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DIVISION 6 – POST-CONSTRUCTION STORMWATER QUALITY FACILITIES

601 GROWING MEDIUM

601.01.00 MATERIALS

Growing medium shall be a blend of top soil, sand, and compost. It shall be well mixed and homogenous. The blended material shall be loose and friable, giving good tilth and aeration. The growing medium shall be a blend that is 30 to 40 percent compost by volume.

601.01.01 TOPSOIL

Topsoil shall be obtained from naturally well-drained construction or mining sites where topsoil occurs at least four inches deep. It shall not be obtained from bogs, wetlands, or marshes.

601.01.02 COMPOST

Compost shall be derived from plant material and provided by a member of the U.S. Composting Council Seal of Testing Assurance (STA) program. For a list of providers in the Willamette Valley, see the United States Composting Council, participants list for the state of Oregon.

Compost shall be the result of the biological degradation and transformation of plant- derived materials under conditions designed to promote aerobic decomposition. The material shall be well composted, free of viable weed seeds, and stable with regard to oxygen consumption and carbon dioxide generation. Compost shall have no visible free water and shall produce no dust when handled.

Compost shall meet the following criteria, as reported by the U.S. Composting Council STA Compost Technical Data Sheet provided by the vendor.

- a. 100 percent of the material must pass through a 5/8-inch screen.
- b. The pH of the material shall be between 6 and 8.
- c. Manufactured inert material (plastic, concrete, ceramics, metal, etc.) shall be less than 1.0 percent by weight.
- d. The organic matter content shall be between 30 and 70 percent.
- e. The soluble salt content shall be less than 6.0 mmhos/cm.
- f. Germination (an indicator of maturity) shall be greater than 80 percent for Germination and Vigor.
- g. The stability shall be “Stable” to “Very Stable.”
- h. Carbon/Nitrogen (C/N) ratio shall be less than 25:1.
- i. The trace metals test result = “Pass.”

601.01.03 GRADATION

A particle gradation analysis of the blended material, including compost, shall be conducted in conformance with ASTM C1 17/C136 (AASHTO T11/T27). The analysis shall include the following sieve sizes with the material meeting the gradation criteria indicated herein.

Sieve Size	Percent Passing
1 inch	100
# 4	75 -100
# 10	40-100
# 40	15-50
# 100	7-25
# 200	7-15

The growing medium blend shall have a Coefficient of Uniformity (D60/D10) equal to or greater than 6 to ensure that it is well graded (has a broad range of particle sizes). The coefficient is the ratio of two particle diameters on a grain-size distribution curve; it is the particle diameter at 60 percent passing divided by the particle diameter at 10 percent passing.

601.01.04 ACIDITY AND ALKALINITY

The blended material shall have a pH of 6 to 8.

601.01.05 DELETERIOUS MATERIALS

The blended growing medium shall be free of deleterious materials including, but not limited to manure, wood pieces, including root material; plastic; plant material not conforming to 601.01.02; clods or lumps of clay; pockets of unmixed component materials; hydrocarbons (diesel, gasoline, paint thinner, etc.); building materials; paint; concrete slurry or washout; or any other material determined by the Engineer to be harmful to stormwater quality or to the promotion of plant growth.

The blended material shall be free of weeds including but not limited to: *Cirsium arvense* (Canadian Thistle), *Convolvulus* spp. (Morning Glory), *Cytisus scoparius* (Scotch Broom), *Dipsacus sylvestris* (Common Teasel), *Festuca arundinaceae* (Tall Fescue), *Hedera helix* (English Ivy), *Holcus canatus* (Velvet Grass), *Lolium* spp. (Rye Grasses), *Lotus corniculatus* (Bird's Foot Trefoil), *Lythrium salicaria* (Purple Loose Strife), *Melilotus* spp. (Sweet Clover), *Myriophyllum spicatum* (Eurasian Milfoil), *Phalaris arundinaceae* (Reed Canary Grass), *Rubus discolor* (Himalayan Blackberry), *Solanum* spp. (Nightshade), and *Trifolium* spp. (Clovers).

The blended growing medium shall not contain nematodes, grubs, other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens.

601.02.00 CONSTRUCTION

Growing medium shall be no less than eighteen inches in depth unless otherwise shown on the project plans.

601.02.01 PLACEMENT

The blended growing medium shall have no visible, free water at time of placement.

