

SECTION 32 94 56
PLANTING SOIL for SOIL CELLS

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*This specification defines material and performance requirements for soils which are to be used within the Silva Cell system. The **SPECIFICATION EDITOR** must select the type of soil appropriate to each particular application, reflecting local market availability and specific application requirements such as soil type, pH, and drainage characteristics for the project. The **SPECIFICATION EDITOR** is responsible for selecting from the following soil types (see specification for requirements of each):*

2.5 EXISTING SOIL MIX:

Planting mix including existing soil.

2.6 UNSCREENED SOIL MIX:

Custom planting mix of topsoil, coarse sand, and compost. Unscreened to maintain important soil characteristics.

2.7 SCREENED SOIL MIX:

Planting mix composed of topsoil, coarse sand, and compost.

2.8 BIORETENTION SOIL MIX (for stormwater applications):

Planting mix to achieve specific water permeability.

See the DeepRoot website (www.deeproot.com) for questions. DeepRoot can assist in evaluating and sizing project-specific design elements for Soil Cells stormwater applications.

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GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Furnishing and installation of Planting Soil within the Silva Cell system.

- B. Related Sections:

1. Division 32 – Exterior Improvements
a. Section 32 94 50 Soil Cells

1.3 DEFINITIONS

- A. Clay: Soil particles smaller than 0.002mm.

- B. Existing Site Soil:

1. Existing site soil that is clean, coarse grained fill soil meeting the requirements of the Unified Soil Classification system for soil type GW, GP, GC with less than 40% fines, SW, and SC with less than 40% fines. Soil shall be sufficiently friable to be mixed with the required compost and installed into the Silva Cell system.
2. Existing site soil shall be free of, trash and other debris. It shall be free of stones, stumps, roots, or other similar objects larger than three inches, and shall be free of toxic material injurious to plant growth.

- C. Gravel: soil particles larger than _____

- D. Planting Soil Mix: Soil, of a variety of textures, defined in this section, intended to fill the Silva Cell frames and other planting spaces to support the growth of trees and other plants. All planting soils within this specification shall be suitable for the germination of seeds and the support of vegetative growth.

- E. Screened Soil: Typical of stockpiled soils available direct from a soil supplier. Screening eliminates soil peds, and should be limited in the soil mixing process.

- F. Silt: Soil particles ranging in size from 0.002-0.05mm.

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- G. Soil Cells: Plastic structural cellular system with post, beams and decks designed to be filled with planting soil for tree rooting and/or used for water storage and support vehicle loaded pavements.
- H. Soil Peds: Clumps of soil that naturally aggregate during the soil building process. Creating a soil mix shall be done in a way that maintains the soil peds. Refrain from over-mixing.
- I. Topsoil: Fertile, friable, loamy soil, harvested from natural topsoil sources; free from subsoil, refuse, roots, heavy or stiff clay, stones larger than 1 inch, contaminants, noxious seeds, sticks, brush, litter, and other deleterious substances; suitable for the germination of seeds and the support of vegetative growth.
- J. Tree: A perennial woody plant with one or several trunks and a distinct crown and intended to become large enough to shade people and or vehicles.

1.4 SUBMITTALS

- A. Upon forty-five (45) days prior to start of installation of items in this section, the Contractor shall provide submittals required in this section to the landscape architect for review and approval.
- B. Soil test analysis: Submit soil testing results from an approved soil-testing laboratory for each soil mix for approval.
 - 1. All testing will be at the expense of the Contractor. The landscape architect may request additional planting mix tests on different mix component ratios in order to attain results that more closely meet the mix requirements.
 - 2. The testing laboratory shall be a member of the Soil Science Society of America's, North American Proficiency Testing Program (NAPT), and have a minimum of five years experience with the test protocols of the United States Golf Association - Green Section.
 - 3. All testing shall comply with the requirements of the Methods of Soil Analysis Part 1 and 3, published by the Soil Science Society of America.
 - 4. Soil testing shall be required as defined below:
 - a. Physical analysis.
 - 1. USDA particle size analysis shall be provided for gravel, clay, silt, and sand fractions
 - 2. USDA soil texture
 - 3. Fines Modulus Index for each sand source
 - 4. Infiltration/Permeability/Hydraulic Conductivity testing shall be done using ASTM D 2434 or ASTM F1815 at 80% AND 85% compaction at proctor density (ASTM D 698-91).

