SECTION 075564
VEGETATED ROOF TRAYS

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This specification section is written to CSI MasterFormat 2004 and CSI SectionFormat 2008.

Specification master was written around Columbia Green, Advanced Vegetative Roof System (AVRS).

This is a turn-key fully integrated green roof tray system that meets or exceeds FLL and Federal Green Roof planning, installation, and maintenance guidelines and requirements for storm water, energy, and environmental management.

Columbia Green, AVRS, includes double interlocking trays, connectors, regionally-engineered growing media, specified firewise and firesafe plants, stainless steel trim elements, and integrated irrigation system. Growing media can be stacked above level of interlocking trays for thicker beds because of interlocking design. Drainage system is designed to control flow of water and bottom of trays are designed to reduce wind uplift.

A Columbia Green Technologies, Inc. (CGT) certified installer will provide quotations, and materials and resources to plan, install, support, and maintain a green roof installation.

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PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Vegetated tray system installed over membrane roofing system, including:

1. Trays.
2. Growing media.
3. Plants.
4. Drip irrigation system.
5. Edge elements / metal trim.

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Edit related Sections to those referenced in body of specification section

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B. Related Requirements:

1.	[Section 013113	-	Project Coordination]
2.	[Section 013119	-	Project Meetings]
3.	[Section 013300	-	Submittal Procedures]
4.	[Section 014300	-	Quality Assurance]
5.	[Section 016510	-	Product Delivery, Storage, and Handling Requirements]
6.	[Section 017700	-	Closeout Procedures]
7.	[Section 017823	-	Operation and Maintenance Data]
8.	[Section 017836	-	Warranties]
9.	[Section 018113	-	Sustainable Design Requirements]
10.	[Section 075323	-	EPDM Membrane Roofing System]
11.	[Section 076000	-	Flashing and Sheet Metal]
12.	Division 22	-	Plumbing for water and connections required for irrigation system
13.	[Section 328413	-	Drip Irrigation]
14.	[Section 329000	-	Planting]

1.2 REFERENCES

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Edit reference standards to those referenced in body of specification section.

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A. Reference Standards: Current edition at date of Project Manual, except as otherwise specified.

B. US Green Building Council (USGBC), Leadership in Energy and Environmental Design (LEED) - LEED Reference Guide, Version 3.0, and USGBC Project Calculation Spreadsheet. Web Site http://www.usgbc.org.

1.3 DEFINITIONS

A. Phytoremediation: Use of green plants to extract pollutants, mineral elements, heavy metals, and radioisotopes, and other contaminants from soil and water environments.

B. German FFL Greenroof Guidelines: Guideline for the Planning, Execution and Upkeep of Green Roof Sites, Release 2002. Worldwide acknowledged state-of-the-art technology as scientific foundation for successful and thriving green roofs.

1.4 ADMINISTRATIVE REQUIREMENTS

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Edit sections to include coordination and sequencing as needed for completion of work.

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A. Coordination: Conform to Section [013113] for coordination with work of other Sections.

1. Section [075323] for sequencing, scheduling, and placement over EPDM [_____] roofing system.
2. Section [076000] for integrating with flashing systems at parapet walls and other locations.

B. Preinstallation Meetings:

1. Arrange, in accordance with Section [013119].
2. Attendance: Contractor, installer, Owner, Architect, vegetated roofing system, and membrane roofing system manufacturer representatives, roofing installer, and those requested to attend.
3. Meeting Time: Minimum 2 weeks prior to beginning work of this Section and to prior work of related Sections affecting work of this Section.
4. Location: Project Site.
5. Agenda:

a. Discuss drainage mats, root barriers, filter fabrics, slip-sheets, protection course, and other requirements required by roofing manufacturer.
b. Verify water source and connections for drip irrigation system.

1.5 SUBMITTALS

A. Submit under provisions of Section [013300].

B. Shop Drawings: Plan layout and details at critical terminations of garden roof system with adjacent building construction. Include flashing connections to planter system, and building systems.