The bottom of the excavated stormwater quality facility shall be surface roughened to facilitate water permeation into the native material. Lined facilities do not require surface roughening.

Growing medium shall be placed in even lifts no greater than eight inches in depth, as measured loosely. Lifts shall be moderately compacted by use of a sand- or water-filled lawn roller. Mechanical means of compaction ("jumping jacks," "plate whackers," etc.) shall not be used on growing medium.

601.02.02 CONDITIONS

The growing medium shall not be placed when the ground or growing medium is frozen or water saturated, nor when standing water exists within the stormwater quality facility. The growing medium shall not be placed when it is raining, or if rain is forecast within 12 hours of placement.

601.02.03 PROTECTION OF THE GROWING MEDIUM

The growing medium shall be protected from all sources of contamination, including weed seeds, while at the supplier, in conveyance, and at the project site.

Following placement of the growing medium, vegetated stormwater facilities shall be protected from pedestrian, vehicular, and equipment traffic. Traffic upon facilities shall be cause for removal and re-installation of growing medium and such other features as determined necessary by the Engineer.

Surface drainage shall be prevented from entering the facility during construction until surface treatments are fully installed. Facilities shall be protected from sedimentation during construction of other improvements draining to the facility.

The specified surface treatment shall be applied on the same day the growing medium is placed in the facilities.

601.03.00 TESTING

601.03.01 SUBMITTALS

At least 10 working days in advance of the construction of vegetated stormwater facilities the contractor shall submit the following:

- a. Two five-gallon buckets of the blended material, upon request.
- b. Documentation for conformance to the requirements for particle gradation with calculated coefficient of uniformity, content of organic compost, and pH. The analyses shall be performed by an accredited laboratory with current certification. The date of the analyses shall be no more than 90 calendar days prior to the date of the submittal. The report shall include the following information:
 - 1. Source of blended material (supplier)
 - 2. Name and address of the laboratory
 - 3. Phone contact and e-mail address for the laboratory
 - 4. Test data, including the date and name of the test procedure

A list of soil testing labs serving Oregon can be found through the Oregon State University Extension Services, Department of Crop and Soil Sciences.

- c. A compost technical data sheet from the vendor of the compost. The analysis shall be performed and reported by an approved independent US Composting Council STA program participant laboratory.

601.03.02 VERIFICATION

The City may, at its sole discretion, take a representative soil sample on site to check for conformance of the blended material with the requirements of this specification. Where tests indicate non-compliance, soil shall be amended to meet the requirements or replaced, as determined by the Engineer. Plants will be re-planted or replaced at the discretion of the Engineer.

601.04.00 MEASUREMENT AND PAYMENT

Tools, equipment, labor, materials, and testing necessary to furnish and place growing medium shall be incidental to specified bid items, unless otherwise identified in the contract documents.

602 AGGREGATES

602.01.00 DRAIN ROCK

602.01.01 GRADATION

Drain rock shall be comprised of 1½” – ¾”, washed, open graded rock as follows:

Screen Size	% Passing
1¾”	100
1½”	90-100
1”	30-50
¾”	15-35
½”	0-20
3/8”	0-10
No. 4	0-10
No. 8	0-5
No. 200	0-1

602.01.02 PLACEMENT

Drain rock shall be no less than nine inches in depth unless otherwise shown on the project plans.

602.01.03 MEASUREMENT AND PAYMENT

Tools, equipment, labor, materials, and testing necessary to furnish and place drain rock shall be incidental to specified bid items, unless otherwise identified in the contract documents.

602.02.00 GRAVEL LENS

A gravel lens shall be placed to separate the growing medium from the drain rock. The gravel lens shall be placed to prevent growing medium from infiltrating and loading the void spaces in the drain rock.

602.02.01 GRADATION

Material for the gravel lens shall conform to the *Oregon Department of Transportation Standard Specifications For Construction*, Section 00710.10 – Aggregates, (a) Size Designation – Single Sized Medium consisting of 3/8”-1/4” washed, open graded rock, or as follows:

Screen Size	% Passing
1/2”	90-100
3/8”	50-100
1/4”	0-15
No. 30	0-2
No. 200	0-2

602.02.02 PLACEMENT

The gravel lens shall be no less than three inches in depth.

