SOPREMA

**

VEGETATIVE ROOF ASSEMBLIES

PART I - GENERAL

1.01 Summary

 A. This is meant to be a guide specification for overburden placed over a waterproofing assembly from the section 073363 or Roofing portion of this specification

 B. Furnish all labor, materials, tools, and equipment to furnish and install garden roof system, drainage materials, growth media and plants on a low-sloped roof.

* 1. PERFORMANCE REQUIREMENTS

 A. Division 2 – Sitework – Pavers and other accessories to complete the installation supplied by SOPREMA. See Division 7 for specific details.

 B. Division 3 – Concrete Roof Deck

 It is important to coordinate Division 3 (Concrete) with Division 7 (Waterproofing) since the concrete must be properly installed and finished to satisfactorily accept the waterproofing membrane. Installations in which an existing roof is to be removed down to the existing structural concrete (e.g., existing materials to be removed) might require additional surface conditioning prior to the installation of the waterproofing membranes. Consult the membrane manufacturer for requirements. Concrete decks must meet the requirements of ASTM D 5295 The preparation of concrete decks.

 1. Min 3500 psi compressive strength in 28 days Minimum.

 2. Wood-float/wood-trowel finish; finishing should not be performed with a steel trowel.

 3. Concrete Cure

 a. Structural concrete must be cured a minimum of 14 to 28 days in accordance with industry criteria prior to installation of the waterproofing membranes. Time required will vary depending on the application of the waterproofing membrane.

 b. Cure can be tested in accordance with ASTM D 4263 *Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method* or in accordance with NRCA deck dryness methodology.

 C. Division [ ] – Wood Blocking and Curbing

 D. Division [ ] – Insulation

 E. Division [ ] – Sheet Metal Flashing & Counterflashings and Terminations

 F. Division [ ] – Prefabricated Roof Specialties

 G. Division [ ] – Caulking & Sealants

 H. Division [ ] – Plumbing Specialties

 I. Division [ ] – Roof Hatches

 J. Division [ ] – Landscaping

* 1. PERFORMANCE REQUIREMENTS

 A. Maintain a vegetated green roof for the life of the purposed warranty.

 B. Install all components of green roof in accordance with manufactures guidelines and in a manner that will not damage the waterproofing membrane.

1.04 REFERENCES

 A. American Society for Testing and Materials (ASTM).

 B. Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau (FLL) guidelines

1.05 DEFINITIONS

 A. Garden Roof -- An area of planting/landscaping, built up on a waterproofed

 substrate at any level that is separated from the natural ground by a man-made structure.

 B. Extensive Garden Roof -- Low maintenance landscaping consisting of shallow

 soil depths (3 to 6 inches) with plant varieties to be chosen by a certified

 Landscape Architect.

 C. Semi-Intensive Garden Roof – Medium maintenance landscaping consisting of

 medium soil depth (6 to 8 inches) with plant varieties to be chosen by a certified

 Landscape Architect.

 D. Intensive Garden Roof – Higher maintenance landscaping consisting of high soil

 depths (8+ inches) with plant varieties to be chosen by certified Landscape

 Architect.

 E. Garden Roof Contractor – A contractor certified by the Garden Roof System

 Manufacturer to install all components of a comprehensive green roof system

 including, but not limited to protection layer, thermal insulation, drainage layer,

 filter fabric, edging, growing medium (soil), and vegetation.

1.06 DESCRIPTION OF GREEN ROOFING SYSTEM

1. A well designed Green Roof System is comprised of 3 high quality key components specifically chosen and matched as a system in order to function optimally to maximize microbial life and subsequent vegetative plant cover with minimal man-made input.
	1. The growing substrate layer is a light weight engineered soil-like material. Properly designed and produced it has three objectives:
		1. Maximize water retention within a certain soil column weight constraint of the roof.
		2. Secondly, an equally important objective of the Growing Substrate is to create optimized microbial soil health conditions that makes more water and nutrients available to the plants, allowing the plants to grow a 95%+ closed vegetative canopy.
		3. Thirdly, the microbes in optimized soil conditions act like a ‘sink’ for water and more importantly dissolvable nutrients which prevents runoff pollution. Both water and nutrients are now available to the plant when needed, which means the system can thrive while requiring less water and/or synthetic fertilizers.
	2. The drainage / water storage layer is a man-made durable plastic form. It has 3 objectives it needs to address:
		1. It drains excess water from the roof through the ‘tunnel-side’ of the drainage layer to prevent weight capacity overload and fungal rot (Pythium) in the root zone.
		2. The ‘cup-side’ of the drainage layer mimics nature as it stores water underneath the root zone to bridge times of drought.
		3. To facilitate appropriate oxygen exchange within the soil layer that promotes microbial soil health, root growth and prevents any root rot.
	3. The instant vegetation is comprised of fully grown Sedum plants grown in a thin layer of mineral substrate on a 4’x6’coco- fiber blanket. This component has 4 objectives:
		1. Instant aesthetics
		2. Wind erosion and fire prevention benefits
		3. Weed prevention. A fully grown closed plant canopy upon installation prevents weed growth. Optimal and instant solar protection for optimized microbial conditions. An instant and fully grown canopy protects the substrate year round from solar radiation which optimizes soil conditions that promote robust microbial soil health. This in turn allows the plants to be healthy, stress resistant and maximizes growth while minimizing man-made input.

