 REV4-08/2023 Skyland USA, PO Box 159, Landenberg, PA 19350 610.268.0017 rooflitesoil.com ©2023 SKYLAND USA

**PART 1 - GENERAL**

1.1 SUMMARY

A. This Section specifies all labor and materials necessary to install a complete multi-layered engineered soil profile on top of building structures specified elsewhere. Rooftop Farms are intensive green roofs that have a total soil system depth of 10 to 16 inches, depending on the crops grown. This system supports agricultural production on rooftops.

B. Related requirements specified elsewhere include:

1. Waterproofing - Section xxxxxx

2. Insulation - Section xxxxxx

3. Other green roof components - Section xxxxxx

4. Plantings - Section xxxxxx

5. Maintenance - Section xxxxxx

1.2 REFERENCES

A. Referenced standards:

1. ASTM D 422-63 Standard Test Method for Particle Size Distribution

2. ASTM C 330 Standard Specification for Lightweight Aggregates

3. ASTM E 2396: Standard Testing Method for Saturated Water Permeability of Granular Drainage Media (Falling-Head Method) for Green Roof Systems

4. ASTM E 2399: Standard Testing Method for Maximum Media Density for Dead Load Analysis

5. ASTM E 2777 Standard Guide for Vegetative (Green) Roof Systems

6. ASTM E 2788 Standard Specification for Use of Expanded Shale, Clay and Slate (ESCS)

7. ASTM D 4491: Standard Test Methods for Water Permeability of Geotextiles by Permittivity

8. ASTM 4533 Standard Test Method for Trapezoid Tearing Strength of Geotextiles

9. ASTM D 4632: Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

10. ASTM D 4833 Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products

11. ASTM 5199 Standard Test Method for Measuring the Nominal Thickness of Geosynthetics

12. ASTM D 5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles

13. ASTM D 6241 Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

14. AASHTO T103: Soundness of Aggregates by Freezing and Thawing

15. FLL - Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e.V. (The Landscape Development and Landscaping Research Society) latest English edition

16. TMECC -Test Methods for the Examination of Composting and Compost (latest edition)

* 1. DEFINITIONS (per ASTM E2777-14)
1. Granular Drainage Medium:

A coarse and porous mineral aggregate providing a natural root environment with excellent water and air distribution. Granular drainage layers promote healthy plant growth by retaining and draining water in a natural and efficient way.

1. Separation Fabric:

A thin yet durable fabric separating the coarse aggregate of the drainage layer from the planting media layer above. The filter fabric should be root-permeable so that plants can use the total system depth for root growth. At the same time, the fabric works as a filter, which is designed to keep the finer particles contained in the growing medium layer from migrating into the drainage without clogging.

1. Agricultural Growing Medium:

An engineered planting media for agricultural (green) roof systems optimized for fertility, workability and longevity. The medium of choice for rooftop farms to produce vegetables and herbs, it combines the characteristics of an excellent farm soil with the performance of a modern green roof medium.

1. System Provider:

Company that provides all materials required for installation of this Rooftop Farming soil profile.

1.4 SYSTEM DESCRIPTION

A. All components must be tailored to the whole system to optimize performance.

Use a single source system provider for all system components.

B. Design Requirements for Rooftop Farming:

1. System components are a granular drainage layer, below a separation fabric, below a top layer of agricultural growing medium. Rooftop Farms are intensive green roofs with a total depth between 10 and 16 inches. Drainage layer depth can vary between 2 inch to 4 inches. Growing medium depth can vary between 8 and 12 inches. This system supports agricultural production of vegetables, greens, and herbs.

2. Depending on the green roof area and the roof slope embedded drainage channels and/or additional drainage components may have to be installed below the Rooftop Farming system to ensure adequate lateral flow of water run-off.

3. The system is compatible with drip and spray irrigation.

C. Performance Requirements:

1. The Rooftop Farming system shall support long lasting and healthy plant growth.

2. Build a stable structure of mineral components, which is not prone to loss of volume and change of physical properties.

3. Retain and distribute moisture for plants and stormwater mitigation while efficiently draining excess water.

1.5 SUBMITTALS

A. Product Data:

1. System Provider’s technical literature showing compliance of all components with specified requirements.

2. Certified laboratory reports demonstrating compliance of the proposed media with this Specification.

B. Shop Drawings:

1. A CAD drawing showing the system build up including the thickness of each system layer.

C. Samples for approval by the Landscape Architect:

Quantity Size Description

1 6” x 6” Separation Fabric

1 16 oz Granular Drainage Medium

1 16 oz Agricultural Growing Medium

D. Certify all materials for the Rooftop Farming System come from one single source System Provider.

1.6 DELIVERY, HANDLING, STORAGE

A. Loose Bulk Media: Dump bulk growth media or granular drainage on paved areas only. Avoid any contamination by weed seeds, foreign materials, or debris. Tarp stockpile and maintain proper moisture content, and condition. Avoid sloped surfaces and site runoff in stockpiling locations.

