

Summary Fact Sheet

Category: 1.0 Bioretention Systems
Practice: 1.6 Tree Box Filters

General Description: Tree box filters are precast concrete boxes filled with bioretention type soil media installed below grade at the curb line. A standard street tree or shrub is planted in the box, which resembles a curbside planter. Tree box filters are located upstream of a standard curb inlet. For low to moderate flows, stormwater enters through the tree box’s inlet, filters through the soil, and exits through an underdrain into the storm drain. For high flows, stormwater will bypass the tree box filter if it is full and flow directly to the downstream curb inlet.

Water Quantity Controls

Tree box filters can reduce the runoff volume and peak discharge rate for small, frequently-occurring storms by capturing the water quality volume (WQV). They are not intended to capture volumes larger than the WQV, or to detain the WQV for extended periods of time, however. Volumes larger than the WQV can be detained in a subsurface storage system (e.g. gravel bed) downstream.

Water Quality Controls

Tree box filters remove pollutants through the same physical, chemical, and biological mechanisms as bioretention cells. Virginia Stormwater Minimum Standard 3.11C gives the following expected removal rates for tree box filters, provided that the filter surface area is at least 0.33% of the drainage area. In other words, to achieve these removal efficiencies, the drainage area to a 6’ x 6’ tree box (standard size) must be 0.25 acres or less.

Pollutant	Expected removal
Total suspended solids	85%
Total phosphorous	74%
Total nitrogen	68%
Total metals	82%

Location: Tree box filters can receive runoff from both streets and parking lots, as long as a downstream inlet or outfall is present. All land uses are suitable.

Design Construction and Materials: To treat 90% of the annual runoff volume, tree box filter surface area should be approximately 0.33% of the drainage area. Tree boxes must be regularly spaced along the length of a corridor as appropriate to meet the annual treatment target. A standard curb inlet must be located downstream of the tree box filter to intercept bypass flow. Tree box filters are off-line devices and should never be placed in a sump position (i.e. low point). Instead, runoff should flow *across* the inlet (e.g. left to right). Also, tree box filters are intended for intermittent flows and must not be used as larger event detention devices.

Tree box filters consist of a precast concrete container, a mulch layer, bioretention media mix, observation and cleanout pipes, underdrain pipes, one street tree or large shrub, and a grate landscape cover. Pretreatment under normal conditions is not necessary.

Cost: The cost for a tree box filter to treat runoff from ½ impervious acre is comprised of both the installation cost and annualized costs. These cost calculations were based upon installing two (2) 6’ x 6’ tree box filters. A tree box filter is assumed to have a lifespan of 25 years, at which point it will be removed and replaced.

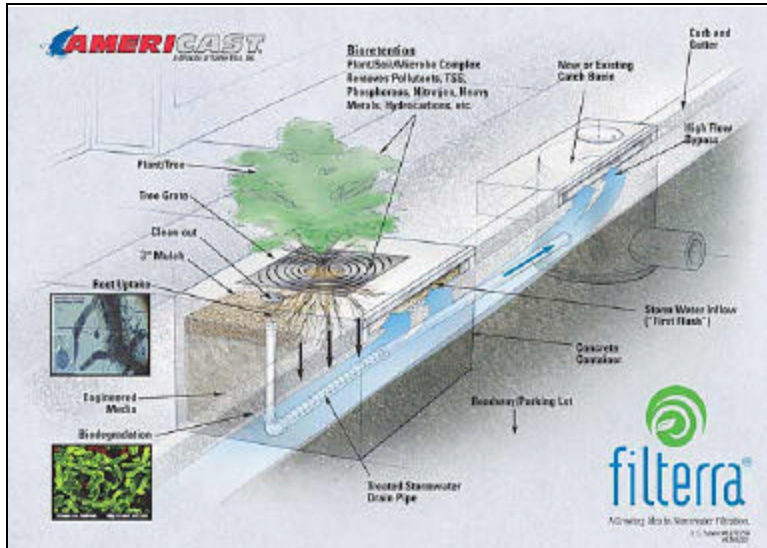
A standard 6’ x 6’ tree box filter costs approximately \$8,000. This estimate includes two years of operating maintenance and filter material and plants. Installation costs are approximately \$1500 per unit. Annual maintenance is \$500 per unit when performed by the manufacturer and \$100 per unit when performed by the owner.

Item	Required Cost per Year (2005 Dollars)													
	0	1	2	3	4	5	6	7	8	9	10	...	25	
Installation ¹	19,000													
Mulching and Debris Removal		150	150	150	150	150	150	150	150	150	150			
Replace Vegetation						250						250		
Remove & Replace														19,000
Total Cost	19,000	150	150	150	150	300	150	150	150	150	300			19,000
Annualized Cost	\$950 / year (includes replacement in year 25)													

¹Developer Cost. Not included in annualized cost.

Maintenance: Maintenance consists of annual routine inspection and the regular removal of trash and debris. The mulch will need to be replenished one (1) to two (2) times per year. The cleanout pipe can be used to flush the system if the underdrain becomes clogged. During extreme droughts, the trees or shrubs may need to be watered in the same manner as any other landscaping. The plants may need to be replaced every few years (5 years are assumed for the cost estimate).

Performance and Inspection: To ensure proper performance, visually inspect that stormwater is infiltrating properly into the tree box filter. Excessive volumes of stormwater bypassing the tree box filter to the standard inlet may indicate operational problems. Corrective measures to restore performance include inspection for accumulated sediments and debris and removal, if necessary. In instances where the condition of the soil media has degraded significantly, the media and vegetation should be removed and replaced. Inspection and maintenance should occur on an annual or semi-annual basis.



Tree box filter schematic

Source: Americast PERMISSION PENDING



Tree box filter at the Pentagon

Source: LID Center

Potential LEED Credits:

Primary: N/A

Other: Innovation & Design Process (1-4 Points)

Links to Additional Information:

Virginia Department of Conservation and Recreation. 2002. *Minimum Standard 3.11C Filterra™ Bioretention Filter System*. Available at <http://www.dcr.state.va.us/sw/docs/tecbltn6.pdf>