shall be delivered in the following means to ensure plants are healthy at receipt of materials:
(i) For air shipment, an insulated box with enclosed ice packs to ensure the perennial plugs remain cool and temperate until they are delivered.
(ii) For local shipment, all trucks need to be vented and/or plants must be in protected conditions that moderates temperatures from 40°F-85°F during shipment. Shipments of greater than four hours shall require air shipping standards.
(c) Contact Total System Provider for available and/or In-Season varieties. Reference Hanging Gardens Technical Guide and/or website for commonly available plantings.

H) Specified Plantings
1) Nursery stock plantings grown in accordance to the standards of American Nursery and Landscape Association.

I) Paver Pedestals
1) Type: SpiralJack Pedestals [HG 5100]
(a) Properties: Recycled Polypropylene resistant to mold, alkali and bitumen.
(b) Base Diameter: 6 1/16” standard, 6 3/4” with Base Slope Corrector.
(c) Height Range: ½” - 4 ¾”
(d) Maximum Compressive Strength: 4,496 lbs. (20 kN)
(e) Components: Separate tab and shim components available if roof slope compensation is desired.
(i) Standard Spacer tabs available in 5/64”, 1/8”, 5/32”, 1/4”, and 3/8” widths.
2) Type: DeckJack Pedestals [HG 5200]
(a) Properties: Recycled Polypropylene resistant to mold, alkali and bitumen.
(b) Base Diameter: 7 1/2” standard, 8 7/8” with Base Slope Corrector.
(c) Height Range: 1 ½” – 40 ¼”
(d) Maximum Compressive Strength: 3,372 lbs. (15 kN)
(e) Components: Separate tab and shim components available if roof slope compensation is desired.
(i) Standard Spacer tabs available in 5/64”, 1/8”, 5/32”, 1/4”, and 3/8” widths.

J) Walkway Pavers
1) Type: Classic-Line Concrete Pavers [HG 5310]
(a) Finish: Available in 12 standard colors as well as custom varieties available upon request.
(b) Standard size: 23 3/8” x 23 3/8” x 2” (Actual)
(c) Weight: 24 lbs. / ft^2
(d) Compressive Strength: > 8,000 lbs. / in^2

2) Type: Flex-Line Concrete Pavers [HG 5320]
   (a) Finish: Available in 24 standard colors as well as custom varieties available upon request.
   (b) Standard size: 23 7/8” x 23 7/8” x 2” (Actual)
      (i) Other Available Sizes (Actual):
         (i) 1 ¼”- 3” thicknesses
            1. 11 ¾” x 11 ¾”
            2. 11 ¾” x 23 ½”
         (ii) 1 ½” - 3” thicknesses
            1. 11 ¾” x 36”
            2. 12” x 36”
            3. 14 ½” x 14 ½”
            4. 14 5/8” x 29 5/8”
            5. 15 ¾” x 15 ¾”
            6. 15 ¾” x 23 5/8”
            7. 17 5/8” x 17 5/8”
            8. 18” x 18”
            9. 17 5/8” x 23 ½”
            10. 23 ½” x 23 ½”
            11. 23 ¾” x 23 ¾”
            12. 24” x 24”
         (iii) 2” - 3” thicknesses
            1. 17 5/8” x 35 3/8”
            2. 23 ½” x 29 ½”
            3. 23 ½” x 35 3/8”
            4. 29 ½” x 29 ½”
            5. 29 ¾” x 29 ¾”
         (iv) 2 ½” - 3” thicknesses
            1. 35 ½” x 35 ½”
   (c) Weight: 23 lbs. / ft^2
   (d) Compressive Strength: > 9,500 lbs. / in^2

K) Type: Wood Deck Tiles [HG 5350]
   1) Materials: Ipe, Cumaru, Tigerwood, Black Locust, Garapa, Massaranduba, and/or Itauba.
      (a) Sizes (Actual):
         (i) 23 5/8” x 23 5/8” x 1 1/2”
         (ii) 23 5/8” x 47 3/8” x 1 1/2”
      (b) Weight: 6 lbs. / ft^2

L) Type: Porcelain Pavers [HG 5360]
   1) Finish: Available in 23 different finishes. Please contact Hanging Gardens, LLC for samples.
   2) Sizes (Actual):
      (a) Wood Finish
         (i) 11 13/16” x 47 1/4” x ¾”
         (ii) 23 5/8” x 47 1/4” x ¾”
      (b) Stone Finish
         (i) 23 5/8” x 23 5/8” x ¾”
         (ii) 23 5/8” x 47 1/4” x ¾”
   3) Weight: 9 lbs. / ft^2

M) Drainage Stone
   1) Material: Smooth landscape stone
   2) Size: 1/2"-1” diameter
   3) Shape: Round / elliptical. Any stone with sharp edges will be rejected.

