6.3 Tree Well Filter

Figure 6-15: Non-proprietary tree well filters in Fremont use bio-retention soils with a long-term minimum permeability of 5 inches per hour. Spacing the units closely together provides a total tree well filter surface area that is 4 percent of the impervious surface area from which stormwater runoff is treated.

Best Uses

- Limited space
- Parallel to roadways

Advantages

- Aesthetic
- Small surface land use
- Blends with the landscape

Limitations

- Can clog without maintenance
- Higher installation cost
- Systems with very high permeability are allowed ***only in Special Projects***

Tree well filters are especially useful in settings where available space is at a premium. They can be installed as open-bottom systems that promote infiltration or in closed-bottom systems where infiltration is undesirable or infeasible, such as sites with tight clay soils, groundwater contamination, or high groundwater levels. Tree well filters are often installed along urban sidewalks as part of an integrated street landscape, but they are highly adaptable and can be used in most development scenarios. Tree well filters can also be constructed using modular suspended pavement system products such as Silva Cells (see Chapter 4 and Figure 6-18 below).

The tree well filter's basic design is similar to that of a bioretention area or flow-through planter. It consists of an excavated pit or vault filled with biotreatment soil mix or other filtration media, planted with a tree and/or other vegetation, and underlain with drain rock and an underdrain. A tree well filter that uses a biotreatment soil mix and is designed for a stormwater runoff surface loading rate of 5 inches per hour is considered a LID treatment measure (either an infiltration or biotreatment measure, depending on its design). Silva Cells and other modular suspended pavement system products can provide additional uncompacted soil volume for tree root growth under adjacent pavement areas as well as allowing for "underground" bioretention. If used as part of the stormwater treatment system, the areas under the pavement should be installed with the required minimum 18 inch depth of biotreatment soil mix and underdrains as necessary.

Proprietary tree well filters containing manufactured media with design loading rates that exceed 5 inches per hour do not qualify as LID treatment measures and will only be allowed for use in Special Projects, as described in Appendix J.

Design and Sizing Guidelines

- Flows in excess of the treatment flow rate should bypass the tree filter to a downstream inlet structure or other appropriate outfall.
- Tree filters cannot be placed in sump condition; therefore tree filters should have flow directed along a flow line of curb and gutter or other lateral structure. Do not direct flows directly to a tree filter.
- If a proprietary tree filter is used, it should be reviewed by the manufacturer before installation.
- For proprietary tree filters, manufacturer will size the tree filter to the impervious surface of a site. The manufacturer should certify the ratio of impervious area to treatment area for the project. For example, Filterra states that a tree filter of 6 x 6-feet can treat 0.25 acres of impervious surface.
- Proprietary tree filters are available in multi-sized pre-cast concrete drop in boxes, Sizes range from 4 x 6-feet up to 6 x 12-feet boxes. The required size of the box is based on the size of the tributary impervious surface and the permeability of the filter media. The product must be certified by the Washington State Technical Assessment Protocol – Ecology (TAPE) program, General Use Level Designation (GULD) for Basic Treatment, and sized based on the certified design operating rate[1].
- It is recommended that a non-proprietary tree well filter (with biotreatment soil mix) be sized to be 4% of the contributing impervious surface area; i.e., the area of impervious surface multiplied by the 0.04 sizing factor will equal the required surface area of the tree well filter. This sizing factor is derived from the flow-based treatment standard (runoff from 0.2 in/hr intensity rainfall) and a required surface loading rate of 5 in/hr. Alternatively, if there are site constraints, tree well filter sizing may be calculated using a volume-based treatment method or a combination flow- and volume-based treatment method.

INLETS TO TREATMENT MEASURE

Flow may enter the treatment measure (see example drawings in Section 5.13):

- As overland flow from landscaping (no special requirements)
- As overland flow from pavement (cutoff wall required)
- Through a curb opening (minimum 18 inches with the number and locations designed so that runoff is dispersed throughout the bioretention area or through the use of a flow spreading system)
- Through a curb drain
- With a drop structure through a stepped manhole (refer to Figure 5-3 in Chapter 5)
- Through a bubble-up manhole or storm drain emitter
- Through a roof leader or other conveyance from building roof

[1] For more information, see: http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html

- Where flows enter the biotreatment measure, allow a change in elevation of 4 to 6 inches between the paved surface and biotreatment soil elevation, so that vegetation or mulch build-up does not obstruct flow.
- Cobbles or rocks should be installed to dissipate flow energy where runoff enters the treatment measure.