C. Product Data:

1. Vegetated roofing system, components, growing media type, and planting types with descriptive published data indicating characteristics and limitations.

2. Include standard details, system components, and proposals for plant types and characteristics.

D. Manufacturer Instructions: Include manufacturer's installation instructions, special procedures, and conditions requiring special attention.

E. Certifications: Written submittal by manufacturer indicating that installer is certified as qualified to perform work of this Section.

F. Sample Warranty: Manufacturer's standard warranty meeting or exceeding provisions specified by this Section.

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Insert recycled content to meet sustainable project requirements. Following is an example.

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G. Recycled Content: Confirm recycled content of system components that meet or exceed 20 [__] percent post consumer and 40 [__] percent post industrial recycled content conforming to USGBC LEED Reference Guide

1.6 CLOSEOUT SUBMITTALS

A. Submit under provisions of Section [017700] and [Section 017824].

B. Maintenance Instructions: Manufacturer's instructions for Owner maintenance of planting media as needed for long term propagation and health of vegetation. Include special provisions as applicable for specific plant media and climatic zone.

1.7 QUALITY ASSURANCE

A. Single Source Responsibility: Provide interlocking plastic trays, growing media, plant materials, flashings, [drip irrigation,] and maintenance for stipulated period as a single system by or under direction of vegetated manufacturer.

B. Manufacturer Qualifications:

1. Company specializing in work of this Section.
2. Maintain locally available representation for technical and inspection support services.
3. Manufacturer's Technical Representative:

   a. Available on site to make interim observations, recommendations, and final inspection.
   b. Available to verify installation in conformance with manufacturer's Warranty provisions.

C. Installer Qualifications: Certified as pre-approved and qualified by manufacturer to install work of this Section.

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Insert sustainability standards where applicable. Following is an example.

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D. [Sustainability Standards Certifications:

1. Conform to Section 018113 for documentation of LEED Credits contributing to Certification of Project under USGBC LEED-NC 3.0 Green Building Rating System for sustainable building requirements.
2. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.]

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For new construction, coordinate with structural engineer of record to calculate roof loads imposed by tray system and design into roof framing system.

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E. Preconstruction Testing: Conduct to verify following:

1. Existing Roofing System: Conduct testing and inspections by professional engineer licensed in State of [_____] to verify that roof is designed and constructed to adequately support load of vegetated roof tray system.
2. Membrane Roofing Manufacturer: Conduct inspection by certified manufacturer representative to verify that in-place membrane roofing system is acceptable for installation of vegetated roof tray system. Verify protection course and other requirements to maintain warranty provisions.
3. Flood Test: Conduct 24 hour flood test under provisions of applicable membrane roofing section or under work of this section by Owner's roofing inspection agency to waterproof and weathertight condition.

1.8 DELIVERY, STORAGE, HANDLING

A. Conform to provisions of Section [016510] and manufacturers instructions.

B. Delivery: Conduct roof top delivery, assembly, and storage of each component of vegetated roof system under direction of manufacturer's authorized installer.

C. Storage:

1. Maintain health of plant media as recommended by nursery guidelines prior to rooftop installation.
2. Take measures to located and spread loads in manner to not exceed load bearing capacity of roof deck.
3. Store vegetated planters and materials over plywood panels or protective sheeting and do not allow products, growing media, grit, debris, and pedestrian traffic on unprotected roofing membrane.
4. Provide water source for irrigation of and maintenance of plants until permanent drip irrigation system is in place.

D. Handling: Stabilize equipment for moving pallets to roof deck to account for decreasing load limits as cranes or forklifts are extended.

1.9 FIELD CONDITIONS

A. Ambient Air Temperature: Install plant materials in trays preferably between April 1 and November 1 [at northern latitudes] at temperatures between 40 degrees F and 95 degrees F , except as otherwise instructed by manufacturer.