B. Crane Strapped Super Sacks (Flexible Intermediate Bulk Containers): Super Sacks are delivered on pallets. Extreme care should be used when lifting sacks. Damage or injury to persons or property is a potential risk. Lift sacks directly from truck with appropriately rated lifting equipment according to handling instructions on sack labels. Sacks may be staged onsite if moved and stored on pallets. Do not store onsite for more than thirty days without consulting System Provider for detailed instructions. Inspect all sacks for damage before lifting. Do not lift damaged or punctured bags.

C. Retail Sized Packaging: Retail sized packages are delivered on stacked and stretch wrapped pallets. Keep material in packaging until use.

D. Keep filter fabric wrapped and protected until used.

E. Handle all components in accordance with the System Provider’s instructions. Refer to PART 3 for installation instruction.

1.7 QUALITY ASSURANCE

A. The work of this section shall be performed by a contractor that specializes in green roof installations. This company shall document the successful completion of at least 3 previous projects similar in scope.

B. All test results must be from independent and qualified laboratories. Laboratories may include, but are not limited to:

1. Agricultural Analytical Services Laboratory, Penn State University, Tower Road, University Park, PA 16802
2. CTL Group, 5400 Old Orchard Road, Skokie, IL 60077
3. Geocomp Corporation, 125 Nagog Park, Acton, MA 01720

C. Ensure that all components are engineered to be incorporated into a Rooftop Farming System via a single source by System Provider to ensure the performance requirements specified in Section 1.4 B

**PART 2 - MATERIALS**

2.1 ROOFTOP FARMING SOIL SYSTEM

A. Description: An intensive green roof system with a total depth of 10 - 16 inches consisting of a granular drainage medium, a separation fabric, and an agricultural growing medium.

B. All specified components shall be obtained as a single source from the system provider to ensure total system compatibility and integrity.

 System Provider:

 Skyland USA, LLC – Main Office

 P.O. Box 159

 Landenberg, PA 19350

 Tel. 610.268.0017

 E-Mail: sales@rooflitesoil.com

C. GRANULAR DRAINAGE MEDIUM – rooflite® drain XXX

Description:

A granular drainage medium for intensive green roofs, as well as for planters and containers, designed to retain storm water and to provide horizontal drainage, and which meets the requirements described in ASTM E2777-14 Standard Guide for Vegetative (Green) Roof Systems and E2788-11 Standard Specification for Use of Expanded Shale, Clay and Slate (ESCS) as the Drainage Layer for Vegetative (Green) Roof Systems as detailed below. rooflite® drain consists of all lightweight mineral aggregate complying with the following technical and performance requirements:

1. Gradation Requirements for ESCS Granular Drainage Media (ASTM C330)

 a. Proportion of particles < 12.50 mm 1/2-inch mesh 100 %

 b. Proportion of particles < 9.50 mm 3/8-inch mesh 80 - 100 %

 c. Proportion of particles < 4.75 mm # 4 mesh 5 - 40 %%

 d. Proportion of particles < 2.36 mm # 8 mesh 0 - 20 %

 e. Proportion of particles < 1.18 mm # 16 mesh 0 - 10 %

2. Gradation Requirements for natural Pumice or Scoria Drainage Media may contain more Fines as outlined in ASTM C330.

3. Bulk Density at max. water-holding capacity (ASTM E2399) xx - xx lb/ft³

*{SPECIFIER – USE PROJECT SPECIFIC VALUE*

*and/or visit www.rooflitesoil.com for regional product options*

*Note: rooflite drain is a product line that is available in different saturated weight classes. These weight classes are designed to guide you in choosing the best option for your project based on your weight requirements. Each weight class is identified by a number that corresponds to the typical weight for fully saturated media based on ASTM E2399. Depending on your specific region, the following weight classes may be available for rooflite drain:*

*• drain 400: saturated weight 40-50 lbs/ft3*

*• drain 500: saturated weight 50-60 lbs/ft3*

*• drain 600: saturated weight 60-70 lbs/ft3*

*• drain 700: saturated weight 70-80 lbs/ft3*

*Please confirm regional availability at* [www.rooflitesoil.com/specifications](http://www.rooflitesoil.com/specification) *or call our team at 610.268.0017. Note: All Density Measurements reflect typical ranges for the respective rooflite products. For more detailed information please inquire about latest test results.}*

