

SuDS Palette



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Document History

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1 Introduction

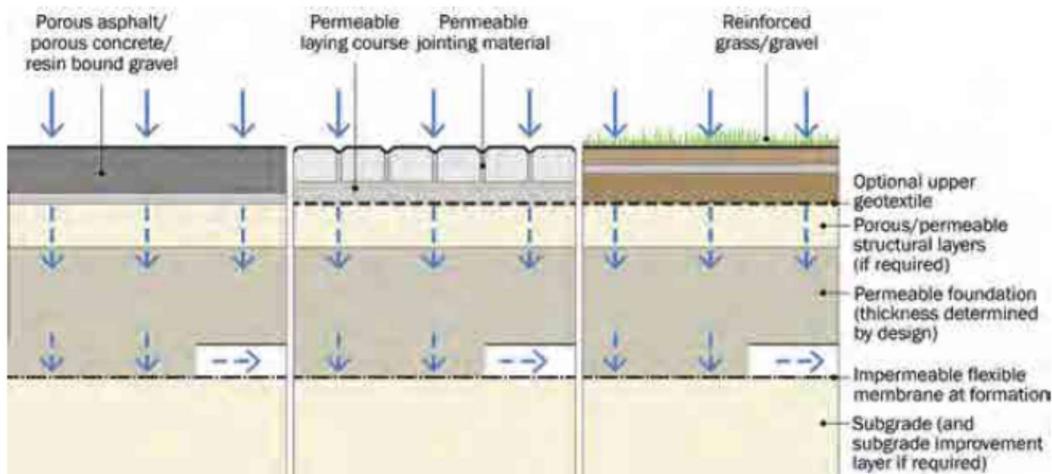
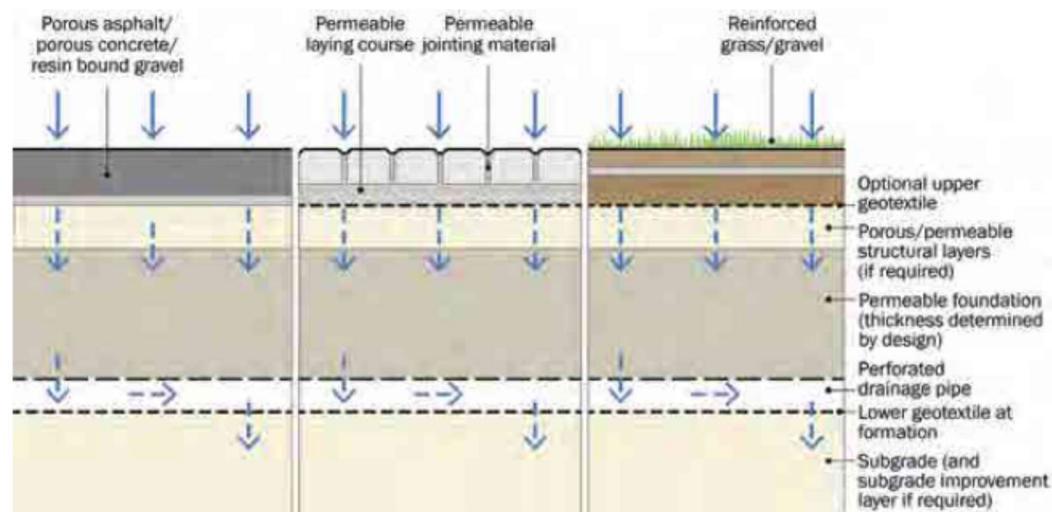
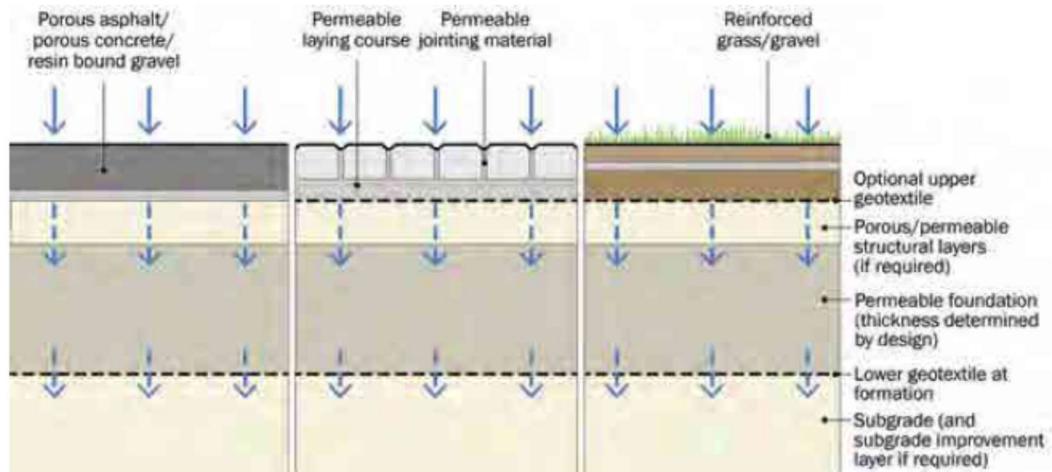
This document has been prepared as a catalogue of acceptable methods of sustainable drainage features from which options can be chosen for use on developments.

