

PLANTING SOIL for SILVA CELLS

All Users: These are non-proprietary soil or media or mix blends. Silva Cells makes no claim that Mix A or Mix Z is needed for Silva Cell function. It is critical to examine design intent.

This specification defines material and performance requirements for soils that are to be used within the Silva Cell system. The SPECIFICATION EDITOR must select the type of soil appropriate to each particular application, reflecting 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):

TOPSOIL

Planting media either existing site soil (if available and specification compliant) or imported topsoil or a Planting soil mix.

BIORETENTION SOIL (for storm water applications):

Planting media to achieve specific water permeability.

See the DeepRoot website (www.deeprroot.com) for questions. DeepRoot can assist in evaluating and sizing project-specific design elements for Silva Cells storm water applications. Given this reference if used in the final document it will be important to divert from the standard specifications as little as possible.

GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Furnishing and installation of topsoil within the Silva Cell system.
- B. Related Sections:
 - 1. Division 32 – Exterior Improvements
 - a. Section 32 94 50 Silva Cells
 - b. Section 32 94 53 Root Barrier

1.3 DEFINITIONS *revise per final agreed upon spec concepts and terms*

- A. Clay: Soil particles smaller than 0.002mm.
- B. Silt: Soil particles ranging in size from 0.002-0.05mm.
- C. Sand: Soil particles ranging in size from 0.05-2.00mm
- D. Silva Cell Topsoil: either site won or imported to the requirements of the specification.
- E. Silva 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.

1.4 SPECIFICATION QUALIFICATIONS

- A. This document considers the proposal to use the specified soils within the Silva Cell system as per the project designer's intent. This document should not therefore be relied on for alternative end-uses for which it was not intended.
- B. This specification has been prepared solely for the benefit of DeepRoot. No warranty is provided to any third party and no responsibility or liability will be accepted for any loss or damage in the event that this document is relied upon by a third party or is used in circumstances for which it was not originally intended.

1.5 Submittals – Testing of Topsoil

A. Programme for sourcing topsoil

- Sufficient time should be allowed for sourcing and testing the proposed topsoil(s) to meet the requirements of this soil specification.
- At least 4 weeks is recommended for sourcing soils so that the necessary testing can be undertaken to demonstrate compliance with the specification.
- The Contractor shall provide soil laboratory test certificates required to the Contract Administrator for review and approval.
- All testing will be at the expense of the Contractor. The Contract Administrator or Project Designer may request additional testing on imported manufactured soils in order to attain results that more closely meet the specifications requirements.
- Any requests for soil substitutions from the specified soils shall require proof of non-availability by providing 3 soil suppliers on their letterhead testifying to non-availability of specified soil.

B. Sampling protocol

- The soil(s) to be considered for use within the Silva Cell system shall be sampled before placement and preferably while stockpiled at its source or manufacturers location.
- The sample (s) shall be truly representative of the soil to be offered. One *Composite Sample* shall be taken for every **50m³** of each type of soil to be used.
- Each composite sample should be made up of **10 No. sub-samples** taken from evenly spaced locations across the stockpile/field. The sub-samples shall be mixed together and quartered down to form a **5kg** composite sample.
- Each composite sample shall be placed in a clean, strong plastic bag and a 1-litre brown glass wide-necked jar (for organic testing) and each labelled with the source reference and date of sampling.
- Soils of different types should never be mixed to form a composite sample such attempts will result in immediate rejection.

C. Soil Testing Facilities

- Soil samples shall be sent to an independent soil science testing facility (UKAS and MCERTS accredited) with a request for each sample to be analysed strictly in accordance with relevant Testing Schedule given in clauses 1.6D-F and reported in accordance with the requirements of clauses 1.6H.
- An approved soil science testing facility is:
Tim O'Hare Associates LLP
Howbery Park
Wallingford
Oxfordshire OX10 8BA
Tel: +44 (0) 1491 822653 www.toha.co.uk

D. Topsoil Testing

The following parameters shall be requested (methods in accordance with BS3882:2007 or as indicated):