1.07 SUBMITTALS

###  A. Product Data: For each type of roofing material indicated.

 1. Provide product data on all components of the garden roof assembly.

 2. Submit list of materials and data sheets describing physical characteristics and performance criteria for materials proposed for use

 3. Include sample of warranty customized for this project.

 B. Shop Drawings: Include plans, sections, details, and attachments to other Work, flashing sheets, roof penetrations, vertical intersections, roof slope, expansion joints, membrane terminations, soil depth, planting schedule and drainage.

 C. Samples for Verification: For each of the following products:

 1. Submit sample of ballast.

 2. Manufacturer’s standard sample of tapered board insulation.

 3. Manufacturer’s standard sample of drainage/water storage board, protection layer and moisture relocation matt.

 4. Submit a sample bag of soil media.

 5. Nursery’s listing of available plants complying with listed specifications.

 6. 12” section of perforated metal edging.

 D. Installer Certificates: Signed by manufacturer’s certifying that installers comply with requirements.

 E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

 F. Maintenance: Provide scope for yearly maintenance of Garden Roofing.

 G. Warranties: Provide documentation either with roof warranty or stand alone for Garden Roof components.

 H. Inspection Report for Information: Copy of roofing system manufacturer’s inspection report of completed roofing membrane.

1.08 QUALITY ASSURANCE

 A. Refer to Section 1.07 SUBMITTALS.

 B. The Garden Roof Contractor shall demonstrate qualifica­tions to perform the work of this Section by submitting the following documentation:

 1. Approved by the Garden Roof System Manufactureras an authorized installer in good standing.

 2. List of at least three (3) projects, satisfactorily completed within the past three (3) years, of similar scope and complexity to this project. Previous experience submittal shall correspond to specific Green Roof System proposed for use by Green Roof/Waterproofing Contractor.

###  C. Installation of leveling layer, separation layer, drainage layer and insulation shall be the responsibility of the Garden Roof Contractor to ensure undivided

###  responsibility.

 D. Supplier Qualifications:

 1. Green Plant supplier that specializes in the propagation of green roof plants.

 2. Green Roof plant supplier must have 5 years experience in the production and maintenance of green roof plants specifically chosen.

 3. Engineered planting media by a firm that specifically mixes rooftop media and is approved by Soprema.

 E. Drainage mat manufacturer should have successfully produced drainage mat material for at least 15 years.

 F. Garden Roof System Manufacturer shall have available an in-house technical staff to assist the Garden Contractor, when necessary, in application of the products and final inspection of the assembly.

###  G. Pre-construction conference to be held with the Owner, Architect, Garden Roof Contractor’s field superintendent, Garden Roof System Manufacturer’s representative, and other involved trades to discuss waterproofing practices applicable to this project, including schedule for waterproofing, flood testing, installation or soil media and planting schedule. Pre-installation conference should include general contractor’s plan for green roof protection, if necessary.

###  1. Review structural load limitations of roof deck during and after roofing.

###  2. Review flashing, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.

###  3. Review regulations and requirements of authorities having jurisdiction for insurance certifications, inspection and testing, if applicable.

###  4. Review temporary protection requirements for roofing system during and after installation.

###  5. Review roof observation and repair procedures after roofing installation.

###  H. Water testing of the completed waterproofing system (minimum of 24 hours) is required. Water testing shall be witnessed and confirmed in writing by the Owner’s Representative, the Garden Roof Contractor, and the Garden Roof System Manufacturer’s representative.

 I. All work shall be completed by trained and authorized personnel.

1.09 DELIVERY, STORAGE AND HANDLING

 A. Deliver materials in original unopened containers of packaging clearly labeled with manufacturer's name, brand name, instruction for use, all identifying numbers, and U.L. labels.

 B. Materials shall be stored in a neat, safe manner, not to exceed the allowable structural capacity of the storage area.