1.10 WARRANTY

A. Conform to Warranty provisions specified Section [017836].

B. Manufacturer: Provide materials and labor Warranty for vegetated system including connectors, and edge elements for length of roofing membrane warranty. Include removal of overburden as required by roofing manufacturer to retain provisions of roofing manufacturer's Warranty.

PART 2 PRODUCTS

2.1 SYSTEM

A. Vegetated Roof System: Plastic trays, growing medium, and plant materials for installation over roofing system, including [flashings,] [irrigation,] and [other systems by manufacturer] as required for complete installation.

2.2 MANUFACTURERS

A. Columbia Green Technologies, Inc., Advanced Vegetative Roof Systems (AVRS).

1. Tel (503) 327-8723, Email vanessa@columbia-green.com (Vanessa Keitges, President and CEO)
2. Tel (503) 327-8723, Email timn@columbia-green.com (Tim Nash, Director of Technical Sales & Programs)
3. Web Site http://www.columbiagreenroof.com

B. Substitution Requests: Conform to provisions of Section [012500].

2.3 PERFORMANCE / DESIGN CRITERIA

A. Roof Load Criteria: Following roof load requirements are regionally dependent and may vary by specific installation.

B. Post, Sedum Tiles, Hydro Planted AVRS 5.25 inch Growing Media

Fully Saturated Weight	26 psf
Field Moisture Capacity Weight	20.5 psf

C. Pre-planted AVRS 4.625 inch Growing Media

Fully Saturated Weight	23 psf
Field Moisture Capacity Weight	18 psf

D. Max-Lite AVRS 5.25 inch Growing Media

Fully Saturated Weight	18.5 psf
Field Moisture Capacity Weight	12.5 psf

E. Max-Lite AVRS 4.625 inch Growing Media

Fully Saturated Weight	16.5 psf
Field Moisture Capacity Weight	11 psf

2.4 TRAYS

A. Performance / Design Criteria: Engineer to:

1. Retain and meter rain and drip irrigation water.
2. Allow hydration of plants and prevent root rot.
3. Allow phytoremediation (removal of contaminates) from soil and water at bottom of trays.
4. De-energize wind flow under trays reducing chance of wind uplift.
5. Eliminate need for additional drainage material, root barriers, and filter fabric.

B. Tray Size: 2 foot square 4-5/8 inch deep.

C. Material: 100 percent post-industrial recycled content, injection molded, 100 mil polypropylene.

1. Water-Retention Ridges and Troughs: Eleven 3/4 inch wide by 5/8 inch high troughs and corresponding troughs
2. Molded Drain Holes: 3/8 inch diameter. Nine holes located at tops of water-retention ridges and one at each trough.

3. Interlocks: Two flat and two overlapping top edges designed to connect and hold adjacent trays together.
4. Sides: Sloped at 5 degree angle from top to bottom.
5. Clearance: 5/8 inch above underlying roof membrane to allow water to flow freely under and around trays.
6. Connection Holes and Fasteners:

    a. Four 3/8 inch holes, aligned and centered in each vertical side panel.
    b. Quick-lock fasteners.
    c. Hook and quick-lock fastener for drip irrigation system.

D. Weight:

1. Unloaded Tray Weight: 3.6 pounds.
2. Loaded With Mature Plants and Fully Saturated 23 to 26 pounds per square foot,
3. Moisture Content Weight: 18 to 20 pounds per square foot, fully saturated.

E. Color/Sheen: Black/semi-gloss.

2.5 GROWING MEDIA

A. Growing Media: Based on German FLL Greenroof Guidelines.

1. Produced from organic recycled material and inorganic by-products for use as a light weight growing media for hardy long lasting succulent or phytoremediation plants that are beneficial in a green roof environment.
2. Pre-blended regionally and delivered to site for application in bulk or minimum in 1.5 cubic yard super totes when possible.

2.6 PLANTS

A. Conform to project landscape design requirements, recommendations of local horticulturists, where possible, and requirements of authorities having jurisdiction, including Fire Marshal, for specific recommendations and regulations.