602.02.03 MEASUREMENT AND PAYMENT

Tools, equipment, labor, materials, and testing necessary to furnish and place the gravel lens shall be incidental to specified bid items, unless otherwise identified in the contract documents.

602.03.00 AGGREGATE FOR GRAVEL BALLAST

602.03.01 GRADATION

Aggregates shall be comprised of 2” to 4” rock, crushed with 100 fractured faces. Aggregate shall be washed free of fine materials.

602.03.02 PLACEMENT

Place as shown on the standard drawings or as indicated in the contract documents.

602.03.03 MEASUREMENT AND PAYMENT

Tools, equipment, labor, materials, and testing necessary to furnish and place the aggregates for splash pads or ballast shall be incidental to specified bid items, unless otherwise identified in the contract documents.

603 STRUCTURAL COMPONENTS

603.01.00 PORTLAND CEMENT CONCRETE (PCC)

Concrete splash pads shall be installed at all inlets into vegetated stormwater facilities. PCC structures shall conform to the requirements of sections 206, CONCRETE STRUCTURES; and 306, CURBS, GUTTERS, SIDEWALKS, DRIVEWAY APPROACHES, AND ACCESS RAMPS of these Specifications.

603.01.01 CONSTRUCTION

Splash pads shall measure 12 inches wider than the inlet opening or contributing pipe diameter, centered. Splash pads shall be no less than 18 inches long as measured along the flow path into the structure. All surfaces of PCC structures shall be smooth and free of defects, and shall have a light broom textured finish. For planter walls, contraction joint spacing shall be a maximum of 10 feet.

603.01.02 MEASUREMENT AND PAYMENT

Tools, equipment, labor, materials, and testing necessary to furnish and place the PCC structures shall be incidental to specified bid items, unless otherwise identified in the contract documents.

603.02.00 PIPES AND FITTINGS

603.02.01 GENERAL

603.02.01A PUBLIC RIGHT OF WAY FACILITIES

Pipes and piping components within public rights-of-way shall conform to Division 4 of these Specifications. Where the provisions of Division 6 may conflict with those of Division 4, the requirements of Division 6 supersede those of Division 4.

603.02.01B ONSITE FACILITIES

Pipes outside of public-rights-of way shall conform to the requirements of the Oregon Plumbing Specialty Code. The contractor shall obtain all necessary permits for construction and inspections, unless specified otherwise in the contract documents.

603.02.02 MATERIALS

603.02.02A PERFORATED PIPE

Drain pipe for stormwater quality facilities shall be perforated, as below, except where it is located under street trees planted within the facilities. Pipe in these locations shall be of the same material and manufacture as the perforated pipe. Connections between pipe lengths shall be made in accordance with manufacturer's recommendations.

603.02.02B POLYVINYL CHLORIDE (PVC) PIPE

Perforated PVC drain pipe shall be smooth wall, perforated, meeting the requirements of ASTM F782 for PVC underdrain systems. PVC drain pipe shall be manufactured of Polyvinyl compounds with a minimum cell classification of 12364-C as defined by ASTM D1784. Unless otherwise specified or shown, joint systems shall be solvent-cement type. Perforations shall be circular, on 3¼" centers. Hole size shall be a minimum of 3/16" and a maximum of 3/8" arranged in four rows along the full length of pipe below the spring line (midpoint height) of the pipe.

603.02.02C HIGH DENSITY POLYETHYLENE (HDPE) PIPE

HDPE drain pipe shall conform to ASTM F2648/F2648M-13. Perforations shall be slotted or circular, conforming to AASHTO M252 Class II Perforation requirements.

603.02.03 CONSTRUCTION

Drain pipe within stormwater quality facilities shall be laid flat, unless otherwise shown on the project plans.

603.02.04 MEASUREMENT AND PAYMENT

Tools, equipment, labor, materials, and testing necessary to furnish and place pipes for vegetated stormwater facilities shall be incidental to specified bid items, unless otherwise identified in the contract documents.

603.03.00 LINERS

Liners shall be 30 mil thickness, high-density polyethylene material, or approved equal.

603.03.01 CONSTRUCTION

603.03.01A PIPE PENETRATIONS

Pipe penetrations shall be made with the use of manufactured pipe boots of the same material as the liner provided. Pipe boots shall provide a continuously bonded seal to the liner. Pipe boots shall provide a chemically bonded or mechanical seal to the pipe to prevent passage of water or soils at the point of pipe penetration.