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- a. This is a **LABORATORY TEST** to determine water flow at specified compaction rates.
 - b. Laboratories that provide this testing include:
 - a. Hummel Soil Labs, www.turfdoctor.com; (607) 387-5694, 35 King Street, PO Box 606, Trumansburg, NY, 14886.
 - b. Turf Diagnostics & Design, www.turfdiag.com; (913)-723-3700, 613 E. 1st Street, Linwood, KS, 66052.
 - b. Chemical analysis. Note that nutrient levels and chemical analysis shall include recommendations from the testing laboratory for ranges of each element appropriate for the types of plants to be grown in the soil mix.
 1. Nutrient levels by parts per million including phosphorus, potassium, calcium, magnesium, manganese, iron, copper, zinc and calcium
 2. Percent organic content
 3. pH
 4. Soluble salt by electrical conductivity
 5. Cation Exchange Capacity (CEC)
 1. Chemical analysis shall be interpreted by project Landscape Architect based on plant material specified and testing recommendations.
 - C. Product Data: For each type of product, submit manufacturer's product literature with technical data sufficient to demonstrate that the product meets the requirements of the specification.
 - D. Material Certificates: Submit material certificates for all natural and bulk material indicating that the material meets the requirements of the specification.
 - E. Samples for Verification: one gallon minimum per soil component or soil mix. Label samples to indicate product, source location, specification number, characteristics, and locations in the Work. Samples will be reviewed for appearance only. Compliance with all other requirements is the exclusive responsibility of the contractor. Delivered materials shall closely match the samples.
 1. Planting mix samples shall be labeled as to the percentage of each component.
- 1.5 SOIL INSTALLATION MOCK UP AND COMPACTION EVALUATION
- A. Prior to the installation of planting soil within the Soil Cells, construct a mock up of the complete installation at the site. The installation of the mock up shall be in the presence of the landscape architect.
 - B. The Silva Cell mock up shall be as outlined in Specification Section 32 94 30 Soil Cells.

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1.6 SCHEDULING

- A. General: Prior to the start of Work, prepare a detailed schedule of the work for coordination with other trades.
- B. Schedule all utility installations prior to beginning work in this section.
- C. Where possible, schedule the installation of planting soil within the Soil Cells immediately after the installation of the Silva Cell frames. Protect installed Soil Cells from damage in the event that work must occur over or adjacent to the completed Soil Cells.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Soil within the Soil Cells shall be installed by the same contractor who is installing the Soil Cells. See Specification Section 32 94 50 Soil Cells for installer qualifications.

1.8 PERMITS AND CODE COMPLIANCE

- A. Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary permits/approvals from all such authorities.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, if applicable. Protect materials from deterioration during delivery and while on the project site.
- B. Bulk Materials: Do not deliver or place backfill, soils and soil amendments in frozen, wet, or muddy conditions.
 - 1. Bulk materials shall be stored and staged in a location approved by landscape architect or as indicated on the plans and in a manner that prevents damage to the site or the stored materials.
 - 2. Provide protection including tarps, plastic and or matting between all bulk materials and any finished surfaces sufficient to protect the finish material.
- C. Provide erosion-control measures to prevent erosion or displacement of bulk materials and discharge of soil-bearing water runoff or airborne dust to adjacent properties, water conveyance systems, and walkways. Provide additional sediment control to retain excavated material, backfill, soil amendments and planting mix within the project limits as needed.