 C. Store materials in a clean, dry area protected from water and direct sunlight.

###  D. Membrane rolls shall be stored lying down on pallets and fully protected from moisture with canvas tarpaulins.

###  E. Bonding adhesives shall be stored at temperatures above 40°F (5°C).

 F. Deliver roof media in bags on site and protect from contamination dumping on site is not accepted.

1.10 PROJECT CONDITIONS

###  A. Proceed with Garden roof installation only after water test has been completed. Owner’s Representative and/or Architect and Garden Roof Contractor must

###  water test results before proceeding with membrane installation.

###  B. Do not work in rain or snow or adverse weather conditions. Comply with

###  applicable installation requirements for all components.

###  C. All work shall be scheduled and executed without exposing the interior building areas to the effects of inclement weather. The building and its contents shall be

###  protected against all risks.

###  D. The Garden Roof Contractor shall take precautions that storage and/or

###  application of materials and/or equipment does not overload the deck or building

###  structure.

###  E. All new and temporary construction, including equipment and accessories, shall

###  be secured in such a manner, at all times, as to preclude wind blow-off or

###  damage.

###  F. Arrange work sequence to avoid use of newly-constructed garden roof for

###  storage, walking surface, and equipment movement. Where such access is

###  absolutely required, the Roof/Waterproofing Contractor shall provide all

###  necessary protection and barriers to segregate the work area and to prevent

###  damage to adjacent areas. Any damage which occurs to the garden roof system

###  is to be brought to the attention of the Owner’s Representative and/or Architect

###  and the Garden Roof System Manufacturer’s representative. All damage is to be

###  repaired according to Garden Roof System Manufacturer recommendations.

###  G. Prior to and during installation, all dirt, debris and dust shall be removed from

###  surfaces by vacuuming, sweeping, blowing with compressed air, pressure

###  washing and/or similar methods per manufacturer’s written instructions.

###  H. All materials shall be immediately taken off the site to a legal dumping or

###  recycling area authorized to receive such materials.

###  I. If any unusual or concealed condition is discovered, stop work and notify the

###  Owner’s Representative and/or Architect and Garden Roof System

###  Manufacturer’s representative immediately, in writing.

###  J. Liquid materials such as solvents and adhesives shall be stored and used away

###  from open flames, sparks and excessive heat. All products including solvents,

###  compatible with and not detrimental to plant components and plant growth.

###  K. Contaminants, such as grease, fats, oils, and solvents, shall not be allowed to

###  come into direct contact with the waterproofing membrane. Any such contact

###  shall be reported to Owner’s Representative and/or Architect and the Garden

###  Roof System Manufacturer’s representative immediately.

###  L. The Garden Roof Contractor shall verify that all drain lines are connected and

###  un-blocked before starting work. Report any such blockages or non-connected

###  drains to the Owner’s Representative and/or Architect in writing.

###  M. Site cleanup, including both interior and exterior building areas below or

###  adjacent to, or in any way affected by the construction, shall be complete and to

###  the Owner’s satisfaction.

###  N. All landscaped areas affected by the garden roof system installation shall be

###  raked clean and restored to original conditions, if required.

###  O. All paved areas shall be swept clean.

###  P. All areas stained, dirtied, and discolored or otherwise damaged due to the

###  garden roof system installation shall be cleaned, restored, and replaced as

###  required.

 Q. Garden Roof Contractorshall assure that adequate protection is provided after installation so other trades do not damage garden areas.

1.11 WARRANTY

 A. Please refer to the roofing portion of this specification to see what the warranty will cover. The following are some components that may or may not be covered: protection layer/root barrier, rigid thermal tapered insulation, drainage layer, filter fabric, river gravel maintenance strip / ballast, lightweight engineered growing medium (soil), vegetation, and automatic irrigation system. All components

are under a single-source warranty offered by Soprnature.

 This includes 2 years from the Vegetative Plant System Grower assuming the

Vegetation System is properly maintained per the Vegetative Plant Grower

Maintenance Requirements.

 1. Duration of Membrane/Flashing: See Roofing Section

 2. Duration of Insulation: See Roofing section

 3. Material Integrity of Green Roof Components: 20-years

 4. Extensive Vegetation: 2-year thrive coverage

 Note: As part of the plant thrive warranty the owner will be required to help maintain the planting throughout the year according to the guidelines provided by the grower.

PART II PRODUCTS

2.01 MATERIALS

 A. General: Provide products required by manufacturers to be fully compatible with each other and with indicated substrates, or provide separation materials as required to eliminate contact between Incompatible materials.

B. See Roofing section of specification

 C. Root barrier

1. Sopranature Root Barrier – Available in 20 mil or 30 mil thicknesses.

Virgin- blended linear polyethylene. Used below the drainage layer. Double- sided and single sided BUTYL tape available to tape seams.

 Soprnature 20 (20 mils) Properties

 a. Roll sizes: 467 sq ft or 700 sq ft

 b. Tensile Strength: 75 lbs.

 c. Elongation at Break: 800%

 d. Tear resistance: 11 lbs/ft

 e. Hydrostatic resistance: 100 psi

 f. Puncture resistance: 30 lbs/ft

 g. Perm rating: .041perms

 Soprnature 30 (30 mils) Properties

 a. Roll length: 467 sq ft or 700 sq ft

 b. Tensile Strength: 142 lbs

 c. Elongation at Break: 800%

 d. Tear Strength: 16 lbs/ft

 e. Hydrostatic resistance: 170 psi

 f. Puncture Resistance: 45 lbs/ft

 g. Perm rating: .031 perms

 D. Adhesive Tapes (choose one is applicable)

1. Soprnature Butyl Seam Tape – single or double-sided reinforced aggressive black butyl, that is non-hardening and will remain flexible.