603.03.01B LINER ATTACHMENT

Liner shall be mechanically anchored with aluminum bar. Aluminum bar shall be 2" by ¼" and shall conform to ASTM B211.

603.03.02 MEASUREMENT AND PAYMENT

Tools, equipment, labor, materials, and testing necessary to furnish and place liners for vegetated stormwater facilities shall be incidental to specified bid items, unless otherwise identified in the contract documents.

603.04.00 OVERFLOW ASSEMBLIES

603.04.01 Beehive Inlet Grates (Large Overflow Assembly)

Approved “beehive” style inlet grates include the following:

Pacific Marine	model R-2510-A	Beehive Grate Heavy Duty
Pacific Marine	model R-1761	Frame Heavy Duty

Beehive inlet grates shall be secured to the vertical drain pipe to prevent theft. See Standard Construction Detail Number 620.

603.04.02 Atrium Inlet Grates (Small Overflow Assembly)

Approved 4” and 6” atrium inlet grates include the following:

NDS	part no. 75 (for 4” grate)
NDS	part no. 80 (for 6” grate)
Dura Plastic Products, Inc.	part no.040-A (for 4” grate)
Dura Plastic Products, Inc.	part no. 060-A (for 6” grate)

603.04.03 MEASUREMENT AND PAYMENT

Tools, equipment, labor, materials, and testing necessary to furnish and place overflow assemblies for vegetated stormwater facilities shall be incidental to specified bid items, unless otherwise identified in the contract documents.

603.05.00 CHANNEL GRATES

Channel grates shall be “Interlaken” 18” grates as manufactured by Iron Age Designs, Model IN18-18I13. Frames shall be type “E” embed style as provided by the manufacturer. Installation shall be per manufacturer’s recommendation.

603.05.01 MEASUREMENT AND PAYMENT

Tools, equipment, labor, materials, and testing necessary to furnish and place channel grates for vegetated stormwater facilities shall be incidental to specified bid items, unless otherwise identified in the contract documents.

603.06.00 METAL FRAME FOR CURB OPENINGS

HSS channel shall conform to ASTM A-500 Grade B. End plates shall conform to ASTM A-36. Headed concrete anchors shall conform to ASTM A-108.

603.06.01 MEASUREMENT AND PAYMENT

Tools, equipment, labor, materials, and testing necessary to furnish and place metal frame for curb openings for vegetated stormwater facilities shall be incidental to specified bid items, unless otherwise identified in the contract documents.

603.07.00 CHECK DAMS

603.07.01 WOOD BOARDS

Wood boards for check dams shall be constructed from wood naturally resistant to decay, such as cedar, redwood, or approved equal.

Wood shall be free of splits, holes, and/or other damage.

603.07.02 MEASUREMENT AND PAYMENT

Tools, equipment, labor, materials, and testing necessary to furnish and place check dams for vegetated stormwater facilities shall be incidental to specified bid items, unless otherwise identified in the contract documents.

604 SURFACE TREATMENTS

604.01.00 JUTE MATTING

604.01.01 MATERIALS

Jute matting shall be woven coir fabric produced by BonTerra CF-7, DeKoWe 700, Nedra KoirMat 700, Rolanka BioDMat 70, or approved equal; a high strength 700 Weight (100 percent coconut fiber), continuously woven mat (i.e., without seams), with a measured maximum open area of 50 percent; tested in accordance with ASTM D1777 (Thickness), ASTM D4595 (Tensile Strength), and ASTM D3776 (Weight).

604.01.02 CONSTRUCTION

Use 1" × 2" × 18" Factor W wood stakes, or approved equal to anchor all coir fabrics. Stakes shall be solid and free of knots or defects.

604.01.03 MEASUREMENT AND PAYMENT

Tools, equipment, labor, materials, and testing necessary to furnish and place jute matting shall be incidental to specified bid items, unless otherwise identified in the contract documents.

604.02.00 STRAW MATTING

604.02.01 MATERIALS

Straw matting shall be contained within bio-degradable netting on top and bottom. Straw matting shall be rated for application on slopes 2:1 or steeper, and/or flow velocities up to six feet per second. Testing shall be in accordance with ASTM D6525 (Thickness), ASTM D6818 (Tensile Strength), ASTM D6475 (Weight).

Products containing synthetic netting or other components shall not be used.