VEGETATION

- Suitable plant species are identified in Appendix A planting guidance.
- Use integrated pest management (IPM) principles in the landscape design to help avoid or minimize any use of synthetic pesticides and quick-release fertilizer. Check with the local jurisdiction for any local policies regarding the use of pesticides and fertilizers.
- Irrigation should be provided, as needed, to maintain plant life.
- Trees and vegetation do not block inflow, create traffic or safety issues, or obstruct utilities.
- Install and maintain a 3-inch layer of composted arbor mulch (composted tree trimmings also called “aged arbor mulch”) around the tree as appropriate or as recommended by the landscape architect. Rock, cobble, or pea gravel may also be used. “Micro-bark” and “gorilla hair” mulches are not recommended.

SOIL AND DRAINAGE REQUIREMENTS SPECIFIC TO TREE WELL FILTERS

- Filter media in tree well filter should be specialized for expected site pollutant loads.
- Beginning December 1, 2011, if the long-term permeability of media exceeds 5 inches per hour, use of the tree well filter will not be allowed, except for Special Projects (see Appendix J).
- An underdrain system is required for tree well filters.
- Consideration of groundwater level and placement of the underdrain:
    1. If there is less than a 5-foot separation between the bottom of the facility and the seasonal high groundwater level, or infiltration is not allowed due to other site constraints, an impermeable liner should be placed between the drain rock and the bottom of the facility and the underdrain placed on top of that liner.
    2. If there is at least a 5-foot separation between the bottom of the facility and the seasonal high groundwater level, and geotechnical conditions allow infiltration, the facility should be unlined and the underdrain should be raised at least 6 inches above the bottom of the drain rock to allow storage and infiltration of treated water.
- To avoid excess hydraulic pressure on subsurface treatment system structures:
    1. The depth to seasonal high groundwater level should be at least 5 feet from the bottom of the structure.
    2. A geotechnical engineer should be consulted for situations where the bottom of the structure is less than 5 feet from the seasonal high groundwater level.

SOIL AND DRAINAGE CONSIDERATIONS FOR ALL BIOTREATMENT SYSTEMS

- Filter fabric should not be used in or around underdrain trench.

- The underdrain should include a perforated pipe with cleanouts and connection to a storm drain or discharge point. Clean-out should consist of a vertical, rigid, non-perforated PVC pipe, with a minimum diameter of 4 inches and a watertight cap fit flush with the ground, or as required by municipality.
- Underdrain trench should include a 12-inch thick layer of Caltrans Standard Section 68-1.025 permeable material Class 2, or similar municipality-approved material. A minimum 4-inch diameter perforated pipe should be placed within the backfill layer. To help prevent clogging, two rows of perforation may be used.
- There should be adequate fall from the underdrain to the storm drain or discharge point.
- Soils used in the tree well filter must meet the biotreatment soil mix specifications included in Appendix K of this Handbook. The minimum long term permeability of the biotreatment soil is 5 inches per hour - the initial permeabilitymay exceed this to allow for tendency of the permeability to reduce over time.

CONSTRUCTION REQUIREMENTS FOR ALL BIOTREATMENT SYSTEMS

- When excavating, avoid spreading fines of the soils on bottom and side slopes. Remove any smeared soiled surfaces and provide a natural soil interface into which water may percolate.
- Minimize compaction of existing soils. Protect from construction traffic.
- Protect the area from construction site runoff. Runoff from unstabilized areas should be diverted away from biotreatment facility.

MAINTENANCE CONSIDERATIONS FOR ALL TREATMENT MEASURES

- See Chapter 8 for specific maintenance guidance.
- A Maintenance Agreement should be provided and should state the parties' responsibility for maintenance and upkeep.
- Prepare a maintenance plan and submit with Maintenance Agreement. Maintenance plan templates are in Appendix G.

Figure 6-16: Non-proprietary Tree Filter with Overflow Bypass. Source: University of New Hampshire Environmental Research Group, 2006