B. Design mix of firewise/firesafe hardy long-lasting fibrous succulents, capable of thriving in limited-irrigated rooftop environment for project location. Selections conforming to USDA hardiness zone classification and regional horticulturalist recommendation and as accepted by Architect.

C. Planting Method: [Pre-planting of trays] [Post-planting of trays] [Sedum Tiles] [and] [Hydro-planting], as accepted by Architect.

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Post-Planting and Pre-Planting: Minimum 15 inch wide plugs and planted 9, 13, 16, or 25 plugs per tray. Pre-planted trays do not include an integrated irrigation system.

Sedum Tiles: Allows quicker installation and includes integrated irrigation.

Hydro-planting: Practical planting option for buildings of one or two stories with direct curbside access, using sedum cuttings and a facilitating slurry.

Edit following paragraphs accordingly.

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D. Post Planting [Pre-Planting]:

1. Plug Size: Minimum 1.5 inch wide.
2. Plant Spacing: [9] [13] [16] [25] plugs at each tray.
3. [Distribute differing plant species evenly and uniformly within each tray for overall uniform appearance of in-place installation.]

E. [Sedum Tiles: Post plant following installation of irrigation system.]

F. [Hydroplanting: Distribute plant cuttings by evenly broadcasting over growth medium.]

2.7 EDGE ELEMENTS / METAL TRIM

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Multiple edge flashing designs and configurations are available to meet specific interlocking, irrigation enclosure, and building integration requirements. Consult with manufacture and edit following to project requirements.

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A. Edge Flashing and Trim: Manufacturer's standard 26 gauge stainless steel sidewall flashing and trim at trays and walkways to frame, connect, and tie tray and walkway systems into each other and adjacent building components.

1. Pre-drill to accommodate quick-lock fasteners and
2. Notch and configure to allow for tray placement and irrigation access.

B. Other flashing: As specified Section 076000.

2.8 DRIP-IRRIGATION SYSTEM

A. Irrigation Components:

1. Low-pressure (15 psi) agricultural-grade line.
2. Water source connectors.
3. Patented AVRS irrigation line retention hook and quick-lock fastener.

B. Provide connections to sub-main, valves, timers, and manifold components at tray under work of [Division 22].

PART 3 EXECUTION

3.1 EXAMININATION

A. Inspect and verify roofing membrane and components complete and ready prior to beginning work of this Section.

B. Verify protection course over membrane roofing in place and conforming to roofing manufacturer instructions, as inspected and accepted by roofing manufacturer's technical representative.

C. Verify that equipment and methods needed to place trays, growing media, planting, and other system components as adequate, stabilized, and available.

3.2 SUBSTRATE PREPARATION

A. Sweep with broom and then use air compressor to blow remaining dust and debris from substrate.

3.3 INSTALLATION – GENERAL

A. Conform to manufacturer's instructions and provisions of Contract Documents. Where in conflict verify with Architect before beginning.

3.4 TRAYS

A. Place trays directly over protection cover provided under roofing work of Section [075323].

B. Positioned bottom troughs of trays perpendicular to roof slope, except minor crickets.

C. Orient edges to interlock and hold trays in place.

D. Attach trays in place with manufacturer's standard quick-lock fastener through aligned holes in tray sidewalls.

E. Secure trays together with quick-lock fasteners and install edge flashing in place.

F. Promptly after placing trays on roof, install growth medium or ballast as necessary to prevent movement of trays due to weather and construction activities..

3.5 IRRIGATION SYSTEM

A. Lay out and secure irrigation lines to trays using manufacturer's irrigation hook and quick-lock fastener system [, conforming to Section 328413].

B. Make connections of irrigation lines to water supply provided under work of other Sections, including sub-mains, valves, and manifold system.

C. Install regulator to govern pressures exceeding 15 psi.

D. Conduct testing procedures to verify performance prior to installing growing medium.

3.6 GROWING MEDIA

A. Transport bulk growing media to roof on pallets of trays using stabilized hoisting equipment or cranes in [1.5 or 2.0] cubic yard totes or 50 to 70 pound sacks.

