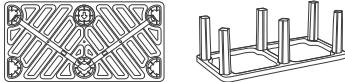


# SILVA CELL SYSTEM LAYOUT INSTRUCTIONS



*Silva Cell system layout is not complicated, but it does require general product orientation. Accordingly, this document is divided into three sections – General Principles, Sizing a Silva Cell System, and Layout Guidelines. An understanding of each of these sections is critical for the successful integration of the Silva Cell into your site plans. Use these guidelines with the [Standard Silva Cell details](#).*

## GENERAL PRINCIPLES

- The Silva Cell system is designed to be installed beneath paved areas such as sidewalks, plazas, and parking bays. Different pavement types (concrete, asphalt, or pavers) require different pavement profiles in order to meet H-20 loading requirements. The Silva Cell system is not designed to support high speed traffic loads. Consult our standard details for more information.
- Understand how utilities, soils, water table and structures might affect your Silva Cell layout. Silva Cells can often accommodate existing and proposed utilities and structures, but planning for this integration is critical for a successful layout and installation. Share your Silva Cell layout with the project Civil Engineer in order to work around site and utility conflicts early in the process.
- Silva Cells allow growth of large trees that, with adequate soil volumes, proper installation and care, will reach its true mature size. This tree will grow to have a large canopy and a significant trunk flare that your design should accommodate.

- Wherever possible, link Silva Cell soil volumes to each other or to existing nearby soil volumes such as parks or lawns.

## SIZING A SILVA CELL SYSTEM

1. Determine if the Silva Cell system will be used to grow big trees or grow big trees and treat stormwater.
  - Silva Cells are used to provide soil to grow large trees, but can also be used to treat stormwater. Determine your project goals for using Silva Cells and begin to think about how to size and design your system accordingly.
  - For large trees, consider how the Silva Cell system can use a passive irrigation system. If passive irrigation is not a possibility, make sure to include irrigation in your plans.
  - For large trees and stormwater, consider how to distribute the stormwater throughout the Silva Cell system and tie into overall site drainage.
  - See “[Stormwater Schematics](#)” for concepts for managing stormwater in the Silva Cells.

2. Determine the optimal tree size that you would like to achieve on your site.

- See "[How Much Soil to Grow a Big Tree](#)" to find a target soil volume for your ideal tree size.
- A simple rule of thumb for target soil volume is to provide 1,000 ft<sup>3</sup> (28m<sup>3</sup>) of soil for a canopy tree and 600 ft<sup>3</sup> (17m<sup>3</sup>) of soil for an understory tree. You can also use a general 2:1 ratio of Soil Volume: Canopy Size. Trees can also share soil volumes, an efficient way to provide rooting volume is to connect planters together. Shared soil volume targets are typically around 600 ft<sup>3</sup> (17m<sup>3</sup>) per overstory tree.

3. Determine the volume of suitable soil available outside of the Silva Cell system.

- Make your tree openings as large as possible. Due to lack of infrastructure, this is the cheapest soil available. Large tree openings will also accommodate the size of a mature tree.
- Wherever possible, link Silva Cell soil volumes to each other or to existing nearby soil volumes, such as parks or lawns.
- Calculate the Available Soil Volume in the area of work, including available soil in the treeopenings themselves, as well as adjacent open space that the Silva Cells can link to like parks, lawns, etc.

4. Determine how many Silva Cells are needed to meet the target soil volume.

- Each Silva Cell holds approximately 10 ft<sup>3</sup> (0.28 m<sup>3</sup>) of soil.

- Target Soil Volume = (Available Soil Volume + Soil in Silva Cells)

*For example: The target soil volume is 1,000 ft<sup>3</sup> (28m<sup>3</sup>). Each tree has a 4'x4' tree opening, and the Silva Cell system will be 3-frames deep. The depth of planting media in the Cells (and adjacent tree opening) would be approximately 3.75'.*

*3.75'x4'x4' = 60 ft<sup>3</sup> (1.7m<sup>3</sup>) in the tree opening*

*1,000 ft<sup>3</sup> – 60 ft<sup>3</sup> = 940 ft<sup>3</sup> needed in Silva Cells*