Maintenance requirements for the various SuDS features have also been included to aid in choosing which options are to be utilized.

Diagrams, where provided, for the various type of SuDS features are courtesy of The SuDS Manual 2015

2 Pervious Surface/Paving

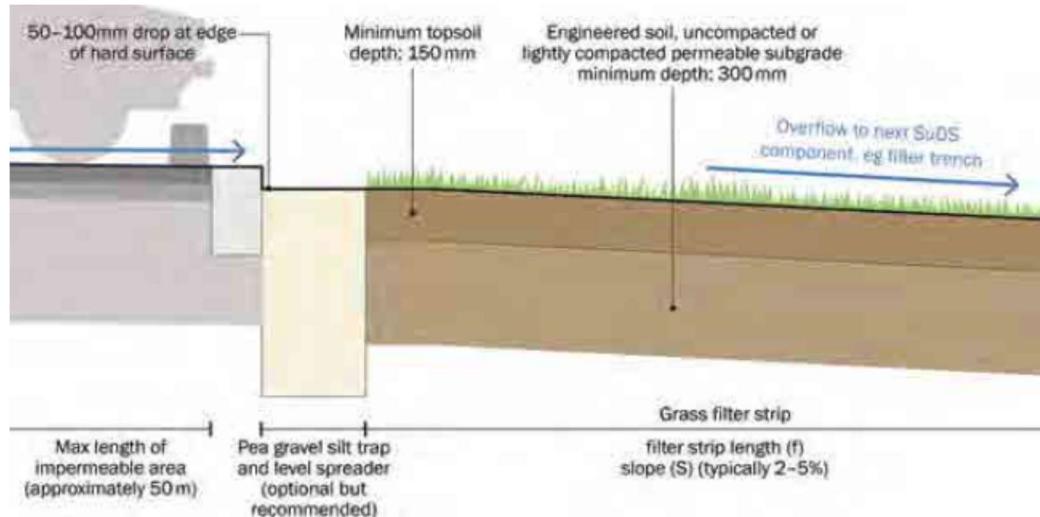
Permeable hardstanding areas that allow the passage of rainwater into the underlying construction. Provides a pavement suitable for pedestrian and/or vehicular traffic while allowing rainwater to infiltrate through the surface and into the underlying structural layers. The water is temporarily stored beneath the overlying before infiltration to ground or controlled discharge downstream.



Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glysophate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate and landscaping which through vegetation maintenance or soil slip has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for 3 months after installation
	Inspect for evidence of poor operation and/or weed growth – if required take remedial action	3 monthly, 48 hours after large storms in the first 6 months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

3 Filter Strips

Filter strips are gently sloping areas of vegetated land where run-off is directed. Uniformly graded and gently sloping strips of grass or other dense vegetation that are designed to treat runoff from adjacent impermeable areas by promoting sedimentation, filtration and infiltration (if required).