PART 3 EXECUTION

I) EXAMINATION

A) Verify that the surfaces and site conditions are ready to receive work.
B) Verify that the deck is supported and secured.
C) Verify that the deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers or gutters.
D) Verify that the deck surfaces are dry and free of ice or snow.
E) Verify that all roof openings or penetrations through the roof are solidly set, and that all flashings are tapered.

II) PREPARATION

A) Condition of Surface: Any new concrete surfaces shall be wood float finish ACI 301-11.7.3 or better.
    1) All surfaces shall be dry, clean, firm and free from laitance, frost, dust, dirt, oil, unapproved curing compounds or other foreign matter detrimental to performance of the waterproofing membrane.
    2) The Contractor shall certify no wax base curing compounds have been used. Follow ASTM D-5295 Guide for preparation of concrete surfaces.
    3) All concrete shall have cured for a minimum of 28 days or, alternatively, pass ASTM D-4263 Plastic Film Moisture Content Test and the NRCA deck dryness test.
B) Evaluate the level of moisture in the substrate to determine that moisture levels are acceptable for application of the specified waterproofing system.
    1) Concrete substrates to receive an application of the waterproofing membrane shall have a maximum moisture content of 6% and a maximum internal relative humidity of 75%. Verify the substrate is visibly dry and free of moisture.
    2) Capillary moisture is tested by plastic sheet method according to ASTM D4263, and/or moisture meters or infrared cameras.
C) Before commencing work, examine all areas and report in writing to Architect any conditions that will adversely affect successful installation.
    1) Do not begin work until the conditions have been corrected.
    2) Voids, cracks, holes and other damaged surfaces shall be repaired with materials compatible with reinforced rubberized-asphalt waterproofing.
    3) On existing concrete decks, all old existing membrane and flashings shall be completely removed to bare concrete.
D) No protection from the weather is necessary for reinforced rubberized-asphalt waterproofing, but temporary protection for installed membrane is required to prevent damage by mechanical gouging, scraping, spilling of oil, solvents or exposure to excessive heat.
E) Expansion Joints: Expansion joints shall be sharply formed and free of broken edges or loose aggregate and completely free of preformed joint fillers, sealants or back-up materials to a depth that is at least twice the width of the joint. Curb expansion joints at each side of the joint, either by integrally forming with the slab or securely fastening sulfate treated wood strips to deck. Chamfered the edges of curbs that membrane is installed over.
F) Verify that substrate complies with roofing manufacturers and leak detection manufacturer's requirements. Proceed with installation once substrate complies with requirements.
    1) Examine each area to receive vegetated roof assembly for compliance with requirements for installation tolerances and other conditions affecting performance.
G) Cutting: Use only hook blade or safety knife when cutting material on the roof. Never use a straight blade. Never cut directly on roof membrane. Protect membrane with plywood or other stable, rigid surface when cutting.
H) General: Protect structures, utilities, sidewalks, pavements, and other facilities and areas from damage caused by installation.