1. Visual examination to record Munsell colour, moisture status, aerobic state, soil structure, texture, stoniness (size & shape), the presence of any foreign matter
2. pH Value (1:2.5 soil/water extract)
3. Electrical Conductivity (1:2.5 soil/water extract)
4. Electrical Conductivity (1:2.5 soil/CaSO₄ extract)
5. Exchangeable Sodium Percentage
6. Particle Size Analysis (clay, silt, 5 sands – USGA sieve sizes)
7. Stone Content by % weight (2-20mm, 20-50mm, >50mm)
8. Total Nitrogen (% - Dumas Method)
9. Extractable Phosphorus, Potassium & Magnesium (RB427 Method)
10. Organic Matter (% dry weight)
11. Calcium Carbonate (%)
12. Potential Contaminants – See Table 2.4

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E. Reporting and Approval

- The results of analysis for each source of soil shall be presented on a ***Certificate of Analysis*** by an approved soil laboratory per Section 1.5C.
- The *Certificate* shall be accompanied by an ***Interpretive Report***. The report shall confirm the sample's compliance or non-compliance with the relevant soil specification, and advise on the significance of any non-compliances with regards to the re-use of the soil in the Silva Cell system.
- The report shall also provide recommendations for improving the composition of the soil, including fertiliser, lime or compost applications, should this be necessary.
- Number of copies: 1 electronic copy (PDF)
- Each test result shall be submitted to the contracting officer and project designer for approval prior to purchasing mixing or installing and soil or soil related products.

1.6 QUALITY ASSURANCE

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

PRODUCTS

2.1 SOILS - GENERAL

All soil materials shall be:

- Purity: Free of pests and disease that would render the soil unsuitable for horticultural use.
- Foreign matter: On visual inspection, reasonably free from non-soil material, brick and other building materials, and free from wastes, sharps, hydrocarbons, plant matter, weed roots, stolons, rhizomes, and any other foreign matter or material or substance that would render the soil unsuitable for horticultural use.
- Contamination: Do not use soils contaminated with, chemical and biological contaminants or any other materials that are:
 - Corrosive
 - Explosive or flammable;
 - Hazardous to human or animal life;
 - Detrimental to healthy plant growth;
- Give notice immediately in writing to contracting officer and project designer: If any evidence of symptoms of soil contamination is discovered in soil to be used.

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2.2 TOPSOIL FOR SILVACELL SYSTEM

- This specification is for topsoil that is to be used within the Silva Cell System
- The topsoil (whether imported or existing site soil) shall comply with the following lower and upper limits:

Parameter	Unit	Lower Limit	Upper Limit
Clay (<0.002mm)	%Vol.	10	25
Silt (0.002-0.05mm)	%Vol.	10	35
Sand (0.05-2.0mm) Of which at least 35% of the total sand particles shall fall into fine sand (0.15-0.25mm) to medium sand (0.25-0.50mm) range	%Vol.	55	80
Stones (2-20mm)	%Vol.	--	20
Stones (20-50mm)	%Vol.	--	10
Stones (>50mm)	%Vol.	--	0
pH Value	Unit	5.5	7.5 (or as high 8.5 or to which the plantings specified are pH tolerant, whichever is more neutral (7))
Calcium Carbonate (CaCO ³)	%	--	5
Electrical Conductivity (1:2.5 water extract)	µS/cm	--	1500
Electrical Conductivity (CaSO ₄ extract)	µS/cm	--	2800
Exchangeable Sodium Percentage	%	--	15
Organic Matter Test: ASTM:D2974 Method C or UK equal	%DW	2.5	5.0
Total Nitrogen	%	0.10	--- ⁺
Extractable Phosphorus	mg/l	16	--- ⁺
Extractable Potassium	mg/l	120	1200
Extractable Magnesium	mg/l	50	600

All *Topsoil* shall also comply with the *Potential Contaminants* GACs unless Site-Specific Assessment Criteria (SSAC) are available for the site where Silva Cell system is to be installed.