 Properties

 a. Color: Black

 b. Size: 2”x50’ (double), 4” x100’ (single)

 c. Service Temp: 30 degrees to 100 degrees F

 d. Minimum Application Temp: 35 degrees

 E. Soprema Drainage and/or Water Retention Layer

 1. Sopradrain Eco-Vent – Drainage composite consisting of a post- industrial recycled polypropylene drainage core of fused, entangled filaments and a composite geotextile fabric heat fused to one side.

 Properties Core

 a. Compressive Strength: 30,000 psf

 b. Thickness: 0.45 in

 c. Flow rate: 9.2 gal/min/ft

 Fabric Properties

 a. Flow: 120.0 gal/min/sf

 b. Puncture Strength: 70 lbs.

 c. Apparent Opening Size (AOS): 70 US sieve

 d. Grab Strength: 120.0 lbs.

 2. Sopradrain Eco-2 – Drainage composite consisting of a post-industrial recycled polypropylene drainage core of fused, entangled filaments and a composite geotextile fabric heat fused to one side and bonded to the other. This second fabric eliminates the need for a protection fabric.

 Properties Core

 a. Compressive Strength: 30,000 psf

 b. Thickness: 0.45 in

 c. Flow rate: 7.7 gal/min/ft

 Fabric Properties (Black)

 a. Flow: 120.0 gal/min/sf

 b. Puncture Strength: 70 lbs.

 c. Apparent Opening Size (AOS): 70 US sieve

 d. Grab Strength: 120.0 lbs.

 Fabric Properties (grey)

 a. Flow: 185.0 gal/min/sf

 b. Puncture Strength: 35.0 lbs

 c. Apparent Opening Size (AOS): .357 mm

 d. Grab Strength: 125.0 lbs.

 3. Sopradrain Eco-Vent WR – This is a multi-function composite consisting of 50% post-industrial recycled polypropylene drainage core of fused, entangled filaments and a specially formulated water retention fabric bonded to one side. The absorbent mat is designed to hold 10 to 12 times its units weight of water.

 Drainage Core Properties

 a. Thickness: 0.60 in

 b. Flow rate: 6.9 gal/min/ft

 c. Compression Strength: 30,000 PSF

 Water Retention Fabric Properties

 a. Weight: 20 oz/sq yd

 b. Puncture Strength: 70 lbs

 c. Grab Strength: 135.0 lbs

 4. Sopradrain Eco-2 WR – This is a multi-function composite consisting of 4 0% post-industrial recycled polypropylene drainage core of fused, entangled filaments and a specially formulated water retention fabric bonded to one side and a protection fabric bonded to the other. The absorbent mat is designed to hold 10 to 12 times its units weight of water. The fabric eliminates the need for a separate protection layer.

 Drain Core Properties

 a. Thickness: 0.60 in

 b. Flow rate: 6.9 gal/min/ft

 c. Compression Strength – 30,000 PSF

 Water Retention Fabric Properties

 a. Weight: 20 oz/sq yd

 b. Puncture Strength: 70 lbs.

 c. Grab Strength: 135.0 lbs

 F. Water Retention/Capillary Water Management System (choose one if necessary)

1. Soprnature Moisture Retention Mat **–** Made from 100% recycled materials 35% polypropylene and 65% polyester. Contains no organic material and will not decompose. Designed to hold moisture in the garden roof assembly.

 MRM14 (455 sf) Properties

 a. Water retention: .123 gal/sf

 b. Roll weight: 84 lbs

 c. Thickness: .087 in

 d. Bursting Strength: 261 lbs

 e. Puncture resistance: 101 lbs

 f. Elongation: Warp 122%; Fill 96%

 g. Breaking strength: Warp 186 lbs; Fill 219 lbs

 MRM30 (455 sf) Properties

 a. Water retention: .201 gal/sf

 b. Roll weight: 110 lbs.

 c. Thickness: .397 in

 d. Bursting strength: 776 lbs

 e. Puncture resistance: 275 lbs

 f. Elongation: Warp: 153%; Fill 131%

 g. Breaking strength: 282 lbs; Fill 435 lbs

 G. Extruded Polystyrene Insulation (if necessary)

 1. Dow Styrofoam

 a. Insulation shall meet ASTM C-578, Type VI or VII.

 b. Minimum compressive strength, ASTM D-1621, 60 psi (variance by type of product). Provide 60 psi insulation under garden system.

 c. Maximum water absorption by volume per ASTM C-272,0.1%

 d. Water vapor permeance for 1" product per ASTM E-96, 1.0 perm (max.) (63 ng/Pa/s/m2)

 e. Insulation shall have an R value of 5.0°F ft2 h/Btu/in. (0.88 K m2/W) of thickness when tested at 75°F (23.9°C) mean temperature in accordance with ASTM C-518

 f. Product shall be free of CFC's

 E. Filter Fabric

 1. Soprnature Filter Fabric –is a virgin non-recycled polypropylene, staple fiber, needle-punched and 3.5 oz non-woven geotextile. Additionally, the fibers in the fabric are needled to filter fabric for a stable network that retains dimensional stability relative to one another. Soprnature Filter Fabric offers resistance to UV degradation and to biological and chemical environments typically found in soil. System Filter is to be used as a separation between drainage layers and medias with green roof systems.

