CRC for Water Sensitive Cities

Fact Sheet: Stormwater biofiltration – What are the ingredients for successful systems?

Key design tips

- **Carefully tailor designs to meet specific performance objectives and suit local site** conditions, including **climate, geology, topography and groundwater.**
- Ensure the system is **sized appropriately** (biofilter area, ponding depth). This is vital for volumetric treatment capacity, the rate of sediment and pollutant accumulation (and therefore lifespan) and the moisture regime to support plant and microbial communities. Avoid excessive oversizing (inflows may be insufficient to sustain vegetation) and undersizing (reduced treatment capacity, lifespan and higher maintenance demands).
- Carefully **select the filter media in accordance with specifications** – in particular, low clay and silt content is essential for effective infiltration and low nutrient content minimises leaching, whilst also providing a suitable growing medium for plant growth.
- **Include a raised outlet** to support healthy plant growth, benefit pollutant removal (particularly for nitrogen and pathogens) and promote infiltration (in unlined systems; suitable in wetter climates) or provide a longer-lasting submerged zone (if lined; recommended in dry climates where > 3 weeks dry is common).
- **Design effective system hydraulics** to ensure an even distribution of flows across the entire surface, the desired ponding depth and safe bypass of high flow events.
- Select **plant species and planting layout** to meet treatment objectives, aesthetic, safety and microclimate considerations (See Plant Selection Fact Sheet). Include a **diversity of plant species** and if appropriate, consider the **inclusion of trees** as a canopy layer.
- **Plant densely** to enhance pollutant removal (particularly for nitrogen), facilitate maintenance by minimising weed intrusion and help maintain infiltration capacity.

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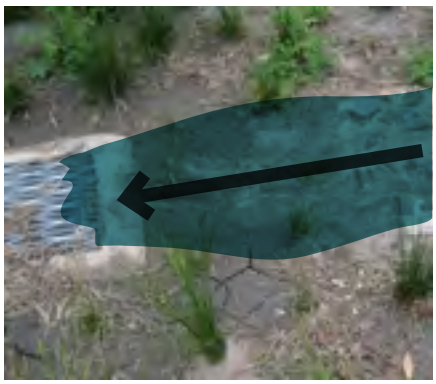
Construction and establishment tips

- **Protect the system from sediment** when construction activities are occurring within the catchment, and during biofilter construction itself.
- **Conduct quality checks** throughout construction and landscaping works to ensure the design intent is represented. Critical checks include:
  - ¬ flow hydraulics (invert level of inlet/s, invert level of the outlet and overflow structures, the ponding depth and slope of the biofilter surface);
  - ¬ filter media (material, layering, depths, potential contamination with site soils, minimal compaction and avoidance of mulch); and
  - ¬ vegetation (plant density, seedling size and establishment).

  Common problems include incorrect surface gradients for streetscape systems (sloping towards the kerb) and inadequate (or no) ponding capacity (if the system is overfilled with media or invert levels are wrong).
- Establishment of healthy plant cover across the biofilter is vital for effective function. The period of seedling establishment and early growth is a vulnerable time and long-term success can hinge on its management. Plant death or stunted growth will compromise long-term hydraulic operation and pollutant removal. A common problem is to 'plant and forget', but **careful and timely management during establishment** will avoid increased replanting and maintenance costs (e.g. repair of erosion).

Sediment management: high risk of sediment washing into biofilter during construction in catchment

No step down into biofilter: flow cannot easily enter



Level of overflow designed or constructed too low, overfilling with media or uneven biofilter surface: these reduce ponding & flow distribution, allowing flows to bypass

Common sediment and hydraulic problems in biofilters

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Monitoring and maintenance tips

- Gather background information and **undertake qualitative** (e.g. check plant health and condition of media surface and flow structures) **and preliminary quantitative monitoring** (i.e. hydraulic conductivity and media testing for metals accumulation) **for every system.** If more extensive quantitative monitoring is to be conducted clearly define the objectives, carefully plan an appropriate sampling plan and incorporate requirements into design.
- For effective planning within an organisation; i.) **train maintenance contractors** in biofilter function, ii.) **develop an inventory of assets and record** monitoring and maintenance activities, iii.) **clearly differentiate maintenance** from more significant rectification or reset works, iv.) **allow sufficient budget** including for additional maintenance during establishment, and v.) develop a **maintenance plan and provide on-site information** to maintenance crews, including individual system characteristics (e.g. provide a drawing of the system illustrating functions (e.g. flow arrows) and key features).
- **Do not use mulch** (rock or organic) as this can clog outlets, prevent the spread of vegetation and hinder sediment removal.
- **Establish a dense and healthy cover of vegetation** – this will develop a system that is more resilient to erosion, requires less long-term maintenance or remediation, and is more effective.
- **Ensure sufficient soil moisture is available** – Systems that are too shallow, sandy or small are particularly vulnerable to drying out. Inclusion of a raised outlet is essential to help maintain moisture for plants.
- **Design pits, pipes and culverts to facilitate inspection** – pit lids should not be difficult or require heavy lifting by maintenance personnel, but should instead be designed with safety and ease of removal in mind. Pipes should be designed to facilitate inspection and cleaning.
- **Provide safe and easy maintenance access with minimum need for traffic management** – when locating and designing the system consider access requirements for maintenance crews.

For full details please refer to the Adoption Guidelines for Stormwater Biofiltration, CRC for Water Sensitive Cities (2015)

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