

# Soil volume calculations

Three regulatory documents set targets for soil volumes:

1. Administrative Regulation 4.3 sets quantity and quality targets for street trees and other public trees in the Appendix:  
<https://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/38/2018/09/Tree-Planting-on-Public-Land.pdf>

Street trees require 600-1200 cubic ft of soil, depending on the ultimate size of the tree. Exceeding these targets, and providing shared soil spaces is encouraged.

2. The Chesapeake Bay Preservation Ordinance Guidance Manual sets soil volume targets for all other trees (such as on-site private trees or other non-street trees), **and** provides guidance on shared soil quantity reductions for all trees. The guidance manual can be found here, with the soil volume section available in section 3.2.3:  
<https://www.arlingtonva.us/Government/Programs/Building/Codes-Ordinances/Chesapeake-Bay#section-6>

On-site trees require 300-1200 cubic feet of soil, depending on the ultimate size of the tree. Exceeding these targets, and shared soil spaces are encouraged. Going below soil volume targets disallows trees to be counted for canopy or replacement. Note which trees are not counted for this reason, on your plan.

3. The ultimate size of the tree, which sets the quantity of soil volume required, can be determined by looking at the Recommended tree lists, at the following link, and looking at the Size column:  
<https://www.arlingtonva.us/Government/Programs/Office-of-Sustainability-and-Environment/Trees/Plant-Trees/Recommended-Trees>
4. [Based on research, Arlington county does not accept structural soils for projects. If you feel you have a unique situation, coordinate with your assigned Urban Forester.](#)

## Urban forester discretion

Soil volume quantities and shapes may help or harm the long-term survivability and likelihood of structural failure of trees. Urban foresters reserve the right to require changes to plans on the basis of their professional experience and current research.

## Critical Soil plan components to display on Landscape and Civil Engineering Plans

### Soil calculation tables

These tables should include two tables, one for street and public trees, and one for all others. A sample table can be seen on the next page:

1. Area of soil described, an identifier referenced on the plans
2. Quantity of trees planted in the area
3. Total soil volume required for that area
4. Soil volume provided in that area
5. Average soil volume per tree, in that area

### Proposed soils

The plan should include:

1. Soil remediation areas, and methods used (such as soil profile rebuilding, where appropriate)
2. Locations and extents of proposed imported soils, including types of soils used
3. Depths of soils (36 inch required for trees. Additional depth cannot be counted for soil volume. Reduced depths require justification and approval by the Urban Forester, but may be acceptable in some situations)
4. Soil expansion techniques under pavement, such as structural support systems for uncompacted soils and continuous soil panels, with callouts to details. Examples are supported pavement, structural cells (such as Stratacell, Silvacell, Stormcell), or providing connection to breakout spaces with large soil volumes.
5. Details for construction of soil expansion.

### Soil volumes with existing soils

Giving established trees more soil volume can improve their long-term survival. Follow these guidelines to expand soil volumes, while reducing impact:

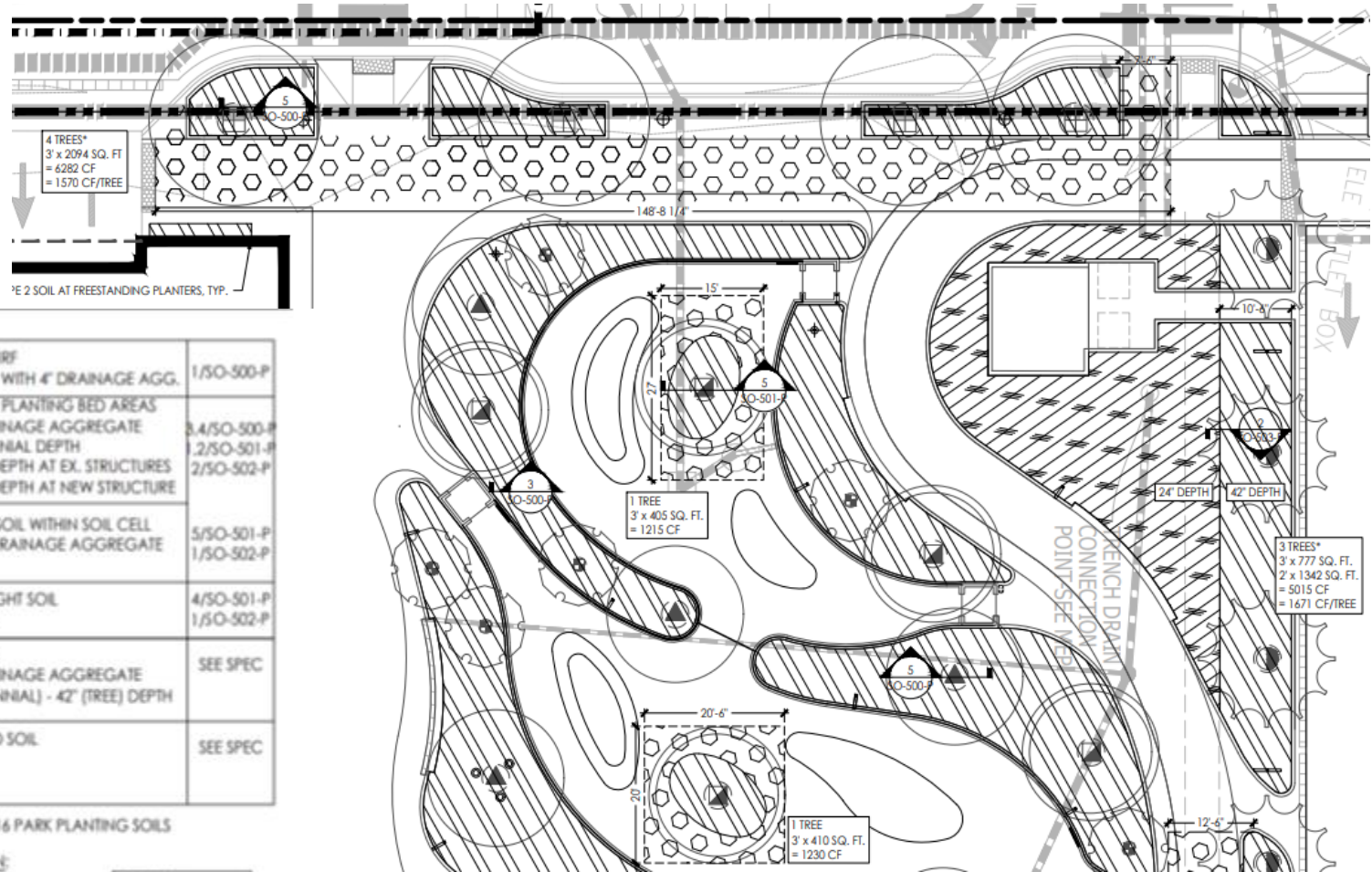
1. Keep existing soils intact. These soils can be counted for down to 3 ft of soil. Show how these soils are protected on your plan.
2. If existing soils require remediation, as identified by a soil test, and reviewed by the Urban Forester, use appropriate methods, such as air excavation tools to incorporate amendments, while minimizing damage to the conserved trees.
3. Where connecting new soil spaces to existing soils, work to match soil types to the best extent possible. Soils may be present on the site, which can be used to create appropriate soils, per the soil standard on the plan.

Sample soil calculation table:

Street trees and public trees						
Planting Area	Trees planted	Shared Soil	Soil volume required (Cu. Ft.)	Soil provided (Cu. Ft.)	Soil per tree (Cu. Ft.)	Requirements Met
A	1 Large tree	No	1200	1500	1500	Yes
B	5 Large trees	Yes	5000	5500	1100	Yes

Other trees						
Planting Area	Trees planted	Shared Soil	Soil volume required (Cu. Ft.)	Soil provided (Cu. Ft.)	Soil per tree (Cu. Ft.)	Requirements Met
C	3 Large on-site tree, 3 Small on-site trees	Yes	4500	5400	1000 per large tree, 600 per small tree	Yes
D	1 Medium tree	No	675	700	700	Yes
E	1 Medium-Large tree, 1 small tree	Yes	1100	1200	1200	Yes
F	20 Small-medium trees	Yes	9000	10000	500	Yes
G	1 Small tree	No	300	300	300	Yes
H	15 Large trees	Yes	15000	Unrestricted	Unrestricted	Yes
I	4 Large trees	Yes	4000	400	100	No, not counted, temporary

Examples of Soil plan with different soil types and depths (note soil is only counted to 36 inches).