 Fabric Properties
 a. Flow: 150 gal/min/sq ft.
 b. Tensile: 90 lbs.
 c. Elongation: 50%
 d. Mullen Burst: 185 psi
 e. Puncture Strength: 55 lbs
 f. Trapezoidal Tear: 40 lb (130 N)
 g. Apparent Opening Size (AOS): 70 US Sieve#

 h. Roll Sizes: 1250 sf, 2050 sf, 4000sf

 F. Sopranature Growing Media

1.Soprnature Media - Custom growing media mix capable of supporting vigorous growth of the specified vegetation, complying with the

 following specification.

 a. Extensive soil mix shall be used when soil depth is 3” - 6” with plant varieties to be selected by Landscape architect

 b. Semi-Intensive soil mix shall be used when soil depth is > 6” with plant varieties to be selected by landscape architect

 c. Intensive soil mix shall be used in Shallow Intensive/Lawn Green Roof applications in which soil depth would typically be >8”.

 G. Wind Erosion Control Mat (if necessary)

1. Soprnature Coir Erosion System–designed to control the erosion of a new green roof system until the planting have grown in enough to prevent erosion. It is available in fine or course bristles.

 a. Erosion blanket is made of naturally biodegradable coconut coir material and will biodegrade in 1 to 2 years. The blankets are 6 ft x 200 ft (fine) or 6.5 ft x 165 ft (course).

 b. Biodegradable erosion blanket anchors are made of recycled polyethylene or biodegradable cornstarch, which allows them to degrade with the blanket.

 c. Plastic anchor and disks are also available.

 H. Sedum mats (if necessary)

1. Soprnature Vegetative Blanket – consist of different varieties of sedum

grown into holding mat at a nursery then delivered to the jobsite and installed like sod giving a look of instant green. Contact local Soprema representative for sedum species available. The details below outline the specifications for growing the substrate from our partner Sempergreen.

 I. Preparation Growing Substrate

1. Growing Substrate shall consist of a light weight, free draining system containing all the physical, chemical, and biological properties to create a sustainable landscape that mimics nature and encourages microbial soil health without the need for excessive irrigation while also minimizing the need for synthetic fertilizers. The Growing Substrate will have optimized organic components, nutritional and capillary performance, water storage and aeration combined.
2. Bulk density of growth media at the correct installed thickness after compression must be at or below the maximum weight limitations of the roof as set by the engineer. Calculations must be based on maximum Growing Substrate density at saturation of growing media per ASTM E2399-05.
3. Minimum dry weight of the Growing Substrate must be more than 55 lb. /ft.3. Calculations must be based on dry weight of growing media per ASTM E2399-05.
4. Entire Vegetative Green Roof System assembly must retain at least 3 US gallons water per 1 cubic foot of soil. Calculations must include volume of water represented by difference in weight between dry and saturated weight of the growth media per ASTM E2399-05.
5. Growth media must have a Saturated Hydraulic Conductivity of 6 inches/hour per ASTM E2399-05.
6. Individual Components
7. The Growing Substrate will consist of the three components listed below which must meet the corresponding testing standards for each component.
	1. Component 1: Rotary Kiln Expanded Clay (Hydrocks) or rock (Kenlite)
		1. Maximum PH of 7.5 or lower
	2. Component 2: Nutrient Grade Compost:
		1. Quality compost must be manufactured by a composter enrolled in the United States Compost Council’s (USCC) Seal of Testing Assurance (STA) Program.
		2. Compost must meet parameters as tested by an STA approved lab using the STA Test Methods for Evaluating Compost and Compost Manufactures method.
		3. Organic Matter Content >50%
		4. Soluble Salts: Maximum 6 mmhos/cm (of which a max. of 2mmhos/cm can be sodium dominant)
		5. 95% of the Particle Size % under 9.5 mm
		6. Stability Indicator (respirometry) CO2 Evolution mg CO2-C/g OM/day <2
		7. Maturity Indicator (bioassay) Percent Emergence: 85% or greater Relative Seedling Vigor: 85% or greater
		8. Select Pathogens: Pass
	3. Component 3: USGA Sand or light weight Rotary Kiln Expanded Clay (Hydrocks) or rock (Kenlite)
		1. Fine Granules (0.15 mm -0.25 mm).

