



# BIOFILTRATION IN THE HILLS SHIRE

Biofiltration is a means of filtering out pollutants from Stormwater runoff by way of vegetation and soil. Biofiltration systems are built in the form of raingarden detention basins or swales.

All developments within Sydney's Growth Centres must comply with stormwater quality and quantity targets set by the NSW Department of Planning and Environment. These targets are met with the installation of stormwater treatment measures including detention basins, raingardens, wetlands, biofiltration swales, gross pollutant traps and rainwater tanks.

The shape and topography of the North Kellyville release area is long and narrow with a ridgeline through the centre, Smalls Creek to the west and Cattai Creek to the east. There are many small sub-catchments and little opportunity to provide traditionally large volume detention basins. Subsequently, due to land constraint, stormwater treatment measures are dispersed throughout the North Kellyville release area, including roadside biofiltration swales.

In comparison, the topography and environmental condition of the Box Hill and Box Hill North release areas is less constrained, allowing opportunity for large detention basins and raingardens along waterway corridors at the end of drainage sub-catchments.

For the design and construction of biofiltration measures the below information may be used as a guide. For detailed specification and information the reader should refer to the latest version of *Adoption Guidelines for Stormwater Biofiltration Systems - Cooperative Research Centre for Water Sensitive Cities*.

## BIOFILTRATION SLOPE AND DETENTION DEPTH

For biofiltration swales a slope of 2-4% is required. Where slopes exceed 4%, biofiltration swales are unlikely to be a feasible stormwater management option. On steeper slopes the inclusion of check dams on linear systems may achieve the desired swale slope.

Both biofiltration swales and raingarden basins are to have a detention depth of 200-500mm.

## BIOFILTRATION VEGETATION

Biofiltration relies on specifically selected plant species that are known to remove pollutants. For the system to work effectively greater than 50% of the total number of plants installed need to comprise of any combination of these pollutant removing plants. The remaining percentage may include any species of choice that are able to withstand wet and dry soils. For road side swales plant selection is to be limited to groundcovers and small to medium sized sedges no greater than 1m wide and 1m high. Standard street tree planting may be included in road side swales but are not to be located in the base of the swale.

Planting should be installed at 6-10 plants/m<sup>2</sup>.

Pollutant removing plants include:

- Carex species
- Juncus species
- Melaleuca species
- Goodenia ovata species

For road side biofiltration swales melaleuca species are too large and are more suited to large biofiltration basins.

Juncus species tend to be less aesthetically pleasing and should also be avoided in road side biofiltration swales at prominent open space locations or in front of residential lots.

Some, but not all, Carex and Goodenia ovata species are suitable for use in road side biofiltration swales in relation to estimated height and width expected for individual species. Below are some examples that grow to an acceptable width and height for road side swales and are aesthetically pleasing.

To avoid plant 'overhang' of driveways and footpaths from road side swales sedges are to be installed at a distance equal to at least half their estimated full size diameter from the footpath or driveway edge.

Groundcovers such as Goodenia ovata (Gold Cover) may be more suitable along swale edges to avoid plant 'overhang'. Consideration should be given to the distance which they are planted from a hard surface edge.

### CAREX

Carex is a vast genus of more than 2000 species varying in height and width. Below are some examples of species suited to road side biofiltration swales due to their appropriate width and height.



Figure 1 - Carex oshimensis 'Everillo'



Figure 2 - Carex rosea



Figure 3 - Carex 'Kyoto'

### GOODENIA OVATA

Goodenia ovata species vary greatly in height and width. Care needs to be taken when selecting species for suitability in road side biofiltration swales. Below are two suitable Goodenia ovata species for road side biofiltration swales.



Figure 4 - 'Gold Cover'



Figure 5 - 'Edna Walling Coverup'

## BIOFILTRATION FILTER MEDIA & SOIL PROFILE

The effectiveness of biofiltration relies not only on the specifically selected plants but also specific soil types for pollutant removal and hydraulic conductivity. The depths provided for each layer described below is that required for raingardens and may vary slightly for road side swales.