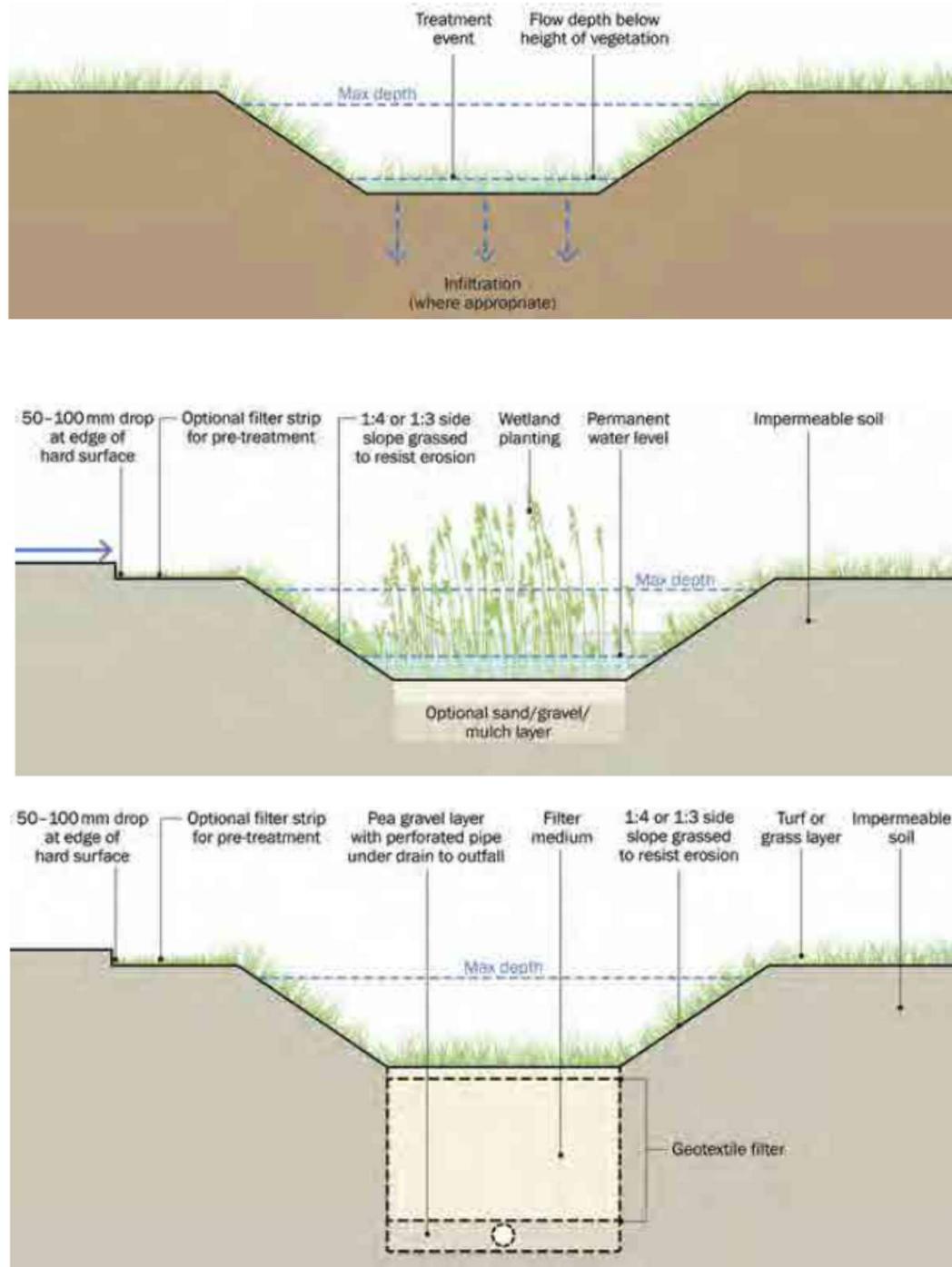


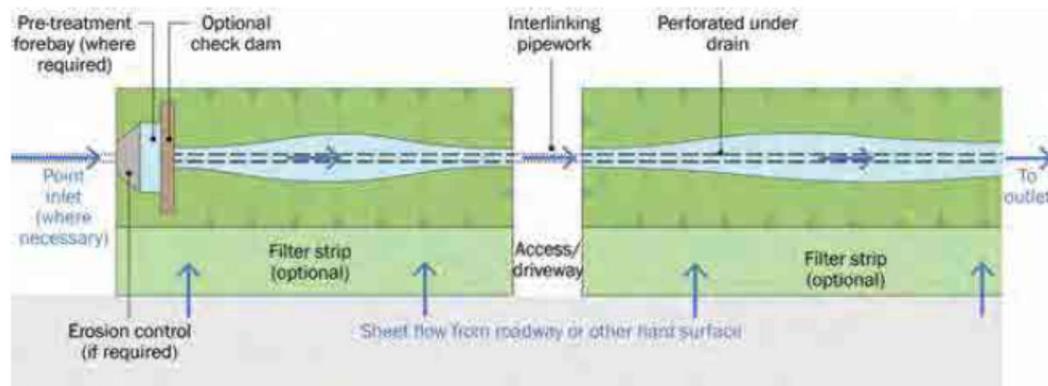
Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly or as required
	Cut the grass – to retain grass height within specified design range	Monthly during growing season or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect filter strip surface to identify evidence of erosion, poor vegetation growth, compaction, ponding, sedimentation and contamination	Monthly at start, then every 6 months
	Check flow spreader and filter strip surface for even gradients	Monthly at start, then every 6 months
	Inspect gravel flow spreader upstream of filter strip for clogging	Monthly at start, then every 6 months
	Inspect silt accumulation rates and establish appropriate removal frequencies	Monthly at start, then every 6 months
Occasional Maintenance	Reseed areas of poor vegetation growth; alter plant types to better suit conditions if required	As required or if bare soil that is exposed is >10% of the filter strip area
Remedial Actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required

	Scarify and spike topsoil layer to improve infiltration performance, break up soil deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

4 Swales

Swales are shallow vegetated open channels that control run-offs from surface to discharge point. Shallow, flat bottomed vegetated open channels designed to convey, treat and often attenuate surface water runoff. Swales can replace conventional pipework as a means to convey runoff.