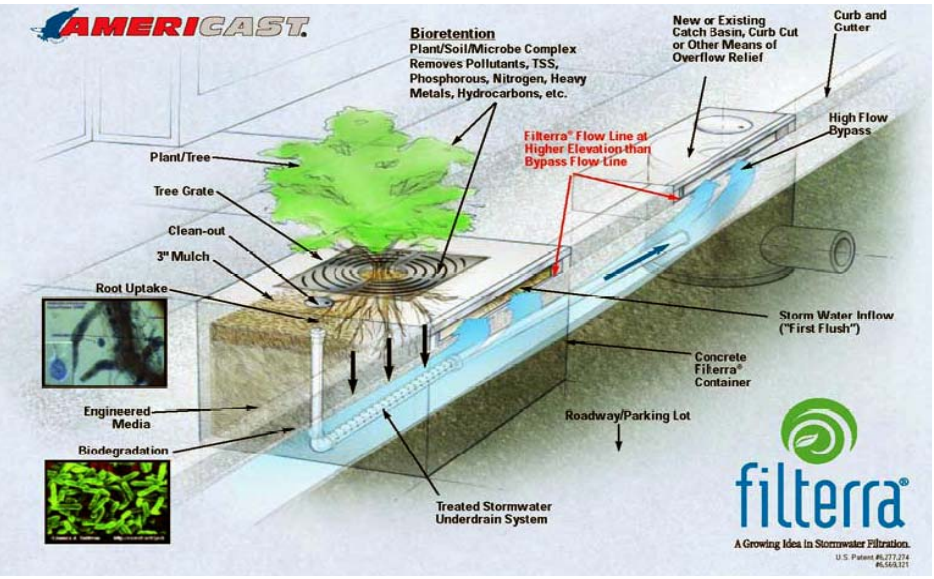

Figure 6-17: Cut Away View. Source: Americast, 2006. The use of this photo is for general information only, and is not an endorsement of this or any other proprietary stormwater treatment device.

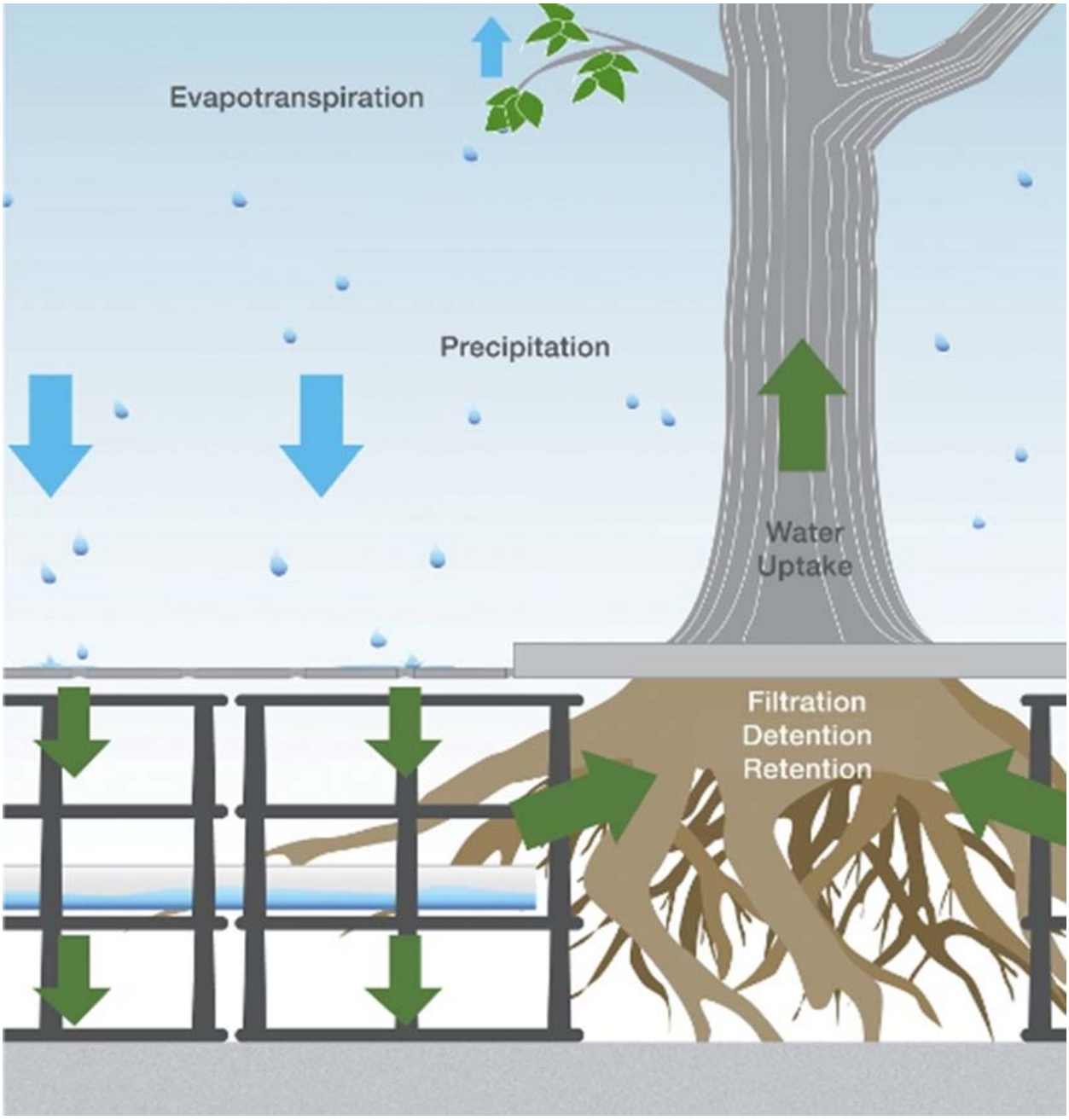

Figure 6-18: Schematic of modular suspended pavement system. Image: deeproot Inc..