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- D. Protect Soil Cells from damage during installation of planting soil.

1.10 PROJECT CONDITIONS

- A. During the installation of Planting Soil within the Soil Cells comply with all project conditions in Specification Section 32 94 50 Soil Cells
- B. Weather Limitations: Do not proceed with work when subgrade, soils and planting soils are in a wet, muddy or frozen condition.

1.11 PROJECT WORK

- A. Coordinate installation with all other work that may impact the completion of the Silva Cell installation.

1.12 PRECONSTRUCTION MEETING

- A. Prior to the start of the installation of Planting Soil within the Soil Cells, meet at the site with the landscape architect, general contractor and the Silva Cell installer to review installation layout, procedures, means and methods.

PART 2 - PRODUCTS

NOTE TO SPECIFICATION EDITOR: *Local soil conditions and availability may require modification to this specification.*

2.1 COARSE SAND

- A. Coarse sand, ASTM C-33 Fine Aggregate, with a Fines Modulus Index of 2.8 and 3.2.
 - 1. Sands shall be clean, sharp, natural sands free of limestone, shale and slate particles.
 - 2. Sand pH shall be lower than 7.0
 - 3. Provide the following particle size distribution:

Sieve size	% Passing
3/8"	100
#4	95-100
#8	80-100
#16	50-85
#30	25-60
#50	5-30
#100	4-10
#200	2-4

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- B. Submittals shall be completed per Section 1.4 and shall be interpreted by project Landscape Architect based on plant material specified and testing recommendations.

2.2 COMPOST

- A. Compost shall meet the requirements of the US Composting Council “Landscape Architecture/Design Specifications for Compost Use”, section “Compost as a Landscape Backfill Mix Component”, with the following additional requirements:
 - 1. Compost feedstock shall be yard waste trimmings and/or source-separated municipal solid waste to produce fungi-dominated compost. Compost shall not be derived from biosolids or industrial residuals.
- B. Compost testing and analysis: Compost analysis shall be provided by the Compost supplier. Before delivery of the Compost, the supplier must provide the following documentation:
 - 1. A statement that the Compost meets federal and state health and safety regulations.
 - 2. Compost testing methodologies and sampling procedures shall be as provided in Test methods for the Examination of Composting and Compost (TMECC), as published by the US Composting Council.
- C. Submittals shall be completed per Section 1.4 and shall be interpreted by project Landscape Architect based on plant material specified and testing recommendations.

2.3 TOPSOIL

- A. Topsoil texture shall be a naturally produced soil of loam, sandy loam to sandy clay loam, within the following parameters, and suitable for the germination of seeds and the support of vegetative growth.

NOTE TO SPECIFICATION EDITOR: *Local soil conditions and availability may require modification to this specification. Modify the physical and chemical parameters to reflect local soil availability. Assure plant selection is suitable for the pH of specified soil.*

B.	Physical Parameters		
	<u>Parameter</u>	<u>Units</u>	<u>Acceptable Range</u>
	Gravel	% by volume	Less than 10%
	Sand	% by volume	30-70%
	Silt	% by volume	10-50%
	Clay	% by volume	10-25%
C.	Chemical Parameters		
	<u>Parameter</u>	<u>Units</u>	<u>Acceptable Range</u>
	Organic Matter	% Dry Weight	2-8%
	pH	pH Units	5.0 to 7.3

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- D. Submittals shall be completed per Section 1.4 and shall be interpreted by project Landscape Architect based on plant material specified and testing recommendations.

2.4 FERTILIZER

- A. Local soil types and conditions may require supplemental nutrients. If noted by the soil testing facility, add slow-release, organic fertilizer based on plant requirements.
1. Fertilizers should NOT be added in Bioretention applications.
 2. Submittals shall be completed per Section 1.4 and shall be interpreted by project Landscape Architect based on plant material specified and testing recommendations.