No more than 20% of the particles may fall within this range.

* + 1. Medium Coarse Granules (0.25mm – 1.0 mm).

Minimum of 70% of the particles must fall in this range.

* + 1. Coarse Granules (1mm – 3.44mm).

No more than 10% of the total particles in this range.

1. Mixing
	1. Insure that all components meet the requirements of this specification.
	2. Saturate the lightweight aggregate with water and mechanically mix the ingredients at the required volumes until sufficiently blended.
	3. To maintain the integrity of the mix, cover all stockpiled material after delivery to the jobsite. This mix will be pre- blended offsite and delivered ready for installation. The Growing Substrate mix for Sedum Blankets will shrink less than conventional mixes. Confirm with Growing Substrate provider what the estimated shrinkage factor should be to properly calculate the amount of substrate needed.
2. Finished Growing Substrate Mix specifications customized for Sedum Blankets.
3. The final mix shall be tested to insure that the following requirements are met.
4. Grain-Size Distribution of the Mineral Fractions: Per ASTM D 422:
	1. Fine Particle Range (clay, silt and very fine sand)
		1. Clay/Silt fraction (<0.002/0.005mm) 15-25%
	2. Sand Particle Range
		1. Retain US #100 sieve (0.15mm) 15-20%
		2. Retain US #60 sieve (0.25mm) 15-20%
		3. Retain US #35 sieve (0.50mm) 15-20%
		4. Retain US #18/10 (1-2mm) 10-15%
	3. Gravel Particle Range
		1. 1/8th inch Sieve to max 3/8th inch 15-40%
	4. Organic Material 8-12%
5. Growing Substrate Requirements:
	1. Non-Capillary Pore Space at Field Capacity: Minimum 10 percent by volume at 0.333 bar.
	2. Water Capacity: Ideal range is 30-40 percent volume per ASTM E 2399.
	3. Density at Maximum Water Capacity: Maximum 85 lbs/cuft. per ASTM E 2399.
	4. Saturated Hydraulic Conductivity: Minimum is 6 inches / hour per ASTM E 2399.
	5. Alkalinity, Ca CO3 Equivalents: Maximum 2.5 percent per ASA MSA.
	6. Total Organic Matter: 8 to 12 percent by dry weight, loss of ignition method, per ASA, MSA.
	7. Acidity/Alkalinity: pH of 6.5 to 7.0
	8. Soluble Salts: Ideal range of 2-3 mmhos/cm. Maximum 6 mmhos/cm (of which a max. of 2mmhos/cm can be sodium dominant)
	9. Organic Supplements: Carbon to Nitrogen Ratio (CN) of 12 or less
	10. CEC - Cation Exchange Capacity: Minimum 10 meq/100g per ASA MSA.

 II General Description of the Sedum Blanket

1. Pre-vegetated Sedum blankets with mature large field grown clumps. Field grown for a minimum of 12 months, on largely mineral based substrate, on a biodegradable coir carrier with a minimum plant canopy coverage of >85%.

 B. Characteristics of Sedum Blanket

 1. Measurements: 48”x75”

 2. Weights: +/- 4 lbs per sqft (dry) and +/- 5 lbs per sqft saturated

 3. Vegetative Coverage: >85% plant canopy coverage

 4. Plant Structure: >85% multi-branched mature plants 12-18

 months old

 5. Diversity: 9-12 plant species per 100 sqft.

 6. Climatic Exposure: 12 months minimum time of outdoor growing

 7. Basis of Design: Sempergreen® Sedum Blankets. (dba Moerings

 USA LLC) 17416 Germanna Highway Culpeper VA 22701

 Phone: (540) 399-5055 xt 101 Attn.: Richard Hoek

 8. Plant Carrier: 97% biodegradable materials (coir)

 9. Sedum blanket substrate: Largely inorganic mineral based

 components. Maximum of 10% peat based on organic materials to

 avoid hydrophobic characteristics and potential lateral fire

 movement.

 10. System Substrate Match:  Air porosity of the Substrate of Sedum

 blanket is to have >80% match with Growing Substrate

 underneath. (Critical that Sedum blanket Substrate is mapped to

 Vegetative System Substrate.)

 11. Wind Uplift Prevention: The Sedum blanket substrate layer at 0.5”

 -0.75” thickness is to weigh a minimum of 4 lbs per sqft (dry) 0.5-

 0.75” mineral based substrate depth on coir carrier to avoid wind

 uplift concerns.

 12. Sedum Blanket Substrate: Meets >80% of overall FLL guidelines

 13. Plant Coverage: 85%+ in Vegetation Cover to protect Growing

 Substrate from Solar radiation, evaporation, and to meet

 ANSI/SPRI RP-14 wind uplift code 2015 regulations.