⁺ - not applicable (N/A) except for Bioretention Soils (see Section 2.3)

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2.3 BIORETENTION SOIL

- A mixture of Topsoil, Coarse Sand and Compost in proportions to achieve the requirements of this paragraph.
- Bioretention Soil shall be loosely mixed with a loader bucket to provide for the retention of soil peds in the final mix. Mix the required coarse sand and compost together first and then mix into the topsoil by pushing and dragging the materials together. Do not over mix. It is understood that after the initial mixing, further mixing shall take place during the transporting and installation of the material.
- Do not utilize soil screening or blending equipment in the process of mixing or processing the soil mix.
- Quantity: Provide as necessary to complete the work. Make due allowance for settlement after laying.
- The bioretention soil shall comply with the following lower and upper limits:

Parameter	Unit	Lower Limit	Upper Limit
Clay & Silt (<0.05mm)	%Vol	15	30
Sand (0.05-2.0mm) Of which at least 70% of the sand fraction shall fall into medium sand to coarse sand (0.25-1.0mm) range	%Vol	70	85
Stones (2-20mm)	%Vol	---	---
Stones (>20mm)	%Vol	---	---
Saturated Hydraulic Conductivity with the sample compacted to 85% of maximum dry density using the standard proctor test, ASTM D698 (kSat)	mm/hr	25	115
pH Value	pH Unit	5.5	7.5 (or as high 8.5 or to which the plantings specified are pH tolerant, whichever is more neutral (7))
Electrical Conductivity (1:2.5 water extract)	µS/cm	---	1500
Organic Matter Test: ASTM:D2974 Method C or UK equal	%DW	3	5
Extractable Phosphorus	mg/l	12	36
Calcium Carbonate	%	---	---

All *Bioretention Soil* shall also comply with the *Potential Contaminants* GACs unless Site-Specific Assessment Criteria (SSAC) is available for the site where Silva Cell system is to be installed.

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2.4 POTENTIAL CONTAMINANTS

- The following Generic Assessment Criteria (GAC) shall be used as Tier 1 screening values for the assessment of all soil(s) to be used, unless Site-Specific Assessment Criteria (SSAC) are available for the site where the soil(s) is to be used.
- In circumstances where any of these values are exceeded, further risk assessment and/or testing should be undertaken to confirm the significance of the non-compliance.

Parameter	Unit	Generic Assessment Criteria
Inorganic Arsenic	mg/kg	32
Boron (soluble)	mg/kg	5
Cadmium	mg/kg	3
Chromium (III)	mg/kg	3000
Chromium (IV)	mg/kg	4.3
Copper	mg/kg	100
Lead	mg/kg	450
Mercury	mg/kg	1
Nickel	mg/kg	60
Selenium	mg/kg	350
Zinc	mg/kg	200
Phenol	mg/kg	420
Benzene	mg/kg	0.33
Toluene	mg/kg	610
Ethylbenzene	mg/kg	350
Xylene - m	mg/kg	240
Xylene - o	mg/kg	250
Xylene - p	mg/kg	230
Aliphatics C5-C6	mg/kg	110
Aliphatics C6-C8	mg/kg	370
Aliphatics C8-C10	mg/kg	110
Aliphatics C10-C12	mg/kg	540
Aliphatics C12-C26	mg/kg	3000
Aliphatics C16-C35	mg/kg	76,000
Aromatics C5-C7	mg/kg	280
Aromatics C7-C8	mg/kg	611
Aromatics C8-C10	mg/kg	151
Aromatics C10-C12	mg/kg	346
Aromatics C12-C16	mg/kg	593
Aromatics C16-C21	mg/kg	770
Aromatics C21-C35	mg/kg	1230
Acenaphthene	mg/kg	480
Acenaphthylene	mg/kg	400
Anthracene	mg/kg	4900
Benzo (a)anthracene	mg/kg	4.7
Benzo[a]pyrene	mg/kg	0.94
Benzo(b)fluoranthene	mg/kg	6.5
Benzo(g,h,i)perylene	mg/kg	46
Benzo(k)fluoranthene	mg/kg	9.6
Chrysene	mg/kg	8.0
Dibenzo[a,h]anthracene	mg/kg	0.86