**SOILS LEGEND**

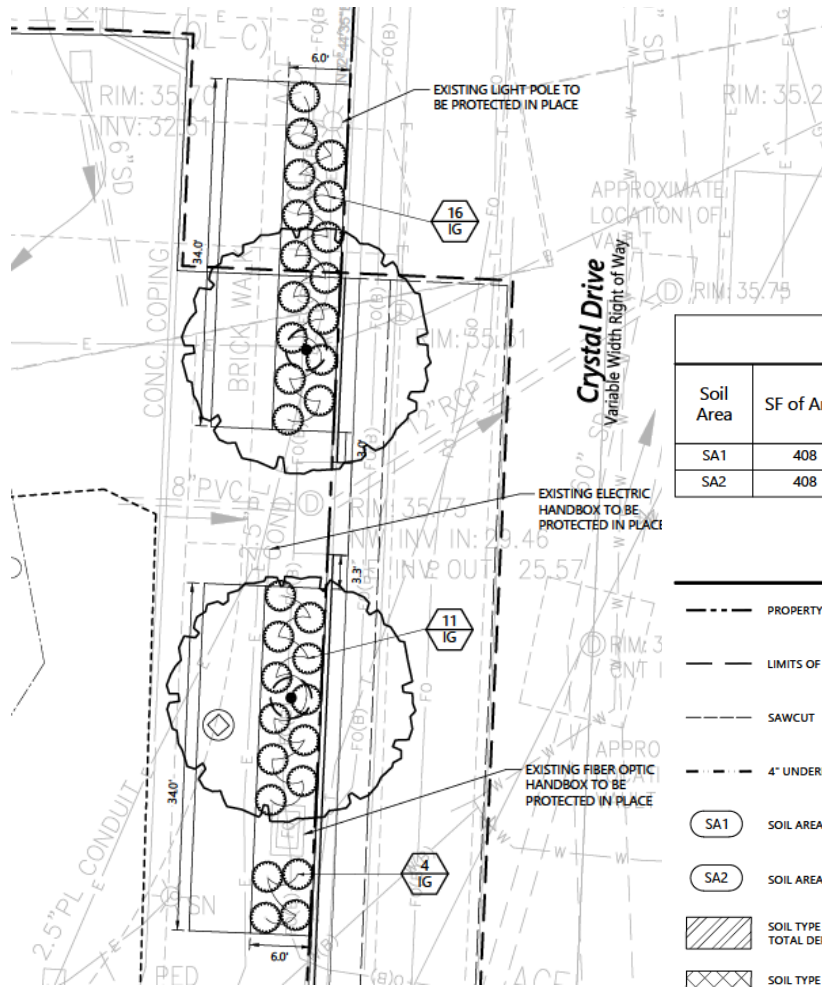
	TYPE 1 SOIL	SOIL AT TURF 12" DEPTH WITH 4" DRAINAGE AGG.	1/SO-500-P
	TYPE 2 SOIL	TREE AND PLANTING BED AREAS WITH DRAINAGE AGGREGATE 24" PERENNIAL DEPTH 48" TREE DEPTH AT EX. STRUCTURES 42" TREE DEPTH AT NEW STRUCTURE	3/4/SO-500-P 1/2/SO-501-P 2/SO-502-P
		42" DEEP SOIL WITHIN SOIL CELL WITH 4" DRAINAGE AGGREGATE BASE	5/SO-501-P 1/SO-502-P
	TYPE 2A SOIL	LIGHTWEIGHT SOIL 42" DEPTH	4/SO-501-P 1/SO-502-P
	TYPE 3 SOIL	BOG SOIL WITH DRAINAGE AGGREGATE 24" (PERENNIAL) - 42" (TREE) DEPTH	SEE SPEC
	TYPE 4 SOIL	AMENDED SOIL	SEE SPEC

NOTE: REFER TO SPEC. SECTION 32 9116 PARK PLANTING SOILS

EXAMPLE SOIL VOLUME CALCULATION:  
STREET TREE DEPTH IS 42" WITH UPPER 36"  
CALCULATED FOR COUNTY REQUIREMENTS.

2 TREES\*  
3' x 900 SQ. FT.  
= 2700 CF  
= 1350 CF/TREE

Example of small street tree project.



Soil Calculation						
Soil Area	SF of Area	Soil Depth (Inches)	Qty of Trees	Vol. Requirement (CF)	Vol. Provided (CF)	Comments
SA1	408	43	1	1200	1224	Existing utility depths assumed to be 4' below grade. All utilities to be protected in place.
SA2	408	43	1	1200	1224	Existing utility depths assumed to be 4' below grade. All utilities to be protected in place.

### Soil Legend

- PROPERTY LINE
- LIMITS OF DISTURBANCE
- SAWCUT
- 4" UNDERDRAIN
- SA1 SOIL AREA 1
- SA2 SOIL AREA 2
- ▨ SOIL TYPE 1 - STRUCTURAL CELL SYSTEM FOR CRYSTAL DRIVE STREET TREES  
TOTAL DEPTH = 43"
- ▩ SOIL TYPE 2 - TYPICAL PLANTING SOIL FOR CRYSTAL DRIVE STREET TREES  
TOTAL SOIL DEPTH = 43"
- ⊙ ROOTBALL

### Soil Calculations

CRYSTAL DRIVE STREET TREES

SOIL TYPE 1:	731 CF / TREE, AVG.
SOIL TYPE 2:	731 CF / TREE, AVG.
SOIL VOLUME REQUIRED:	1200 CF MINIMUM PER TREE
(REFERENCE FROM ARLINGTON COUNTY LANDSCAPE STANDARD, 2017)	
SOIL VOLUME PROVIDED:	1462 CF / TREE, AVG.

Example of soil expansion through soil cells (left) and breakout zones to open soil (right)