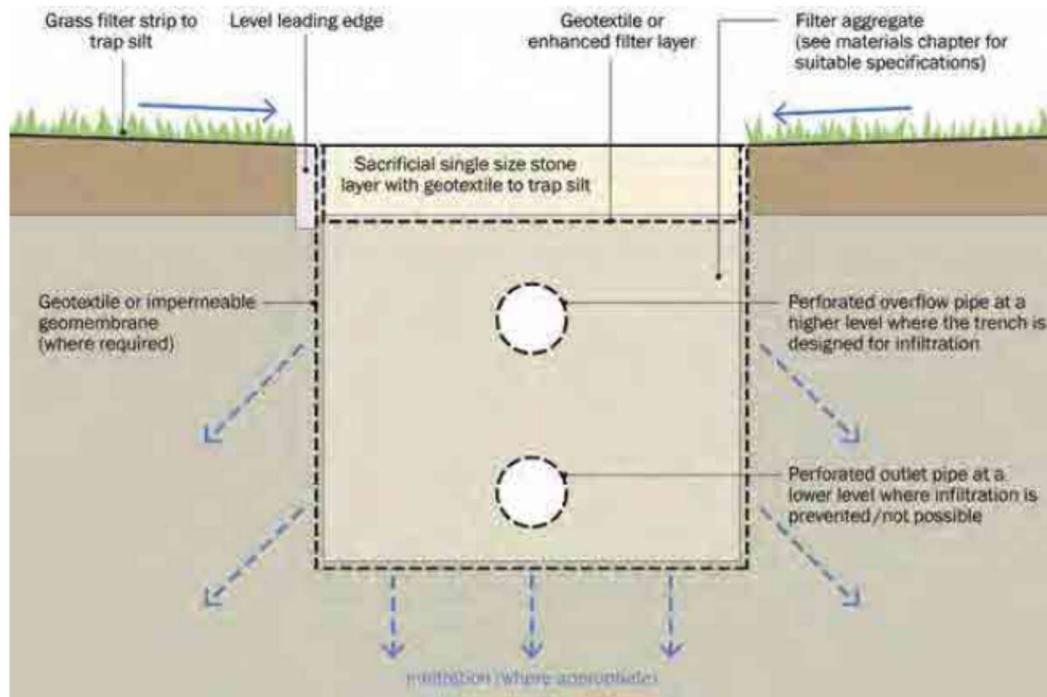


Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly or as required
	Cut grass – to retain grass height within specified design range	Monthly during growing season or as required
	Manage other vegetation and remove nuisance plants	Monthly at start then as required
	Inspect inlets, outlets and overflows for blockages and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for >48hours	Monthly or as required
	Inspect vegetation coverage	Monthly for 6 months then quarterly for 2 years, then every 6 months
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Every 6 months
Occasional Maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions if required	As required or if bare soil that is exposed is >10% of the swale treatment area