III) WATERPROOFING MEMBRANE & ACCESSORIES

A) Primer/Surface Conditioner

1) Surface Conditioner: Each day, prior to application of RAM-Tough 250, apply surface conditioner, as a fine spray at a rate of approximately 1 gallon per 300-600 square feet. Allow to dry completely tack free. Do not allow primed surface to be contaminated with construction debris or dust barrier. Re-prime and allow to dry as may be required by job conditions.
2) Conductive Primer
   (a) Examination:
      (i) Do not begin primer installation until substrates have been properly prepared.
      (ii) Surface should be clean and dry. Do not apply to wet or moisture-soaked materials. Heavy dirt, grease, or other contaminates need to be removed using proper cleaning methods.
      (iii) During hot temperatures surfaces can be extremely hot. Special attention is needed. Apply product in small areas to test application.
      (iv) For previously coated surfaces, certain plastics (e.g. PVC) or glossy surface finishes contact manufacturer or manufacturer's representative for guidance.
   (b) Primer Application:
      (i) Application using a roller - Mix pails of Conductive Primer thoroughly so that the primer has uniform viscosity, color and transparency. Turning the pails upside-down before opening for five minutes is recommended to ensure proper mixing. After mixing, apply the primer using a roller in an even coat so that the substrate turns entirely black. Any coloration of the substrate visible through the primer indicates a shortage of primer and must have more primer applied. Porous substrates such as plywood may require two coats of primer to ensure proper coverage.
      (ii) Spray Application - Mix pails of Conductive Primer thoroughly so that the primer has uniform viscosity, color and transparency. Turning the pails upside-down before opening for five minutes is recommended to ensure proper mixing. After mixing apply the primer using a spray gun so that the substrate turns entirely black. Apply with a steady pattern with 3-inch (76 mm) overlaps. Any coloration of the substrate visible through the primer indicates a shortage of primer and must have more primer applied. Porous substrates such as plywood may require two coats of primer to ensure proper coverage.
      (iii) Minimum thickness:
         (i) 0.8 to 1.0 mils thick dry film
      (iv) Minimum coverage:
         (i) Minimum coverage of 300 to 400 sq ft per gallon (28 sq m/l to 37 sq m/l) required.

B) Crack Treatment
   1) At all cracks over 1/16th inch width and all construction joints, apply RAM-Tough 250, 125 mils thick, then center a 6-inch-wide strip of RAM Flash 327 HDR neoprene flashing over the joint or crack and embed into the warm RAM-Tough 250. Avoid air pockets. Allow assembly to cool. Reinforcement and flashing should be installed before the continuous, unbroken thick film of bitumen or reinforcement felt is applied over the entire roof surface and flashing areas in accordance with specification in Section 3.05.

C) Expansion Joints
   1) Over expansion joints, up to 3 inches in width with a designed total movement of 50% or less, RAM Flash 327 HDR neoprene flashing shall be placed over the joint as shown on the drawings and embedded into a 125-mil thick coating of RAM-Tough 250. The sheet shall be looped into the joint 1-1/2 times the joint width at maximum opening and extend 8 inches onto the deck on each side of the joint. The sheet shall be covered, and the loop filled solid and flush with RAM-Tough 250. Install 2-inch foam rod and second sheet of neoprene flashing looped over the foam rod. Extend sheet 12 inches onto the deck on each side of the joint. Overcoat flange on each side with RAM-Tough 250.

D) Flashing
   1) RAM-Tough 250 Flashings
      (a) Base Flashing Base Ply

(i) Complete base flashing base ply work before doing flat field application in 3.05. Carry hot applied RAM-Tough 250 and reinforcement up all junctions of horizontal deck and vertical surfaces, all changes of plane, all cold joints and cracks as indicated on the drawings. At all parapets, walls, curbs, penetrations, drains, edges, and other changes of plane, install RAM Flash 327 HDR 60 mil neoprene flashing with hot fluid RAM-Tough 250 as shown on the drawings, extending to top of the flashing over the base of RAM-Tough 250 and polyester reinforcement.

(ii) Apply the neoprene flashing tight to all substrates starting the installation on the flat and working the sheet into place in upward direction. Finished sheet shall be completely adhered with no unsupported "bridging" at the change of plane. Over-coat sheet with another 125-mil coat of the RAM-Tough 250. Application width of neoprene flashing sheet shall be a minimum 3 inches in any single direction or more as required by field conditions.

(b) Base Flashing Cap Ply

(i) Do not install the base flashing cap ply until the flat field of the roof is completed. Precut RAM 306 sheet across the roll to install in 36-inch-wide sheets. Embed RAM 306 SBS granular cap sheet membrane into hot RAM-Tough 250 extending flashings out onto the field of the roof 3 inches minimum and up vertical surfaces 8 inches minimum and 24 inches maximum. Overlap shall be 3 inches minimum. Mechanically fasten top to the substrate with 1/8-inch-thick flat bar stock termination bar and mechanically fasten 8 inches on centers. Seal the top edge of flashings with Ram Mastic. Counter-flashing is required.

E) Membrane Installation

1) Liquid Applied Waterproofing Membrane

(a) RAM-Tough 250 / hot rubberized asphalt installation

(i) Rubberized-asphalt waterproofing: Units of rubberized-asphalt waterproofing shall be melted in an approved double-jacket air or oil bath melted under continuous agitation until the material can be drawn free-flowing and lump-free at a temperature of approx. 350°F - 400°F. The rubberized-asphalt waterproofing is applied at a rate to provide a continuous coating not less than 90 mils thick. Carry slab applications up all vertical wall surfaces a minimum of 8 inches.