*940 ft<sup>3</sup>/10ft<sup>3</sup> per frame = 94 Cell frames*

*Since we're using 3-frames deep, 94/3 = 31.3 decks.*

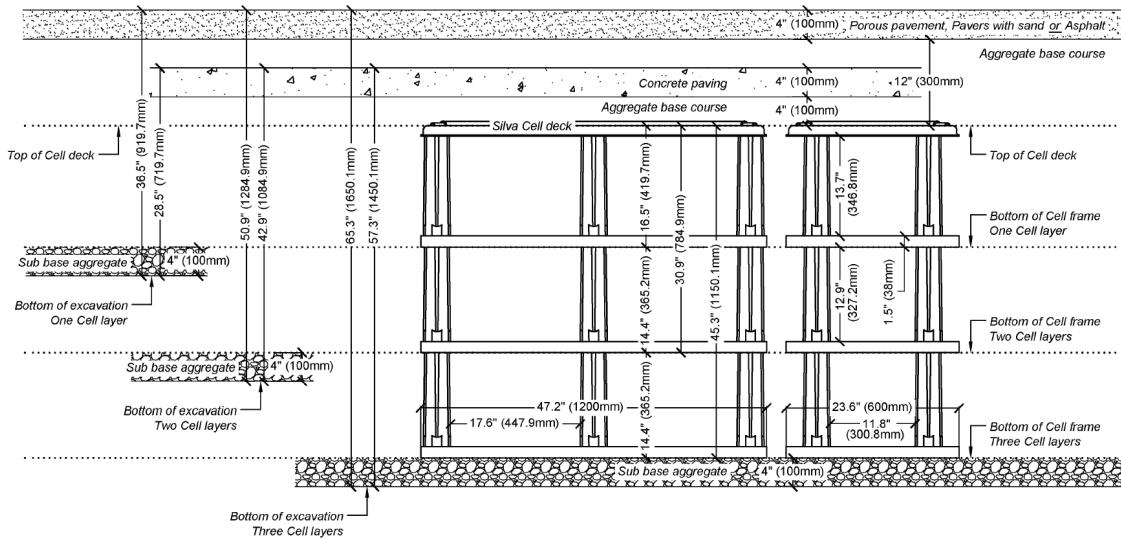
*Obviously, we can't have 0.3 Cell decks. So bump this up to:*

*32 decks x 3 frames deep = 96 Cell frames = 960 ft<sup>3</sup> + 60 ft<sup>3</sup> = 1,020 ft<sup>3</sup> soil provided*

*32 decsk x 3 frames deep = 96 Cell frames = 26.9 m<sup>3</sup> + 1.7 m<sup>3</sup> = 28.6 m<sup>3</sup> soil provided*

5. If designing the system for on-site stormwater management, determine how many Silva Cells are needed to provide stormwater treatment for your site.

- Bioretention soil is used within the Silva Cells for standard stormwater projects. Volume of filtration or "storage" is based on the water storage within the soil, and the location of any distribution or overflow pipes.



- The static storage of water within the Silva Cells will be roughly equivalent to 20% of the total bioretention soil volume ( $2 \text{ ft}^3 / .05 \text{ m}^3$  per frame).

- There are many ways for stormwater to be brought into and out of the Silva Cell system. This is highly project-specific, but we would be happy to discuss your project to help you find the best fit. Please consult with DeepRoot if you have stormwater specific questions.

6. Balance the required soil volume for soil rooting with required soil volume for stormwater treatment.
  - Provide approximately 1,000 ft<sup>3</sup> (28 m<sup>3</sup>) of soil for a canopy tree and 600 ft<sup>3</sup> (17 m<sup>3</sup>) of soil for an understory tree. Stormwater treatment volumes will vary based on project location and goals.

#### CREATING YOUR SILVA CELL PLAN

Standard Silva Cell dimensions are approximately 2' (0.6 m) wide x 4' (1.2 m) long.

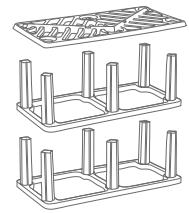
$$\begin{aligned} 1\text{-frame stack} &= 16.5" \text{ (419.7 mm) deep} \\ 2\text{-frame stack} &= 30.9" \text{ (784.9 mm) deep} \\ 3\text{-frame stack} &= 45.3" \text{ (1,150.6 mm) deep} \end{aligned}$$

The standard spacing required between Silva Cells is 1-3" (25 mm x 75 mm). These dimensions should be used for all standard Silva Cell Layouts. As long as you maintain a 1-3" (25 mm x 75 mm) gap between each stack they can be oriented in a layout that best accommodates your site needs.