4. Water/Air Measurements

a. Maximum water-holding capacity (ASTM E2399) > 10 %

b. Air-filled porosity (ASTM E2399) > 20 %

c. Water permeability (ASTM E2396) > 80 in/min

5. pH (in CaCl2) 6.0 - 8.5

6. Soluble salts (water, 1:10, m:v) ≤ 2.5 g (KCl)/L

7. Organic Matter Content LOI at 500°C (SM 2540 G) < 5.0 g/L

D. SEPARATION FABRIC – rooflite® separation fabric SF135

A mechanically-consolidated, needle-punched geotextile for green roofs, planters, and containers as separation layer and filter between drainage and planting media layers. This fiber fleece has an open, three-dimensional surface structure that is highly resistant to clogging. Even very fine media particles are retained on top of the fabric while roots can penetrate and tap into the retained water in the layers below.

1. Material: Blend of Polypropylene and Polyester

2. Dry Weight (typical) (ASTM D 5261) 4 oz/yd²

3. Thickness (typical) (ASTM D 5199) 3/32 in

4. Static Puncture CBR (ASTM D 6241) 120 lb

5. Pin Puncture (ASTM D 4833) 20 lb

6. Elongation (ASTM D 4632) 50%

7. Grab Tensile (ASTM D 4632) 70 lb

8. Trapezoidal Tear (ASTM D 4533) 30 lb

9. Flow Rate (ASTM D 4491) 200 gpm/ft2

10. Permittivity (ASTM D 4491) 2.5 sec-1

E. AGRICULTURAL GROWING MEDIUM – rooflite® agricultural XXX

Description:

A planting medium for agricultural vegetative (green) roof systems with a separate drain layer, designed for rooftop farming with optimal organic matter and nutrient content to meet the special requirements for food production, and which meets the requirements described in ASTM E2777-14 Standard Guide for Vegetative (Green) Roof Systems and detailed below. rooflite® agricultural is a precisely balanced blend of carefully selected lightweight mineral aggregates and premium organic components, like USCC STA approved compost complying with the following technical and performance requirements:

1. Particle Size Distribution (ASTM D422-63)

a. Proportion of particles < 0.05 mm ≤ 20 %

b. Proportion of particles < 0.25 mm # 60 mesh 15 - 40 %

c. Proportion of particles < 1.00 mm # 18 mesh 25 - 60 %

d. Proportion of particles < 2.00 mm # 10 mesh 40 - 80 %

e. Proportion of particles < 3.20 mm 1/8-inch mesh 50 - 90 %

f. Proportion of particles < 6.30 mm 1/4-inch mesh 75 - 100 %

g. Proportion of particles < 9.50 mm 3/8-inch mesh 90 - 100 %

h. Proportion of particles <12.50 mm 1/2-inch mesh 100 %

2. Bulk Density at max. water-holding capacity (ASTM E2399) xx - xx lb/ft³

*{SPECIFIER – USE PROJECT SPECIFIC VALUE*

*and/or visit www.rooflitesoil.com for regional product options*

*Note: rooflite agricultural is a product line that is available in different saturated weight classes. These weight classes are designed to guide you in choosing the best option for your project based on your weight requirements. Each weight class is identified by a number that corresponds to the typical weight for fully saturated media based on ASTM E2399. Depending on your specific region, the following weight classes may be available for rooflite agricultural:*

*• agricultural 600: saturated weight 60-70 lbs/ft3*

*• agricultural 700: saturated weight 70-80 lbs/ft3*

*• agricultural 800: saturated weight 80-90 lbs/ft3*

*Please confirm regional availability at* [www.rooflitesoil.com/specifications](http://www.rooflitesoil.com/specification) *or call our team at 610.268.0017. Note: All Density Measurements reflect typical ranges for the respective rooflite products. For more detailed information please inquire about latest test results.}*

3. Water/Air Measurements (ASTM E2399)

a. Total Pore Volume > 50 %

b. Maximum water-holding capacity 45 - 65 %

c. Air-filled porosity at max water-holding capacity > 7 %

d. Water permeability (sat. hydraulic conductivity) 0.0118 – 1.18 in/min

4. pH (in CaCl2) 6.0 - 8.0

5. Soluble salts (water, 1:10, m:v) ≤ 2.5 g (KCl)/L

6. Organic Matter Content LOI at 500°C (SM 2540 G) 70 – 90 g/L

7. Nutrient Retention Capacity / Cation Exchange Capacity (CEC) > 10 meq/100 g

F. TESTING mETHODS

 All values are based on compacted materials per laboratory standards and testing methods defined by FLL - Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e.V. (The Landscape Development and Landscaping Research Society) if no other standard has been specified. Nutrients of newly blended products may temporarily exceed upper limits.