 14. Species diversity: Species allocation upon delivery to the Roof.

 a. Shallow rooting creeping Sedums: 30-50% of the vegetative cover

 Sedum album ‘Murale’

 Sedum album

 Sedum Stefco

 Sedum acre ‘Aureum’

 Sedum acre

 Sedum sexangulare

 b. Deep rooting broadleaf Sedums: 50-70% of vegetative

 cover

 Phedimus spurium ‘John Creech’

 Phedimus spurium ‘Fuldaglut’

 Phedimus spurium ‘Red Carpet’

 Phedimus takesimensis

 Phedimus kamtschaticum

 Phedimus kamtschatium ‘Variegatum’

 Sedum x hybridum Immergrunchen

 Sedum floriferum ‘Weihenstephaner Gold’

 Sedum reflexum ‘Blue Spruce’

 Sedum rupestre ‘Angelina’

 15. Broadleaf Density: < 10 deep root broadleaf Sedum clumps per

 sqft on average per 100 sqft upon delivery

 16. Sedum Blanket Maturity: 12-14 months, minimum of 9 months

 17. Field Grown: Started and 100% outdoor grown, made up of large

 mature field grown clumps.

 19. Winter Installation: Allowed with permission of Moerings

 Sempergreen

 20. Product Approved for Use: Sempergreen® Standard Sedum Mix

 blankets.

 I. Plugs, Cuttings and Plants (if necessary)

 1. Soprnature Plugs, Sedum Cuttings and Plants - shall be planted and maintained in accordance with Architects written specifications by an approved installer.

 2. Cutting, plugs and plants vary by region please contact your local area

 Soprema representative availability of specific blends.

2.02 Accessories (choose all that apply)

 A. Soprnature Edge Restraints – Designed to meet or exceed drainage capacity of all manufactured green roof drainage panels. They are made from 0.10 Aluminum 5052 sheet (stainless steel also available). These edge restraints are available in either straight or flexible edging. The Flexible edging has V-shaped notches cut into it to allow for shaping to arcs and circles.

 1. Edges come with 12 slots per foot, effective slot mean diameter .375 in. area per slot .11 sq in. Factory Flow = .0119 CFS/5.4 GPM. This equates to 1.7 GPM per linear foot (assuming 1” head to match the drainage course)

 2. Edge restraints come in a various sizes from 3.5” to 8.5” heights with the return leg varying by height of edge restrain. Standard color is Aluminum unfinished, color options are available please consult your local Soprema Representative.

 3. Edge Restraints come with clips and bolts for attachment. Corner pieces are also available.

 B. Soprnature Inspection Chambers: Designed to fit over most standard drains and to keep out large debris and contaminates; to promote positive drainage in the garden roof system. Made of 304 BB 18 gauge stainless steel. They have a removable top for easy inspection of the drain after installation.

 1. Slot dimensions are 3/16-inch x 3-15/16-inch, with a flow rate of 110 gallons per minute. They are available in 11”x11”x5/8” or 18”x18”x5/8”

 C. Soprnature Extensions for Edge Restraints and Inspection Chambers: Extension pieces to be used when the garden roof area is higher than the standard heights. Made of the same materials as the edge restraints and inspection chambers.

 D. Pavers: Wausau or Westile Concrete Pavers, varies by design please contact your local Soprema representative for options.

 E.. Stone Ballast: As shown on the plans, or if not indicated on the plans use well

 screened and washed stone gravel meeting ASTM D-448-80, gradations

 # 57, 2, 4 or 5

PART III EXECUTION

3.01 INSPECTION

 A. The Green Roof/Waterproofing Contractor shall examine all surfaces to receive the garden roof system to verify it is acceptable and proper for the installation of the garden roof.

 B. The Roof/Waterproofing Contractor shall not proceed with the installation of the garden roof system until all roof defects have been corrected. A water test may be required before placement of any overburden.

3.02 INSTALLATION

 A. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

 B. Water Test

 1. All roof areas or portions thereof shall be water tested by means of flood testing water at a minimum depth of 2” for a period of 48 hours to check the integrity of the membrane installation.

 2. Verify that the structure can support the dead load weight of a water test before testing.

 a. If leaks should occur the water must be drained completely and the membrane installation replaced and the roof system area dried out, seal membrane and retest.

3.03 EXTRUDED INSULATION INSTALLATION (if required)

 A. Insulation Placement

 1. Install one or more layers of rigid insulation to required thickness and/or R-value. Stagger all joints, cut and fit to within 3/4 inch (19 mm) of all projections, perimeter walls and penetrations. Insulation is to be loose laid and tightly butted with joints not greater than 3/8 inch (9.5 mm).

 2. Multi-layer insulation applications require the bottom layer of insulation to be the thickest layer and shall be a minimum of 2" thick (50.8 mm). All layers shall be loose laid with the joints of the second layer staggered and offset from all joints of the preceding layer. Each successive layer shall be offset from the underlying layer(s).

 3. Vertical insulation applications shall be spot adhered to the protection layer with appropriate adhesive or additional hot rubberized asphalt membrane.