(ii) Hot fluid applied rubberized-asphalt waterproofing shall be applied in a width exceeding the reinforcement fabric roll width. While rubberized-asphalt waterproofing is hot and tacky, install specified Poly-Felt spun bond polyester fabric reinforcement, brooming in place from the side of the fabric. Side laps shall be a minimum of 2 inches with lap placement so that water flows over them and not against them. All laps shall be sealed with hot rubberized-asphalt waterproofing under lap. In no place shall reinforcement touch reinforcement. End laps shall be 7 inches. Carry reinforcement up all vertical wall surfaces a minimum of 6 inches.

(iii) After reinforcement fabric has been placed and broomed in, install second layer of rubberized-asphalt waterproofing, a minimum of 125 mils thick, at all points of the deck and walls. Carry slab applications up vertical wall surfaces a minimum of 8 inches. Do not leave any reinforcement fabric uncoated at end of day's work or in inclement weather. Complete installation of all plies each day including cap sheet. Total Thickness of rubberized-asphalt waterproofing shall be 215 mils.

F) Deck Equipment & Penetrations

1) All air conditioners and mechanical units set on the deck shall be lifted to allow new waterproofing and flashing under unit as required. Minimum height for all curbs and other flashings is 8 inches above the highest expected waterline. Raise as shown or required. New equipment dunnage, flashing and metal coping shall be installed as shown or required. Install new neoprene wear pads between the unit supports and dunnage.

G) Electronic Leak Detection (ELD) Initial Test

1) Follow submitted shop drawings.

2) Installation Testing: Verify continuity and functioning of system upon completion of installation.
3) Initial Membrane Test: Perform initial leak detection test upon completion of membrane and leak detection system installation and prior to installation of above-membrane components.
   (a) Membrane Integrity Testing
      (i) Engage Installation and Testing Firm to perform membrane integrity testing. Perform testing in accordance with membrane integrity test system manufacturer's recommendations.
         (i) Perform testing following adequate precipitation or wet membrane [and membrane overburden] adequately to enable accurate testing.
         (ii) Identify locations of membrane leaks; record locations and document with photographs. Submit test reports to Architect.
         (iii) Confirm completed repair of identified leaks and retest to verify water tightness of membrane.

H) Protection Course
1) After Electronic Leak Detection (ELD) test is completed, using RAM-Tough 250 as adhesive and starting at the low points, apply specified protection course lapping the side laps a minimum of 2 inches in direction of drainage gradient so water flows over and not against laps.

I) Root Barrier
1) The primary root barrier shall be installed in accordance with manufacturer's recommendations over the protection course. Install primary root barrier with a minimum of 12-inch side and end laps of root barrier. Run root barrier past full height at all base flashings, drain access boxes, vent pipe access boxes and perimeters and temporarily hold in place with RB25 tape.

J) Protection Fleece
1) Roll out protective fleece on top of waterproof membrane and root barrier. Overlap seams a minimum of 4 inches along sides and 12 inches along ends. Wet fabric as necessary to provide short-term ballast. For long term ballast use sandbags or paver slabs. Never cut near the roofing membrane when cutting fabric for installation. Only cut fabric using industrial shears, and never with a utility knife.

K) Drainage Layer
1) Flow Drain [HG 3510, 3511, or 3512]
   (a) Roll out drainage mat on top of protection fleece. Overlap filter fabric a minimum of 3 inches along sides. Never cut near the roofing membrane when cutting drainage mat for installation. Only cut drainage mat using industrial shears, and never with a utility knife.

L) Insulation
1) Insure that membrane, flashing and other associated work is completed, tested and approved by Manufacturer. Upon acceptance of the waterproofing application, install extruded polystyrene insulation and/or expanded polystyrene insulation directly over the protection fleece. Stagger all joints by half a board. Tightly abut all boards. The maximum acceptable opening between boards is 1/4 inch. Install filter fabric over the insulation and turn up 6 inches at all projections and obstructions. Fabric can be trimmed after installation of the overburden. Provide temporary ballast required to prevent wind damage.

M) Composite Drainage Layer – Poured in Place Concrete
1) Paving Drain [HG 3530 and/or 3540]
   (a) Install drainage composite directly over insulation.
   (b) Neatly trim drainage composite to fit closely around penetrations and at the base of all drains to ensure that water will flow freely from composite into drain openings.
   (c) All cut edges of the drainage composite shall be covered to protect the waterproofing membrane from damage.
   (d) Promptly proceed with installation of poured in place concrete.