### FILTER MEDIA

**Depth of Layer:** 400-700mm

#### Particle Size Distribution:

Clay & silt	<3%	(<0.05mm)
Very Fine Sand	5-30%	(0.05-0.15mm)
Fine Sand	10-30%	(0.15-0.25mm)
Medium to Coarse Sand	40-60%	(0.25-1.0mm)
Coarse Sand	7-10%	(1.0-2.0mm)
Fine Gravel	<3%	(2.0-3.4mm)

#### Soil Properties:

- Filter media should be a loamy sand NOT a sandy loam.
- Filter media should be free of rubbish, deleterious material and toxicants and not be hydrophobic.
- Organic Matter Content – less than 5% (w/w)
- pH – as specified for ‘natural soils and soil blends’ 5.5-7.5 (pH 1:5 in water)
- Electrical Conductivity (EC) – as specified for ‘natural soils and blend’ <1.2 dS/m
- Phosphorus - <100 mg/kg. Where plants with moderate phosphorus sensitivity are to be used, phosphorus concentrations should be <20 mg/kg.

### TRANSITION LAYER

**Depth of Layer:** 150mm

Material shall be a clean, well-graded sand/coarse sand material containing little or no fines.

### DRAINAGE LAYER

**Depth of Layer:** 150mm

To be clean, fine gravel, such as a 2-5mm washed screenings.

### SUBSOIL DRAINAGE PIPE

100mm perforated pipe laid on grade, preferably 5% grade, with no sock.

Pipe to be laid at the bottom of the drainage layer so that it has 50mm cover.

### LINING

In Western Sydney due to salinity and groundwater levels biofiltration systems should be lined with an impermeable liner.

Geotextile or other lining between the layers in a biofiltration system is not required and if installed would inhibit the system from functioning effectively.

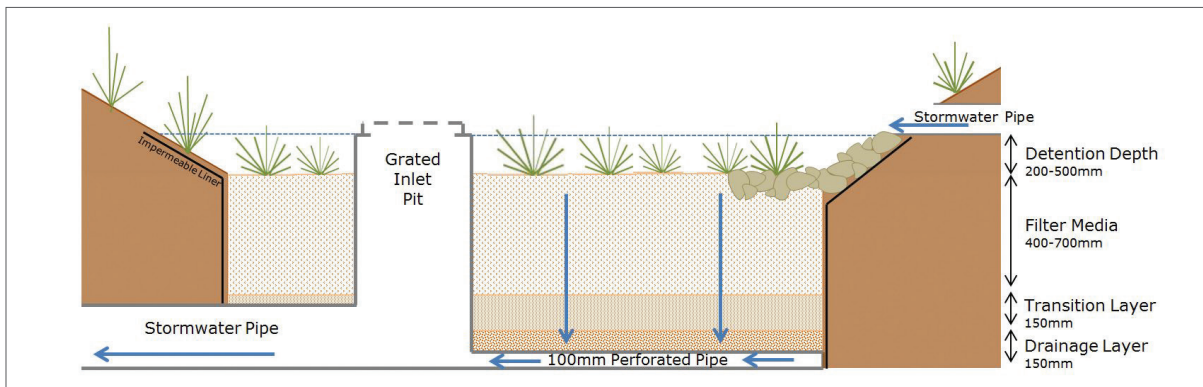


Figure 6 – Indicative Section, Biofiltration Basin (Raingarden)

