PLANTER PERFORMANCE SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies all labor and materials necessary to install complete multi-layered engineered soil profiles in planters and containers specified elsewhere. Install these Terramenta systems provided by Skyland USA, LLC in compatible planters and/or containers to ensure long-term healthy plant growth.

B. Related requirements specified elsewhere include:
   1. Site Furnishings - Section xxxxxx
   2. Green Roofs – Section xxxxxx
   3. Waterproofing - Section xxxxxx

1.2 REFERENCES

A. Referenced standards:

   1. ASTM C29: Standard Test Method for Bulk Density and Voids in Aggregate

   2. ASTM C136: Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

   3. ASTM E2396: Standard Testing Method for Saturated Water Permeability of Granular Drainage Media (Falling-Head Method) for Green Roof Systems

   4. ASTM E2399: Standard Testing Method for Maximum Media Density for Dead Load Analysis

   5. ASTM D3776: Standard Test Methods for Mass per Unit Area (Weight) of Fabric

   6. ASTM D4491: Standard Test Methods for Water Permeability of Geotextiles by Permittivity

   7. ASTM D4632: Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

   8. ASTM D4751: Apparent Opening Size of a Geotextile

   9. ASTM D6241 Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

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

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

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

1.3 DEFINITIONS

A. **Planter Performance System:** A multi-layer engineered soil profile, which ensures long-term healthy plant growth in planters and containers.

B. **Planter:** A permanent built- in-place structure on a non-permeable surface for the purpose of growing plants.

C. **Container:** A freestanding receptacle for soil, and plants, which grow in it.

D. **Drainage Layer:** A granular mineral material 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.

E. **Filter Fabric:** A thin yet durable fabric separating the coarser aggregate of the drainage layer from the media layers 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 keeps the finer particles contained in the growth media or base layer from migrating into the drainage.

F. **Top Layer:** An engineered growth media with optimized performance characteristics for container gardens and planters promoting long lasting and healthy plant growth for ground covers, ornamental grasses, shrubs and trees, or vegetables, herbs, and fruits.

G. **System Provider:** Company that provides all materials required for installation of the planter performance system.

1.4 SYSTEM DESCRIPTION

A. All components must be tailored to the whole system in order to optimize performance. Use a single source system provider for all system components.

B. Design Requirements for Terramenta Planter Performance Systems:

1. **System C** components are a granular drainage layer, below a filter fabric, below a top layer of growth media designed for agricultural use. The system build-up depends on the total depth of the containment and can be optimized by following the System Provider's recommendations.

   This system is for planters and containers with a total depth of more than 14 inches and an intended plant palette of herbs, vegetables, and fruits.

2. The system is designed for deep freestanding containers with adequate drain holes for water run-off. They can also be used for built in place planters complying with related waterproofing and green roof standards.

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

C. Performance Requirements:
   1. Planter performance 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 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 schematic profile showing the system build up including the thickness of each system layer.

C. Samples:

Item No.	Quantity	Size	Description
TM1	1	1'x1'	Filter Fabric.
TM2	1	16 oz	Top Layer for initial approval of the Architect.
TM3	1	16 oz	Drainage Layer for approval by the Architect

D. Certify all materials for Planter Performance 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 section 3 for installation instruction.

1.6 QUALITY ASSURANCE

A. The work of this section shall be performed by a contractor that specializes in container gardens and/or 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 Planter Performance System via a single source by System Provider in order to ensure the performance requirements specified in Section 1.4 B

PART 2 - MATERIALS

2.1 PLANTER PERFORMANCE SYSTEM

A. All Components shall be obtained as a single source from the system provider to ensure total system compatibility and integrity.
System Provider:

Skyland USA, LLC
P.O. Box 159
Landenberg, PA 19350
Tel. 610.268.0017
E-mail: sales@terrramenta.com

B. Drainage Layer is a lightweight mineral aggregate complying with the following requirements and specifications:

Particle Size Distribution (ASTM C136)		
Particles passing US #18 mesh	Mass %	$\leq$ 10
Particles passing 1/4 inch mesh	Mass %	$\leq$ 75
Particles passing 3/8 inch mesh	Mass %	$\geq$ 80
Physical and Chemical Properties		
Density at Maximum Water Capacity (ASTM E2399-05)	lb/ft^3	44 – 60
Porosity (ASTM C29)	Vol. %	$\geq$ 30
Maximum water-holding capacity	Vol. %	$\geq$ 10
Water Permeability (ASTM E2396-05)	in/min	$\geq$ 30
pH (in $CaCl_2$)		6.0 - 8.5
Soluble salts (water, 1:10, m:v)	g (KCl)/L	$\leq$ 2.5
Total Organic Matter, by loss on ignition	%	< 3.0
Soundness (AASHTO T103)	%	loss $\leq$ 5

C. Filter Fabric with root-permeable, non-woven, mechanically strengthened endless fiber fleece, satisfying the following specifications:

Technical Details and Properties		
Material	PP (polypropylene)	
Nominal Thickness	approx. 1.1 mm	
Specific Properties		
Mass per Unit Area	ASTM D 3776	3 oz/yd^2
Apparent Opening Size - Average AOS = O_{95}	ASTM D 4751	0.340