IV) VEGETATED ROOFING SYSTEM

A) Drainage/Retention Board

1) Be sure to orient drainage board smooth side up for semi-intensive board [HG 3616].
2) Install boards starting at roof drains and work towards high elevations. Overlap boards like shingles to ensure continuous drainage to outlets. Overlap edges by interlocking 1-2 rows of cups. Overlap area should total approximately 8% of roof area and be uniform throughout.
3) When cutting boards use only a portable table saw for efficient use of all material and to ensure crisp edges upon cutting. Cut along valley between cups. Never use a utility knife.

B) Filter Fleece
1) Roll out filter fleece on top of drainage/retention board. Overlap seams a minimum of 4 inches along sides and 12 inches along ends. Wet fabric as necessary to provide short-term ballast. For long term ballast use sandbags or paver slabs. Only cut fabric using industrial shears, and never with a utility knife. Never cut near the roofing membrane when cutting fabric for installation.

C) Edge Restraints
1) Type: Semi-Intensive Aluminum Edge [HG 3930] & Intensive Aluminum Edge [HG 3940] (as specified on plans for total growth media depth):
   (a) Lay edge profile sections end to end on top of the protective fleece layer.
   (b) Corner pieces to be used for 90-degree corners. Corners of any angle may be formed by cutting the edging on site.
   (c) Follow the submitted edge installation plan to ensure correct mix of male and female pieces are used. This includes all corners and radiuses. Adjustments to be expected as growing media is being installed that edging remains in the indicated areas on the submitted edge installation plan.
   (d) Connect edge pieces and corners with provided connectors.
   (e) Make sure edging does not come in direct contact with base waterproofing membrane.
   (f) Tools: Rubber or rawhide hammer.
2) Type: Semi-Intensive Aluminum Edge [HG 3930] & Intensive Aluminum Edge [HG 3940] (as specified on plans for total growth media depth):
   (a) Place separation/protective layer between membrane and edge restraints as deemed acceptable by membrane manufacturer.
   (b) Lay edge profile sections end to end on top of the separation/protective layer.
   (c) Corner pieces to be used for 90-degree corners. Corners of any angle may be formed by cutting the edging on site.
   (d) Follow the submitted edge installation plan to ensure correct mix of male and female pieces are used. This includes all corners and radiuses. Adjustments to be expected as growing media is being installed that edging remains in the indicated areas on the submitted edge installation plan.
   (e) Connect edge pieces and corners with provided connectors.
   (f) Secure edge restraint system to deck or waterproofing.
   (g) Tools: Rubber or rawhide hammer.

D) High Wind Stabilization Grid
1) Roll out high wind stabilization grid on top of filter fleece.
2) Overlap seams a minimum of 4 inches along sides and 12 inches along ends.
3) Secure seams together with high tensile strength cable ties.
   (a) Parapet wall height:
      (i) 42 inches = 48 inches on center
      (ii) 18-42 inches = 24 inches on center
      (iii) 0-18 inches = 12 inches on center
4) Secure high wind stabilization grid to edge restraints and/or approved metal flashings with high tensile strength cable ties.

E) Drain/Access Box
1) In the case that drainage board is installed adjacent to the drains, then the drain/access boxes are to be placed directly over top of the board.
2) In the case that a drainage stone is used, the drain/access boxes should be placed directly on the protective fleece with the drainage stone abutting the outside walls.

3) In the case of inverted roofs, the inspection boxes are placed on the thermal insulation. Following this, a separation ring is installed, which is filled with gravel thus forming the gravel strip surrounding the inspection box.
4) Great care should be taken to ensure the continuity of the filter fleece surrounding the inspection boxes. It is advisable to run the filter-fleece at least 4" up along the sides of the inspection boxes and wrap them over the top rim so that the inspection box cover will hold it in place.
5) When connecting drain/access boxes to high wind stabilization grid, utilize one high tensile strength cable tie for each side when attaching it to stabilization grid.