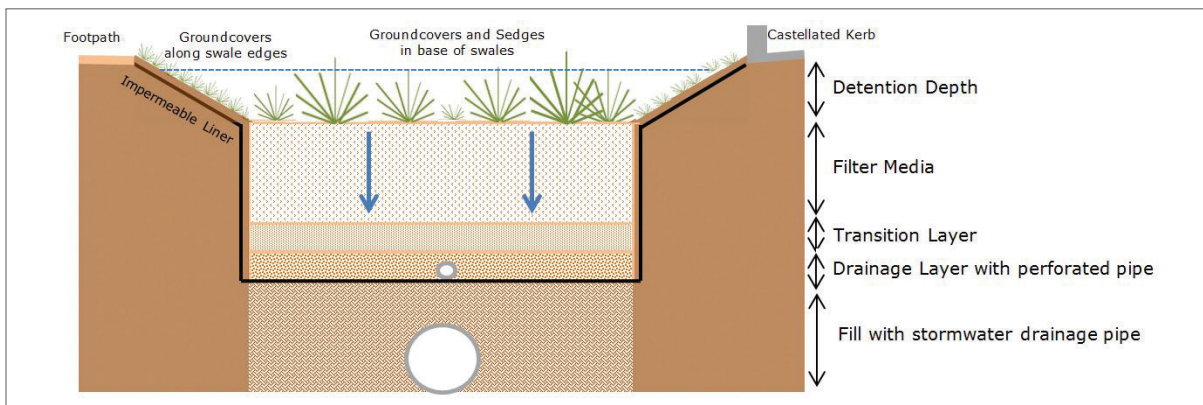


Figure 7 – Indicative Cross Section, Road Side Biofiltration Swale

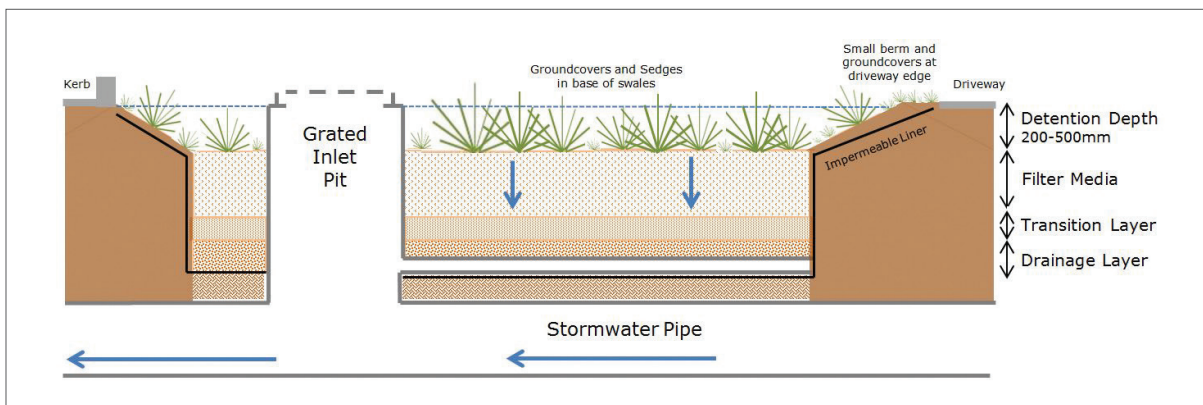


Figure 8 – Indicative Long Section, Road Side Biofiltration Swale

### MAINTENANCE

Council relies on the goodwill of residents to maintain swales fronting their properties. Council will however perform one off maintenance if there is serious concern for public safety e.g. vegetation blocking safe passage of the footpath or vehicle line of sight issues.

Swales located in central road medians or around the perimeter of public open space areas will be maintained by Council.

### FURTHER INFORMATION

For further information on biofiltration or Water Sensitive Urban Design please contact Council's Subdivision and Development Certification Team or Council's Stormwater & Waterways Management Team.

### ASSOCIATED FACTSHEETS

[www.thehills.nsw.gov.au/Building/Development-Approvals/Subdivision/Rain-Gardens](http://www.thehills.nsw.gov.au/Building/Development-Approvals/Subdivision/Rain-Gardens)

[www.thehills.nsw.gov.au/files/sharedassets/public/ecm-website-documents/page-documents/fact-sheets-guides/fact\\_sheet\\_-\\_rain\\_gardens\\_-\\_north\\_kellyville\\_release\\_area.pdf](http://www.thehills.nsw.gov.au/files/sharedassets/public/ecm-website-documents/page-documents/fact-sheets-guides/fact_sheet_-_rain_gardens_-_north_kellyville_release_area.pdf)