Remedial Actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarf and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required

	Remove and dispose of oils or petrol residues using safe standard practices	As required
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5 Filter Drains/Trenches

Filter drains/trenches are linear drains consisting of trenches filled with permeable materials to store and convey water. Shallow trenches filled with stone/gravel that create temporary subsurface storage for attenuation, conveyance and filtration of surface water. They may also be lined or may allow infiltration depending on the suitability of the underlying soils.

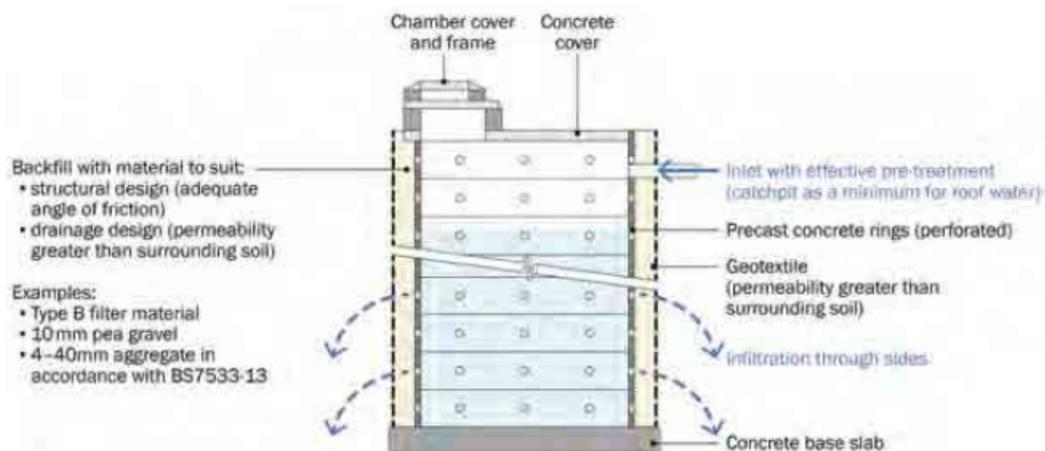
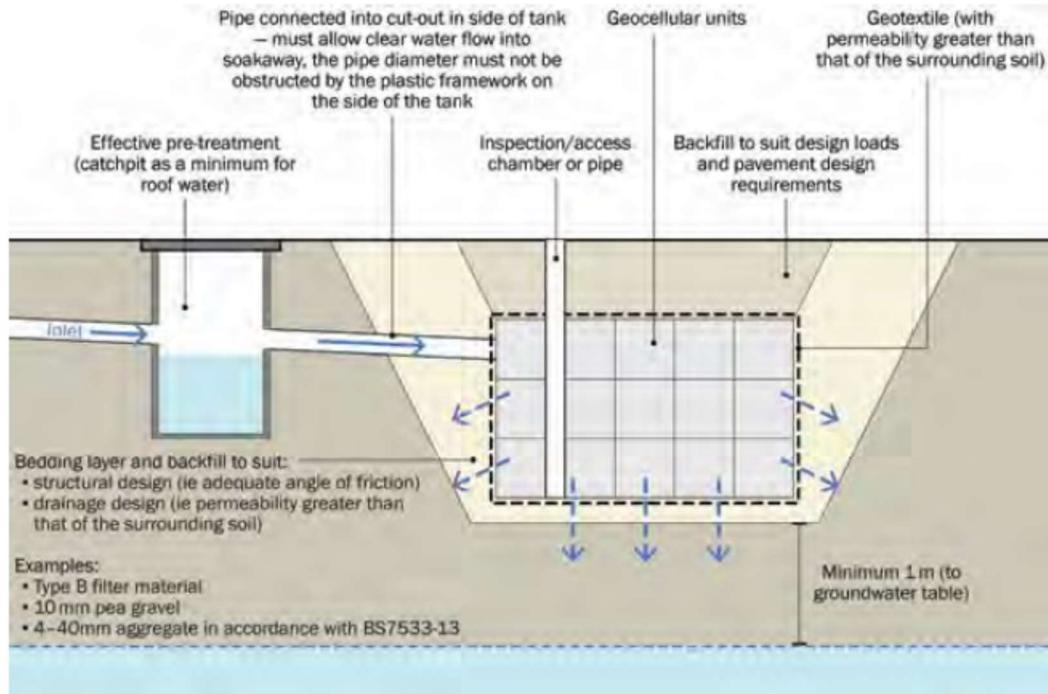