Acceptable straw matting:

Bionet S150BN as manufactured by North American Green or approved equal.

604.02.02 CONSTRUCTION

Use 1" × 2" × 18" Factor W wood stakes, or approved equal, to anchor all coir fabrics. Stakes shall be solid and free of knots or defects.

604.02.03 MEASUREMENT AND PAYMENT

Tools, equipment, labor, materials, and testing necessary to furnish and place straw matting shall be incidental to specified bid items, unless otherwise identified in the contract documents.

605 VEGETATION

605.01.00 TREE AND PLANT SELECTION

Where tree, plant, and shrub species are not identified on project plans approved by the City's Public Works Department, the Contractor, using the City's approved planting lists, shall propose a plant selection to the City Engineer for review and approval.

605.02.00 PLANTING PROCEDURES

Trees shall be planted according to Division 210. Plants and shrubs shall be in a healthy, growing condition and shall be planted upright and adjusted to set best appearance or relationship to adjacent plants and structures.

605.02.01 TIMING

Containerized stock shall be installed only from February 1 through November 15. Bare root stock shall be installed only from October 15 through April 15. Seeding shall occur only from March 15 to October 15. Planting or seeding outside these times may require additional measures to ensure survival.

605.02.02 PLANT PIT SIZE

605.02.02A BARE ROOT STOCK

Bare root stock shall be placed into a plant pit sufficient for root mass. Soil backfill shall be manually compacted around the plant.

605.02.02B CONTAINERIZED STOCK

Containerized stock shall be placed into a plant pit twice the size of container.

605.03.00 ESTABLISHMENT PERIOD

The establishment and warranty period for plantings is two years as identified in Division 1. Establishment period requirements for street trees installed in post-construction stormwater quality facilities are identified in Section 210 of these specifications.

605.03.01 MONITORING, WEEDING, AND PRUNING

Approval and acceptance of the completed post-construction stormwater quality facility will be conditioned upon the contractor providing a monitoring, weeding, and pruning schedule for the purpose of evaluating the ongoing function of the facility, and for the health and establishment of plants, shrubs, and trees. The schedule shall span the entire establishment period; shall identify the responsible party and his/her contact information; and shall identify the dates of inspection and weeding (minimum of three per growing season, evenly spaced, and one prior to onset of growing season) to be performed. The monitoring and weeding schedule shall be updated, revised, and resubmitted within five working days of any request by the City.

During the establishment period the contractor shall provide reporting documents to the City to demonstrate conformance with the monitoring and weeding requirements. Reporting documents shall include the name of the person performing the inspection and weeding; date and time; location; general condition of the facility; and the health, general condition, and number of plants, shrubs, and trees of each variety of planted species. Complete reporting documents shall be submitted to the City within five working days of each inspection.

605.03.02 IRRIGATION

Approval and acceptance of the completed post-construction stormwater quality facility will be conditioned upon the contractor providing an acceptable irrigation schedule. The contractor shall be responsible for irrigating all trees, shrubs, and plants to sustain an unstressed growing condition throughout the establishment period. Regardless of the submitted irrigation schedule, the contractor is ultimately responsible for plant survival throughout the establishment period and is required to increase the irrigation frequency as necessary to avoid stressing trees, shrubs, and plants.

605.03.03 PLANT REPLACEMENT

Plants and shrubs that have died, are dying, or are not demonstrating vibrant and healthy growth, as determined by the City, shall be replaced immediately upon discovery by the contractor or direction from the City Engineer within the establishment and warranty period. Replacement plants shall be of the same species and size as originally specified. Prior to replacement, the cause of loss (wildlife damage, poor plant stock, etc.) shall be documented with a description of the corrective actions taken. All plants being replaced shall be appropriately disposed of offsite.

605.04.00 MEASUREMENT AND PAYMENT

605.04.01 TREES

Trees shall be paid according the provisions identified in Division 210 of these Specifications.

605.04.02 PLANTS AND SHRUBS

Tools, equipment, labor, and materials necessary to furnish and place plants will be paid on a lump-sum basis unless otherwise specified in the contract documents.

605.04.03 ESTABLISHMENT PERIOD MAINTENANCE

Tools, equipment, labor, and materials necessary to provide maintenance for plants and trees throughout the establishment period shall be incidental to specified bid items, unless otherwise identified in the contract documents.

****END OF DIVISION****