1. Determine the available area for Silva Cell placement based on existing and proposed site conditions.

- Use current site base data, including (but not limited to) structures, utilities, roads and landscape plans to evaluate all potential conflicts with the Silva Cell system.
  - Determine the depth of your Silva Cell system. This will depend on available space, target soil volume, and budget.
  - Silva Cells can be stacked 1-, 2-, or 3-frames deep. Once you determine the maximum depth that can be accommodated, refer to "[Construction Depths for Silva Cells](#)" to calculate how the Silva Cell system will fit into your site cross-section. Note the pavement profile required to meet H-20 loading and required sub base depth. Account for these materials when calculating the total Silva Cell system depth.
  - Project sites do not have to be of uniform depth to use the Silva Cell.
  - Stacks of Silva Cells 1-, 2- and 3-frames deep can be positioned adjacent to one another in one-frame increments. Altering the depth of the system is a useful way to transition between site depths to accommodate utilities or other features that pass through your area of work.
  - For use on sites with slopes greater than 5%, please contact DeepRoot directly (415 781 9700 or [info@deeproot.com](mailto:info@deeproot.com)).
2. Determine the available area for Silva Cell placement based on setbacks from proposed or existing curbs.

- Draw in the curb setback.
- The standard setback from face of curb is 18" (45.72 cm). This setback can be used as a general guideline, but project-specific setbacks may vary.
- In many cases, the Silva Cell system can be installed immediately adjacent to walls, footings, or other site structures that extend below the Silva Cell System. The maximum distance should be 3" (75 mm) from these structures in order to eliminate additional support measures. This circumstance should always be evaluated by a DeepRoot consultant prior to construction. Please see the "Gap Bridging" details in our [Modified Details](#) package for more information.



### 3. Evaluate the design of the tree openings.

- Consider the dimensions of the tree openings and how easily they will work with the 2' x 4' (0.6 m x 1.2 m) basic Silva Cell size. If tree grates are part of the tree opening design, take into consideration how the Silva Cells can be arranged to provide support to the grate. Tree grate support shall be placed directly above the Silva Cell posts. Remember to plan for the trunk flare of a mature tree when designing the tree opening and choosing an appropriate tree grate.

### 4. Create a Silva Cell in your landscape plan or use the supplied CAD file.

- Insert the appropriate DeepRoot Silva Cell block into your project Landscape Plan. This

block has been created to-scale and includes required Silva Cell spacing for ease of layout. Verify the size of the Silva Cell after insertion into your drawing for compliance with standard Silva Cell dimensions.

- Silva Cell frames must be placed between 1" and 3" (2.5 cm and 7.6 cm) apart. Spacing between frames does not need to be uniform across the entire site as long as it stays within the 1" to 3" parameters. If Cells need to be placed more than 3" apart for any reason, please refer to our Modified details for information about gap bridging.

## 5. Place Silva Cells on your site starting with the most restrictive areas.

- Copy the Silva Cell block to fill the approximate Silva Cell area, starting along the curb setback and around tree openings and/or other site obstacles and utilities.
- Copy the Silva Cell block to fill the approximate Silva Cell area, starting along the curb setback and around tree openings and/or other site obstacles and utilities.
- All structures such as tree grates, curbs, and footings designed to be supported by Silva Cell structures must be placed directly above the Silva Cell posts. Silva Cell posts are located around the perimeter of the Silva Cell frames.
- Link soil volumes wherever possible between trees so that they can share soil.

## 6. Silva Cells should always be placed parallel or perpendicular to each other.

- Gaps larger than 3" (75 mm) should be avoided if possible. See "Gap Bridging" details for further information.

## 7. After the Silva Cells are laid out, finalize all volume calculations and Silva Cell counts.

- Verify that the designed system meets the target soil volume for the intended tree(s), and if used in a stormwater application, meets the target stormwater treatment volumes.

- Determine the number of Silva Cell frames and Silva Cell decks required for your design (i.e., a 3-layer system requires 3 Silva Cell frames and 1 Silva Cell deck).

All Silva Cell layouts and details must be reviewed by a DeepRoot consultant prior to construction to ensure proper application of the Silva Cell technology. Please contact DeepRoot if you run into any difficulties; we will help find solutions for your site.

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