Maintenance Schedule	Required Actions	Typical Frequency
Regular Maintenance	Remove litter (including leaves) and debris from the filter drain surface, access chambers and pre-treatment devices	Monthly or as required
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	6 monthly
	Remove sediment from Pre-treatment devices	6 monthly or as required
Occasional Maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain using recommended methods	As required
	At locations with high pollution loads, remove surface geotextile and replace,	5 yearly or as required

	and wash or replace overlying filter medium	
	Clear perforated pipework of blockages	As required

6 Infiltration Devices

Subsurface structures excavated and filled with stones or other granular material to provide a transient reservoir, these include soakaways, infiltration trenches and infiltration blankets.

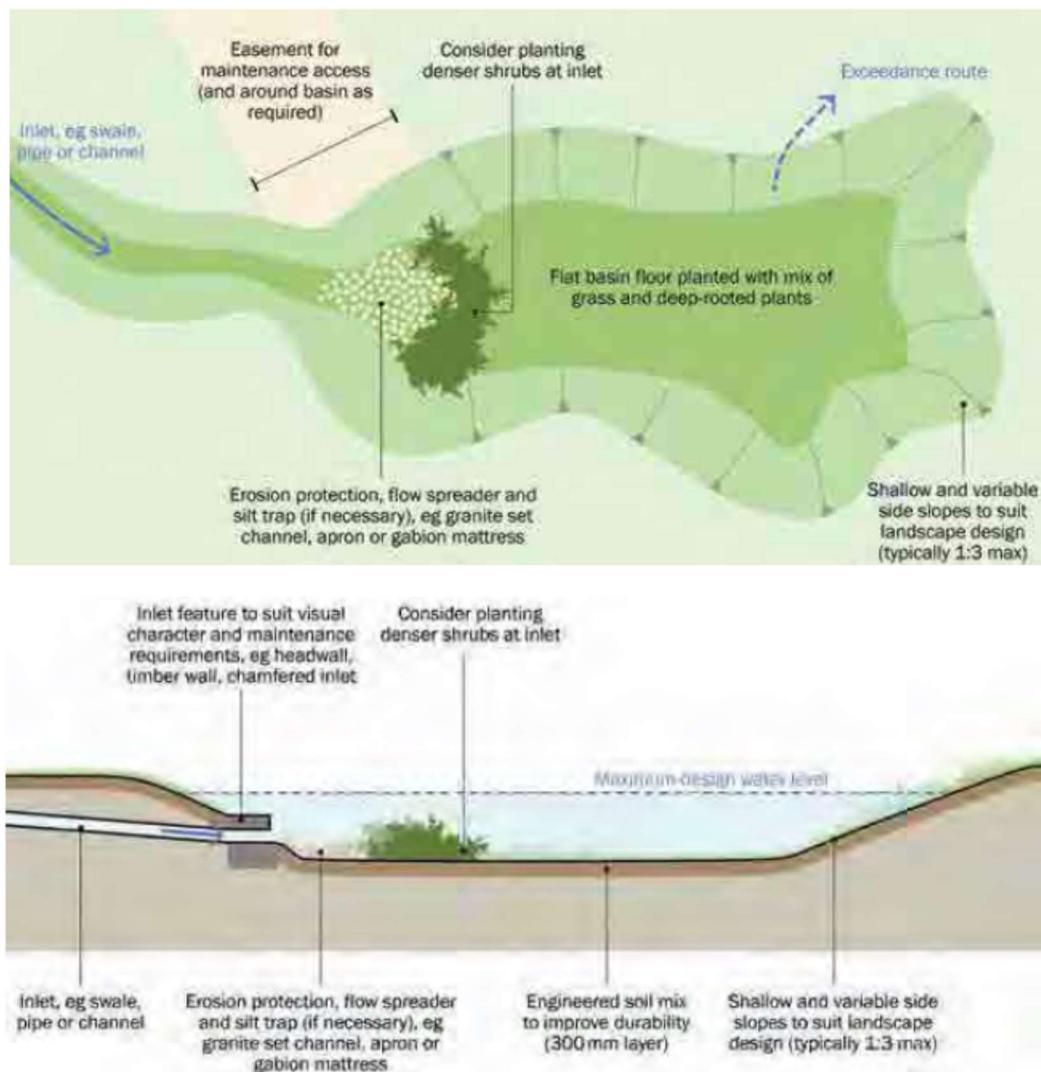


Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually or as required based on inspections