2.5 EXISTING SOIL MIX

NOTE TO SPECIFICATION EDITOR: *This soil mix is intended for reuse of existing soil if meeting the following physical requirements. Local soil conditions and availability may require modification to this specification. Modify the physical and chemical parameters to reflect local soil availability. Ensure plant selection is suitable for the pH of specified soil.*

A. Physical Parameters

Material	Units	Acceptable Range
Compost	% by volume	20%
Existing soil	% by volume	80%

Physical Requirements of existing soil

Parameter	Units	Acceptable Range
Gravel	% by volume	Less than 15%
Sand	% by volume	30-80%
Silt	% by volume	5-60%
Clay	% by volume	0-35%

B. Chemical Parameters

Parameter	Units	Acceptable Range
pH	pH Units	5.5 to 7.3

- C. Existing site soils shall be used only after excavated and approved by the project Landscape Architect.
- D. Do not screen or over mix to maintain soil peds. Soil peds or clumps up to 4 inches in diameter are acceptable in the soil mix.
- E. Once mixing is complete, cover stock piles with tarps or heavy plastic to protect soil from drying, saturation and erosion.
- F. Project Landscape Architect shall approve all existing soil source locations and depths prior to excavation.

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- G. Fertilizers, where indicated by soil test and approved by project Landscape Architects shall be added during soil mixing.
- H. Submittals shall be completed per Section 1.4 and shall be interpreted by project Landscape Architect based on plant material specified and testing recommendations.

2.6 UNSCREENED SOIL MIX

NOTE TO SPECIFICATION EDITOR: *This is intended to be a custom soil mix, specified by percent by volume of each component. Local soil conditions and availability may require modification to this specification. Modify the physical and chemical parameters to reflect local soil availability. Assure plant selection is suitable for the pH of specified soil. Physical testing is required as a record of the approved mix design.*

- A. This soil is a mix of coarse sand, topsoil and compost to achieve the following parameters:

B. Physical Parameters

Material	Units	Acceptable Range
Coarse Sand	% by volume	35-50%
Compost	% by volume	12-17%
Topsoil	% by volume	35-50%

- a. Adjust the ratio of the components to achieve infiltration rates between 2 and 3 inches per hour when compacted to 80-85% maximum dry density.

C. Chemical Parameters

Parameter	Units	Acceptable Range
pH	pH Units	5.5 to 7.3

- D. Do not screen or over mix to maintain soil peds. Soil peds or clumps up to 4 inches in diameter are acceptable in the soil mix.
- E. Fertilizers, where indicated by soil test and approved by project Landscape Architect, shall be added during soil mixing.
- F. Once mixing is complete, cover stock piles with tarps or heavy plastic to protect soil from drying, saturation and erosion.
- G. Submittals shall be completed per Section 1.4 and shall be interpreted by project Landscape Architect based on plant material specified and testing recommendations.

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2.7 SCREENED SOIL MIX

NOTE TO SPECIFICATION EDITOR: *This assumes a standard available soil mix specified by percent by dry weight of each component. Local soil conditions and availability may require modification to this specification. Modify the physical and chemical parameters to reflect local soil availability. Assure plant selection is suitable for the pH of specified soil.*

A. This soil is a mix of sand, silt, and clay to achieve the following parameters:

B. Physical Parameters

Material	Units	Acceptable Range
Gravel > 2mm	% by volume	Less than 10%
Sand (>55% of sand must be classified as medium to coarse sand)	% by volume	60-80%
Silt	% by volume	5-20%
Clay	% by volume	5-20%
Organic matter	% by dry weight	3-5%

a. Adjust the ratio of the components to achieve infiltration rates between 2 and 3 inches per hour when compacted to 80-85% maximum dry density.

C. Chemical Parameters

Parameter	Units	Acceptable Range
pH	pH Units	5.5 to 7.3

D. Once mixing is complete, cover stock piles with tarps or heavy plastic to protect soil from drying, saturation and erosion.