Permittivity	ASTM D 4491	0.344 sec^{-1}
CBR Puncture Resistance	ASTM D 6241	267 lb
Puncture Resistance	ASTM D 4833	50 lb
Mullen Burst Strength	ASTM D 3786	136 lb/in^2
Grab Strength and Elongation	ASTM D 4632	125 lb

D. Top Layer growth media for System C is designed for rooftop farming in large containers and planters. It is a precisely balanced blend adjusted for agricultural use. It consists of lightweight mineral aggregates and premium organic components like USCC STA approved compost and complies with the following requirements:

Particle Size Distribution		
Proportion of silting components < 0.063 mm	Mass %	≤ 20
Proportion of particles < 0.25 mm 60 mesh	Mass %	15 - 40
Proportion of particles < 1.00 mm 18 mesh	Mass %	25 - 60
Proportion of particles < 2.00 mm 10 mesh	Mass %	30 - 70
Proportion of particles < 3.20 mm 1/8 inch	Mass %	50 - 90
Proportion of particles < 6.30 mm 1/4 inch	Mass %	75 - 100
Proportion of particles < 9.50 mm 3/8 inch	Mass %	100
Density Measurements		
Bulk Density (dry weight basis)	g/cm^3	0.65 - 0.85
Bulk Density (dry weight basis)	lb/ft^3	40 - 53
Bulk Density (at max. water-holding capacity)	g/cm^3	1.10 - 1.35
Bulk Density (at max. water-holding capacity)	lb/ft^3	68 – 85
Water/Air Measurements		
Total Pore Volume	Vol. %	≥ 50
Maximum water-holding capacity	Vol. %	45 – 65
Air-filled porosity at max water-holding capacity	Vol. %	≥ 10
Water permeability (saturated hydraulic conductivity)	cm/sec	0.0005 – 0.05
Water permeability (saturated hydraulic conductivity)	in/min	0.0118 – 1.18
pH and Salt Content		
pH (in $CaCl_2$)		6.0 - 8.5
Soluble salts (water, 1:10, m:v)	g (KCl)/L	< 2.5
Organic Measurements		

Organic matter content	g/L	50 - 90
Nutrients		
Phosphorus, $P_2 0_5$ (CAL)	mg/L	$\leq$ 200
Potassium, K_2O (CAL)	mg/L	$\leq$ 1000
Magnesium, Mg (CaCl2)	mg/L	$\leq$ 200
Nitrate + Ammonium (CaCl2)	mg/L	$\leq$ 100

2.1 TESTING METHODS

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

2.2 RELATED MATERIALS

A. Planter as specified in Section … xxxxxx
B. Container as specified in Section … xxxxxx
C. Waterproofing as specified in Section … xxxxxx
D. Plants as specified in Section … xxxxxx
E. Irrigation as specified in Section … xxxxxx
F. Plant Stabilization as specified in Section … xxxxxx

PART 3 EXECUTION

3.1 INSTALLATION

A. Install each component of the Planter Performance System in accordance with the System Provider's instructions in planters or containers as specified in Section xxxxxx.

B. Install each component of the Planter Performance System in accordance with the System Provider's instructions for: : *{SPECIFIER – REMOVE IF DETAILED ELSEWHERE}*

Terramenta System C

1.1 Total System Depth: _____inches
1.2 Total System Depth: _____inches
1.3 Total System Depth: _____inches

3.2 CHECK CONTAINER / PLANTER

A. Verify the correct position and proper placement of freestanding containers before installing the planter performance system.
B. Consider the flow of run-off water from the container.
C. For larger built in place planters it is crucial to ensure that a root resistant waterproofing membrane and an adequate protection layer have been installed and signed off prior to the installation of the planter performance system.

3.3 CHECK DRAIN HOLES / ROOF DRAINS

A. Locate drain hole(s) and check for proper water run-off.
B. Cover drain holes of freestanding containers with a piece of filter fabric to prevent loss of granular drainage particles.
C. For larger built in place planters it is crucial to ensure accessibility of all water outlets. All roof drains located within a planter 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 at the bottom of the planter or container and level the surface. The depth of the drainage layer depends on the depth of the total system. For details, please refer to System Description (1.4 B) and Systems Provider's installation instructions.

3.5 INSTALL FILTER FABRIC

A. Place the filter fabric on top of the drainage layer. Overlap joints by at least 6 inches. Let filter fabric stand up tight at least two inches at all planter edges and secure position with duct tape to keep soil particles from migrating into the drainage layer.

3.6 INSTALL TOP LAYER

A. Place the top layer media directly on the filter. Compress the top layer in lifts of 6 inches to a degree where full exposure of body weight on one foot does not further reduce depth. Mechanical compactors including plate compactors are not acceptable because they can over compact the media. Proper compaction is crucial to avoid loss of volume and to maintain a healthy root environment. Keep the final surface level of the compressed top layer one or two inches below the edge of the container. This creates a helpful buffer zone for water management and maintenance work.

END OF SECTION

PLANTER PERFORMANCE SYSTEM ILLUSTRATIONS FOR SPECIFIER'S REFERENCE