	Trimming any roots that may be causing blockages	Annually or as required
Occasional Maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required based on inspections
Remedial Actions	Reconstruct soakaway and/or replace or clean void fill if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

7 Infiltration Basins

An infiltration basin is a temporary water feature to hold back storm water run-offs to reduce peak flows to receiving waters. These tend to be flat bottomed, shallow landscape depressions that store runoff before infiltration into the subsurface soils.

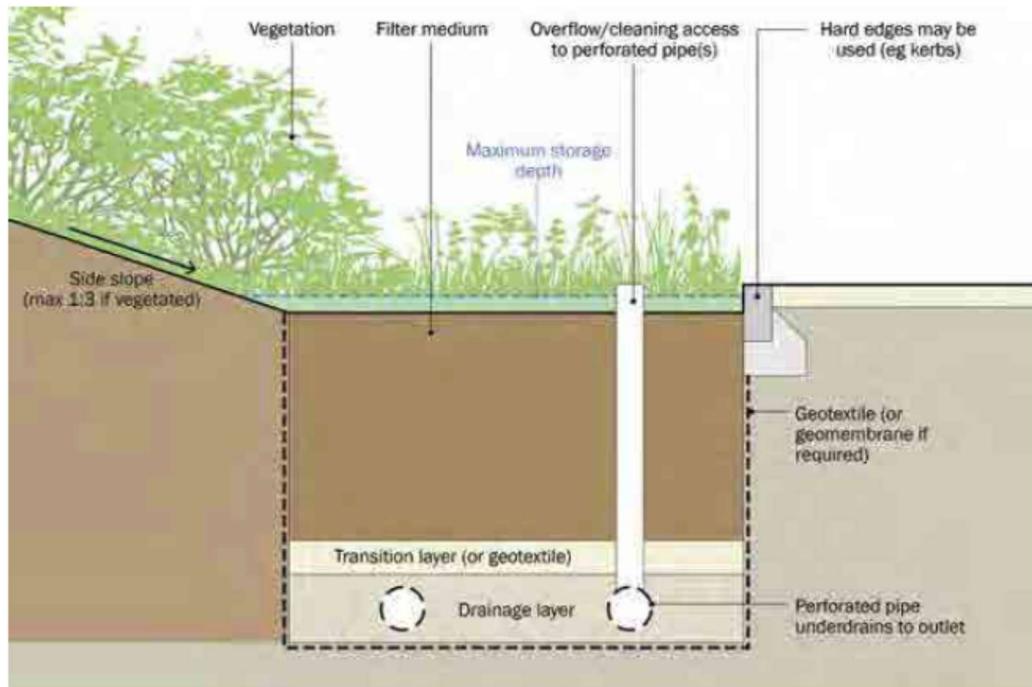


Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter, debris and trash	Monthly
	Cut grass – for landscaped areas and access routes	Monthly during growing season or as required
	Cut grass – meadow grass in and around basin	6 monthly: Spring (before nesting season) and Autumn
	Manage other vegetation and remove nuisance plants	Monthly at start then as required
Occasional Maintenance	Reseed areas of poor vegetation growth	Annually or as required