F) Growth Media
1) Growth media to be placed carefully to avoid damage or displacement of other materials such as edge restraints, filter fleece and drainage components.
2) Spread growth media to the depths as specified on the roofing, landscaping and/or green roofing plans with a variation of no more than 1/2". Ensure that growth media does not get under the layers of filter fleece, between filter fleece overlap, or into drainage/retention board cups. Finish depth of media to be verified by manufacturer prior to vegetation installation.
(a) Apply Bio-Stimulant and Bio-Fertilizer soil amendments over approved growth media depth.
3) Growth media can be shipped in a variety of forms depending on logistics:
(a) 50 lb. Bags: For small applications such as many residential projects.
(b) Super Sacks: 2 Cubic Yards. Ideal for larger vegetated roofs. The load bearing capacity of the roof must be considered before unloading bags on top of roof. Access and operation of a crane must also be considered for this application.
(c) Blowing Trucks: The granulometric distribution may change depending on the source material. A watering arrangement may be used to keep the growing media moist and prevent erosion.
(d) Only use flat-edge plastic shovels & landscaping rakes for placement, movement, and leveling of growth media, all other tools must be approved by manufacturer for use.
4) If there is spillage of growth media into drainage/retention board or subsequent layers beneath, use a portable shop vacuum to ensure that debris is removed and placed appropriately.

G) Perennial Plugs and/or Specified Plantings
1) Plant all specified nursery stock plantings in accordance with approved landscape design.
2) If more than 24 hours has elapsed since installing and soaking the growth media, thoroughly re-soak growth media prior to commencing planting the plugs.
3) Consult drawings for plug planting layout and rate.
4) If an erosion / wind netting is required, make cuts in the erosion / wind netting as required to insert the plugs.
5) Set plugs into the growth media to their full depth and then press the growth media firmly around the installed plug. At the end of each day of planting, soak those areas that have been newly planted.

H) Walkway Pavers and Pedestals
1) Surface on which the pedestals will be placed must be capable of supporting load, clean and free of debris.
2) The finished elevation less the paver thickness shall be established and marked around the perimeter with laser leveling devices.
3) Protective fleece is to be rolled out over the entire area to receive paver pedestals. Overlap seams by 12-18". Staged installation of the product is recommended as the paver/pedestals are being installed. This is to prevent the wind uplift of the material prior to the ballasting of the protective fleece with the paver/pedestal system.
4) For installation of pavers in large areas, a paver shall be installed onto 4 pedestals at dispersed locations at every 2000 square feet. The paver shall be installed at the correct elevation using a laser leveling device (or water level) and serve as a reference point to verify the exact elevation of the remaining pavers.

I) Drainage Stone
   1) Stone to be installed over protective fleece in drainage zones. Be sure protective fleece is covering all portions of the membrane, overlap seams 6" and butt tight against edge restraints.

V) FIELD QUALITY CONTROL

A) Manufacturer's Field Service: Engage Division 07 membrane roofing manufacturer's authorized service representative to provide inspection of vegetated roof assembly installation and prepare inspection reports.
B) Electronic Leak Detection (ELD) Assembly Test: Repeat leak detection test following installation of above-membrane components.
   1) Engage Installation and Testing Firm to perform membrane leak testing. Perform testing in accordance with leak detection system manufacturer's recommendations.
   2) Perform testing following adequate precipitation or wet membrane **[**and membrane overburden**]** adequately to enable accurate testing.
   3) Identify locations of membrane leaks; record locations and document with photographs. Submit test reports to Total System Provider and Architect.
   4) Confirm completed repair of identified leaks and retest to verify water tightness of membrane.
C) Correct deficiencies in work that do not comply with requirements.

VI) PLANT MAINTENANCE

A) Provide contractors' Greenformation® plan for proposed maintenance activities after installation. Owner may also submit maintenance plan to maintain manufacturer warranty. Contact adgreenroof.com for specific information.
B) General: During maintenance period, maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing devices, resetting plants to proper elevations or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep plantings free of insects and disease.
C) Periodically check on soil depth and moisture levels across the planted area. Add growing media to system as needed.
D) Apply treatments as required to keep plant materials, planted areas, and growing medium free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Utilize Greenformation® response to the problem. Treatments may include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.
E) Use only products and methods acceptable to membrane roofing manufacturer.
F) **Provide Greenformation® sample maintenance plan for proposed maintenance activities after installation.**

VII) CLEANING AND PROTECTION

A) During planting and maintenance, keep adjacent areas and construction clean and maintain work area in an orderly condition.
B) Protect Vegetated Roof Assemblies from damage due to planting operations and operations of other contractors and trades. Repair or replace damaged Vegetated Roof Assemblies.

END OF SECTION