E. Submittals shall be completed per Section 1.4 and shall be interpreted by project Landscape Architect based on plant material specified and testing recommendations.

2.8 BIORETENTION SOIL MIX

NOTE TO SPECIFICATION EDITOR: *Bioretention soils are used for stormwater or water harvesting applications for filtration of water contaminants. Tree species selected for planting in this soil mix should be compatible with the expected hydrologic extremes within such a system. Local soil conditions and availability may require modification to this specification. Modify the physical and chemical parameters to reflect local soil availability. Assure plant selection is suitable for the pH of specified soil.*

A. Bioretention soil shall be a planting mix which meet the following parameters:

Parameter	Units	Acceptable Range
Silt and Clay	Combined % by dry weight	Less than 12%
Organic matter content	% Loss on ignition by dry weight	3-7%
Hydraulic conductivity	ASTM D 2434 or ASTM F1815 at 85% compaction	2.5"-4.5"/hour

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NOTE: Hydraulic conductivity may be modified to meet minimums required by local regulators.

<u>Parameter</u>	<u>Units</u>	<u>Acceptable Range</u>
Phosphorus	mg/kg	Less than 200
Cation Exchange capacity	meq/g	More than 10

- B. Planting mix shall be thoroughly mixed prior to installation.
- C. Submittals shall be completed per Section 1.4 and shall be interpreted by project Landscape Architect based on plant material specified and testing recommendations.

2.9 MUNICIPALLY APPROVED BIORETENTION SOIL MIXES

- A. There is a growing list of municipalities and other governing agencies that have custom bioretention soil mixes. The following have been approved for substitution in the Silva Cell system. Municipally Approved Bioretention Soil shall comply with all local requirements and the submittal requirements of these specifications for Bioretention Soil.

- A. Washington State Department of Ecology

- Bioretention soil shall meet the most current requirements as outlined in Volume III-Hydrologic Analysis and Flow Control BMPs, Appendix III-C, Washington State Department of Ecology Low Impact Development Design and Flow Modeling Guidance, Section 7.7.1.

- B. City of Seattle

- Bioretention soil shall meet the requirements of the most current requirements as outlined in the City of Seattle Bioretention Soil Specification.

3.1 **EXECUTION**

Install planting soil in Soil Cells as described in Section 32 95 40 Soil Cells.

END OF SECTION

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Submittal Checklist for Reference Only

Contractor shall provide submittals required to the landscape architect for review and approval. The Submittal process may take up to two months prior to installation of the Silva Cell system and should be executed as soon as possible after the contract is awarded. All testing will be at the expense of the Contractor.

SOIL COMPONENT SUBMITTALS – PRIOR TO SOIL MIXING

- COMPOST
 - Certificate of compliance with federal and state health and safety regulations
 - Lab analysis for physical, organic and chemical requirements, and feed stock percentage
 - One gallon sample

- COARSE SAND
 - Lab analysis for physical and chemical composition
 - One gallon sample

- TOPSOIL
 - Lab analysis for physical and chemical composition
 - One gallon sample

SOIL MIX SUBMITTALS – FOR FINAL APPROVAL BY LANDSCAPE ARCHITECT

- 2.5 EXISTING SOIL MIX
 - Lab analysis for physical and chemical composition

- 2.6 UNSCREENED SOIL MIX
 - Lab analysis for physical and chemical composition
 - Infiltration test results at 80-85% compaction
 - One gallon sample

- 2.7 SCREENED SOIL MIX
 - Lab analysis for physical and chemical composition
 - Infiltration test results at 80-85% compaction
 - One gallon sample

- 2.8 BIORETENTION SOIL MIX
 - Lab analysis for physical and chemical composition
 - Hydraulic conductivity test results at 85% compaction
 - One gallon sample

OTHER SUBMITTALS

- FERTILIZER
 - Lab analysis of soils for nutrient deficiencies & recommendations