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Parameter	Unit	Generic Assessment Criteria
Fluoranthene	mg/kg	460
Fluorene	mg/kg	380
Indeno(1,2,3-cd)pyrene	mg/kg	3.9
Naphthalene	mg/kg	3.7
Phenanthrene	mg/kg	200
Pyrene	mg/kg	1000
Total Cyanide	mg/kg	20
Asbestos screen	Present/ Absent	Absent

GAC values derived from CLEA SGV 2009, LQM/CIEH 2009 and BS3882:2007

EXECUTION

3.1 SOIL INSTALLATION TRIAL AND COMPACTION EVALUATION

- A. Prior to the installation of topsoil and subsoil within the Silva Cells, construct a trial of the complete installation at the site. The installation of the trial shall be in the presence of the landscape architect/ project engineer.
- B. The Silva Cell trial shall be as outlined in Specification Section 32 94 30 Silva Cells.

3.2 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 topsoil and subsoil within the Silva Cells immediately after the installation of the Silva Cell frames. Protect installed Silva Cells from damage in the event that work must occur over or adjacent to the completed Silva Cells.

3.3 DELIVERY, STORAGE AND HANDLING

A. Sample Loads

- Deliver to site a sample load of each soil type indicating weight, certified analysis, name and address of supplier/manufacturer as per Certified Soil Laboratory.
- Give notice: Allow inspection before making further deliveries to site. Retain for comparison with subsequent loads.
- Notice period: 72 hours during Monday – Friday business week.

B. Soil Handling

- Soil handling and placement operations shall be carried out when the soils is non-plastic (friable) in consistency with moisture content at least 5% below the soil's *Plastic Limit*.
- Soil Handling shall be stopped if the soil is frozen as well as during and after heavy rainfall, and should not continue until the soil has regained a non-plastic (friable) consistency.
- Contamination: Do not mix topsoil or subsoil together or with:
 - Stone, hardcore, rubbish or material from demolition work.
- Multiple handling: Keep to a minimum.
- Soil shall not be unnecessarily compacted by trampling or trafficking by site machinery.
- Select and use plant to minimise disturbance, trafficking and compaction.

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C. Temporary Soil Storage

- Location: to be agreed.
- Height (maximum): 4m.
- Protection:
 - To protect from wet weather once the final height is achieved, a tracked dozer or excavator shall regrade the sides and top of each stockpile to encourage water to runoff. The tracked dozer or excavator shall then compact down the surface of the stockpile by tracking across it to seal in the dry soil and reduce rainfall infiltration.
- Do not place any other material on top of or adjacent to each stockpile.
 - Do not place different soil types on top of or adjacent to each stockpile.
 - Use Erosion Control Fence at perimeter of base – repair and reinforce where need within 72 hours. If soil stockpile is anticipated to stay for greater than 3 months an annual grass cover crop shall be applied or see local Erosion Control requirements.
 - Prevent compaction and contamination, by fencing and restricting as appropriate.

D. Use of Fertilisers (Provisional Item)

- The use of additional fertilisers in the topsoil is dependent on the findings of the soil tests (as presented for clause Part 1 – General, sub section “Reporting”).
- A provisional allowance shall be made for the application of the compound, slow release fertiliser Scotts Enmag CRF (11%N:22%P₂O₅:9%K₂O:6%MgO) at a rate of 80g/m² to the surface of each Silva Cell layer before placing the deck of the Silva Cell system.

Timing: Apply at the time of the Topsoil installation into the Silva Cells.

3.4 PROJECT CONDITIONS

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

3.5 PROJECT WORK

- A.** Coordinate installation with all other work that may impact the completion of the Silva Cell installation.(eg. paving, pre-determined pervious pavers at designated parking bays).
- B.** Prior to the start of the installation of *Topsoil* within the Silva Cells, meet at the site with the landscape architect, general contractor and the Silva Cell installer to review installation layout, procedures, means and methods.