G. RELATED MATERIALS

* + 1. Waterproofing as specified in Section xxxxxx
		2. Plants as specified in Section xxxxxx
		3. Irrigation as specified in Section xxxxxx
		4. Other green roof components specified in Section xxxxxx

**PART 3 EXECUTION**

3.1 PREPARATION & EXAMINATION

1. Install each component of the Rooftop Farming System in accordance with the System Provider’s instructions on top of waterproofing as specified in Section xxxxxx
2. Coordinate activities with other project contractors so that there is no growing media disturbance from traffic or other construction activities subsequent to placement.
3. All surfaces shall be dry, smooth, free of depressions, voids, protrusions, clean and free of unapproved curing compounds, from release agents and other surface contaminants.
4. Substrate cleaning:
5. Thoroughly sweep the substrate which is to receive the Rooftop Farming assembly.
6. Substrate may also be blown clean using an air compressor or backpack blower to remove any remaining loose debris.
7. Ensure that underlying roof components have been installed and signed off prior to the installation of the Rooftop Farming System.

3.2 PROTECTION

1. Until the drainage media layer is installed, traffic over the working area shall be strictly controlled and limited to essential personnel, only.
2. All finished surfaces must be protected to prevent staining or infiltration of loose growing medium or plant materials into drainage structures or areas beyond zones defined for growing medium.
3. Heavily traveled areas (e.g., corridors for transporting media to the working areas) must be protected in a manner approved by Construction Manager to prevent damage to finished Work.

3.3 CHECK ROOF DRAINS

1. Locate roof drains and check for proper water run-off.
2. Protect roof drains during the installation of the Rooftop Farming layers to avoid contamination or clogging of drain pipes.
3. Do not cover roof drains with any Rooftop Farming components. All roof drains located within the Rooftop Farming area must be accessible for maintenance and inspection. Inspection chambers or drain boxes prevent the clogging of water outlets by roots or soil and allow for inspection of these critical points.

3.4 INSTALL DRAINAGE LAYER

A. Place the granular drainage layer as first component of the Rooftop Farming System and level the surface evenly at the specified depth.

B. The depth of the drainage layer depends on the depth of the total system.

See Detail xxxxxx

C. Drainage media shall be placed carefully to avoid damage or displacement of other materials such as walls, edging, paving, or any components of the drainage and/or waterproofing system.

3.5 INSTALL SEPARATION FABRIC

1. Verify that the green roof drainage system has been installed and accepted.
2. Place the separation fabric on top of the drainage layer.
3. Overlap joints by at minimum of 6 inches.
4. Filter fabric layer shall be laid overlapping adjacent rolls a minimum of 6 inches (side and end laps). Enough material shall be left to be drawn up at perimeters and penetrations so that fabric extends a minimum of 8-inches above the anticipated soil level. Any excess shall be trimmed and folded down into the top level of the growing medium after completion of planting installation.
	1. INSTALL GROWING MEDIUM
5. Verify that the green roof drainage system and filter fabric have been installed and accepted.
6. Place the growing medium directly on the separation fabric and level the surface evenly.
7. Growing media shall be placed carefully to avoid damage or displacement of other materials such as walls, edging, paving, drainage components, filter fabric, or any components of the waterproofing system.
8. Growing media shall be placed to within 1 inch greater than final grade or to a depth of no greater than 8 inches and compacted as described below. For final grades less than 8 inches only one round of compaction shall be performed and remaining soil loosely placed such that top of growing media exceeds final grade by 1 inch.
9. For final grades greater than 8 inches, place soil at no greater than 6 inches and repeat procedure until soil has been compacted within 1 inch of final grade. The remaining soil shall be loosely placed at 1 inch greater than final grade and hand compacted
10. Compaction shall be performed with a 200 – 300 lb. landscape roller and/or lightly compacted with a hand held, non-mechanical tool to achieve a uniform growing medium compaction.
11. Compress the growing medium to a degree where full exposure of body weight on one foot does not further reduce depth.
12. Mechanical compactors including plate compactors are not acceptable because they can over compact the media and can damage the underlayment.
13. Proper compaction is crucial to avoid loss of volume and to maintain a healthy root environment.

F. Adjust the final compressed growing medium surface to the specified depth as indicated on the grading plan or Rooftop Farming detail. See Detail xxxxxx

END OF SECTION