B. Distribute growing media evenly throughout tray.

3.7 PLANTING

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Edit following accordingly for type of planting. Note that pre-planted trays will not include irrigation system.

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A. Install planting [plugs] [tiles] [hydro-seeded plant cuttings], conforming to landscape design and other requirements, as specified by Section [329000].

B. Distribute differing plant species evenly and uniformly within each tray for overall uniform appearance of overall in-place installation [Install in specific pattern or arrangement conforming to Section 329000, and as accepted by Architect.]

C. Following installation of plant media, irrigate using potable water free of substances harmful to plant growth. Provide hoses in lengths reaching from water supply source to planting trays.

3.8 EDGE FLASHING

A. Conform to manufacturer's details and provisions of Section 076000 for interconnections of flashing systems.

B. Install trim flashing to conceal tray sides [and to lock into metal counter flashing at building perimeter flashing systems as specified by Section 076000].

C. Install interlocking metal anchor flashing at openings between trays and perimeter roof edges to anchor trays, building perimeter flashings and counter flashings together.

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Coordinate to install an additional layer of roofing membrane or protection course under each flashing joint as accepted by roofing manufacturer.

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D. Sheet Metal Fasteners:

1. Concrete Walls: Fasten at 12 inch on center using a 1/4 inch lead drive pins.
2. Wood Parapet Walls: Install interlocking metal anchor flashing fastened with minimum 12 stainless steel fasteners at 12 inch on center.
3. Gypsum Sheathing and Other Low Strength Materials: Install 18 gauge by 4 inch galvanized steel strip installed at structural framing at fastener locations. Fasten with minimum 12 stainless steel fasteners at 12 inch on center.

3.9 FIELD QUALITY CONTROL

A. Manufacturer:

1. Conduct preconstruction, interim, and final inspections to determine acceptance of vegetated roofing system in presence of Owner, Architect, Contractor, manufacturer's representative, and installer.
2. Verify conformance to manufacturer's instructions and Warranty provisions.

B. Final Inspection and Acceptance:

1. Make arrangements for final inspection of in-place installation within 14 days following Substantial Completion with Owner, Architect, Contractor, installer, and others as requested to be present.
2. Owner will assume maintenance and care of vegetated roof try system following acceptance, except as modified by a maintenance service agreement between Owner and manufacturer.

3.10 ADJUSTING

A. Make adjustments and alignments of trays and flashing trim as necessary to give a uniform and finished appearance.

B. Replace plant media that appears to be stressed or damaged.

3.11 CLEANING

A. Leave installations clean, premises free from debris and residue resulting from work of this Section.

B. Remove stains from adjacent surfaces with manufacturer's recommended cleaning agents.

3.12 PROTECTION OF COMPLETED WORK

A. Protect membrane waterproof from contamination from petroleum products, grease, oil, solvents, vegetable and mineral oils, animal fat, chemicals, and other foreign material.

3.13 MAINTENANCE

A. Maintain a uniform stand of succulent plants by watering and maintaining vegetated roof trays for a minimum period of 90 days following installation and through Substantial Completion and occupancy by Owner.

1. Include watering, spot weeding, fertilization, and other measures as necessary to maintain health and propagation of plant materials and as necessary for stabilization.

2. Instruct Owner and furnish written maintenance instructions, following maintenance period, as necessary for planting materials to develop complete root structure and to become stabilized.
3. Provide periodic hydration as needed, depending on precipitation.
4. Follow horticultural / nursery recommended plant maintenance procedures.

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Optional Maintenance Agreement.

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B. Annual Maintenance Continuation Agreement: Following initial construction maintenance, consult with Owner for continuation of maintenance as offered by installer.

1. Include watering for first year after installation to ensure proper root development.
2. Continue watering should be done on an as needed basis.

END OF SECTION