3.04 GARDEN ROOF COMPONENTS INSTALLATION

A.Root Barrier Installation

 1. Unroll the specified root barrier over the entire surface, around all edges and upstands (vertical surfaces); overlapping all seams a minimum 6” (six inches). Seal all side and end laps with Soprnature Butyl Tape to ensure

 a proper seal.

 a. Install root barrier below the drainage layer.

 B. Air layer/Drainage / Water Retention Installation

 1. Install the specified drainage / water retention course over waterproofing or insulation layers with the black filter fabric or water retention mat facing up (product dependent).

 2. Properly position drainage course, carefully cutting and fitting panels to fit the surface. Typically drainage mats will be run over the full length of the roofing system and turned up walls to provide protection for flashing sheets. Cut and snuggly fit the drainage course at all perimeters, curbs and penetrations, following the membrane manufacturer's installation procedures. Cut holes to expose all drain areas

 3. Drainage mat must be positioned so the 3” overlap, laps over the next sheet. It is recommend to adhere this overlap with adhesive to hold it in place for the install of the soil. This can be accomplished with a one part urethane adhesive or a butyl tape.

 4. Drainage mats should be covered with soil as soon as possible to avoid any deterioration to the filter fabric or retention mats.

 C. Edge Restraints and Extensions

 1. Installed on top of Drainage, water retention or root barrier course, so the perforated edge is vertical with a horizontal leg positioned in area that is to receive the soil and vegetation.

 2. Metal edge restraints shall be fastened together using clips and corner pieces. These will be secured with bolts and washers.

 3. Edge restraints may need to be cut to size depending on design.

 4. Extension pieces are secured using bolts and washers and will need to have holes drilled on site hold the two pieces in place

 D. Inspection Chambers and Extensions

 1. Inspection chambers are fit over existing drains

 2. Extensions can be used to extend the Inspection Chamber up to the soil level, these are secured with bolts and washers and must have holes drilled on site for securement.

 E. Water Retention layer (Soprnature Moisture Retention Mat, if necessary)

 1. Loose laid in areas to receive soil, above the drainage or root barrier layer.

 F. Filter Fabric

 1. Filter Fabric shall be laid over the drainage layer, lapping adjacent rolls a minimum of 6 inches (150 mm). Enough material shall be left to be drawn up above the anticipated soil level. Any excess shall be trimmed down to the level of the soil..

 G. Garden roof soil (extensive, semi-intensive and intensive)

 1. Soil shall be placed carefully to avoid damage or displacement of other materials such as walls, paving, drainage components, filter fabric, and roofing membrane.

 2. For final grades less than 4 inches only one round of compaction shall be performed and remaining soil loosely placed such that top of soil exceeds final grade by 1 inch. For final grades greater than 4 inches, place soil at no greater than 4 inches and repeat procedure until soil has been compacted within 1 inch of final grade for vegetated mats and loosely placed to the top of the edge restraint for plugs and cuttings.

1. Compaction shall be performed with a 250-300lbs landscape roller to

 compact the soil.

 4. After compaction remaining soil shall be placed at 1 inch greater than final grade (except when vegetated mats are used) and thoroughly watered over entire area. Low settled areas shall be filled with additional soil and re-wet to achieve uniform prescribed final grade.

 H. Stone ballast or pavers

 1. Installed at all roof perimeters, building walls, penetrations, and access hatches and as required for flashing vegetation barriers, proper wind design, fire breaks, and as walkway/maintenance paths.

 2. Ballast design shall be in accordance with Dow Chemical Company TechNote 508 Ballast Design Guide for IRMA Roofs and other applicable

 codes or wind design guides.

 I. Wind Erosion System (if necessary)

 1. Once soil is installed bury anchors bottom of the anchors 3’ OC in the field and 2’ OC near the edges.

 2. Install Bio-degradable mat, so that it is secured through the shaft of the anchor pieces

 3. Once mat is completely installed, place metal disc over the anchors to secure the mat in place

 J. VEGETATION INSTALLATION

 1. Install the vegetation by Vegetate Mat, Plugs or Cuttings in accordance with design drawings.

 2. Sowing seed for grass or meadow flower plantings must be done so as to achieve the maximum uniformity possible over the entire surface of the medium at the density specified by the seed provider. Once sown, the surface of the medium is gently raked (as with the backside of a leaf rake) to lightly bury the seed; the surface is then gently rolled with a garden roller.

 3. Rolls of sod or vegetative mat are laid out in a staggered pattern, snugly butted side-to-side and end-to-end; do not stretch the rolls. The surface is then gently rolled with a garden roller.

 4. In all instances, all plantings must be thoroughly watered to the point of saturation immediately after planting.

3.05 CLEANING

 A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris, and equipment. Repair damage resulting from extensive green roof installation operation.

 B. Repair or replace garden roof system that is vandalized until final acceptance is granted.

#### END OF SECTION: 073363