	Prune and trim trees and remove cuttings	As required
	Remove sediment from pre-treatment system when 50% full	As required
Remedial Action	Repair erosion or other damage by reseeding or re-turfing	As required
	Realign the rip-rap	As required
	Repair or rehabilitate inlets, outlets and overflows	As required
	Rehabilitate infiltration surfaces using scarifying and spiking techniques if performance deteriorates	As required
	Relevel uneven surfaces and reinstate design levels	As required
Monitoring	Inspect inlets, outlets and overflows for blockages and clear if required	Monthly
	Inspect bank sides, structures, pipework etc. for evidence of physical damage and repair if required	Monthly
	Inspect inlets and pre-treatment systems for silt accumulation and establish appropriate silt removal frequencies	6 monthly
	Inspect infiltration surfaces for compaction and ponding	Monthly

8 Bio-Retention Areas

Bio-retention areas are vegetated areas designed to collect and treat water before discharging via a piped system. Shallow landscaped depressions that can reduce runoff rates and volumes, whilst treating pollution through the use of engineered soils and vegetation.



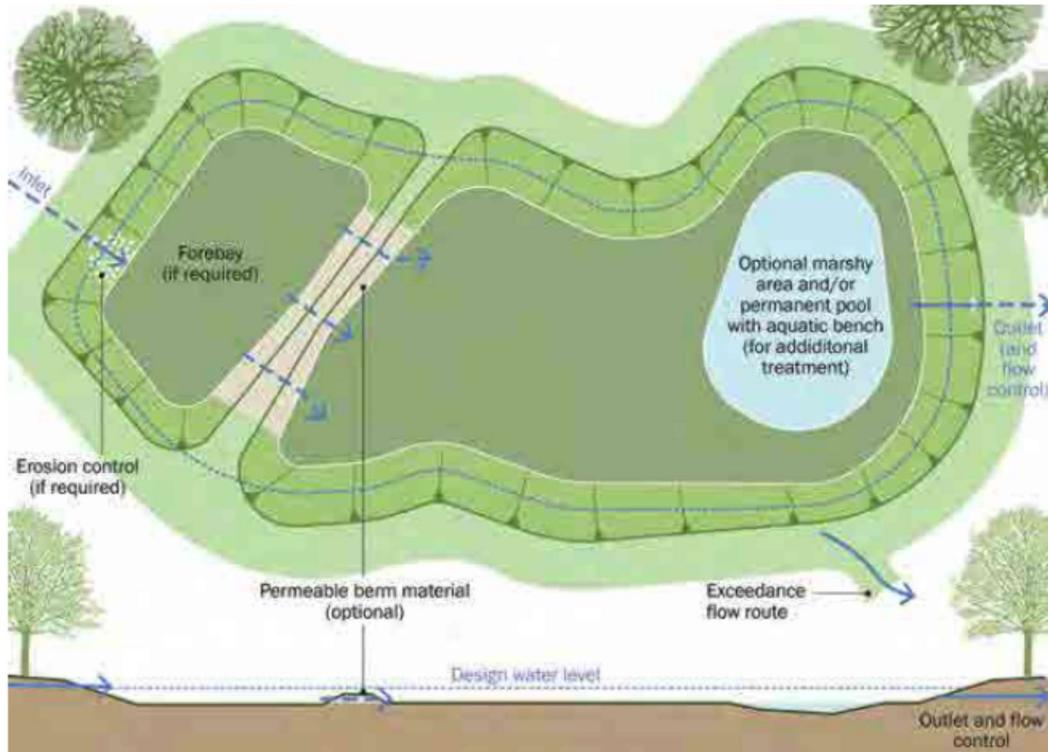
Maintenance Schedule	Required Action	Typical Frequency
Regular Inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc. and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular Maintenance	Remove litter, surface debris and weeds	Quarterly or more frequently for tidiness or aesthetic reasons
	Replace any plants to maintain plant density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly or biannually

Occasional Maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial Action	Remove and replace filter medium and vegetation above	As required but likely to >20 years

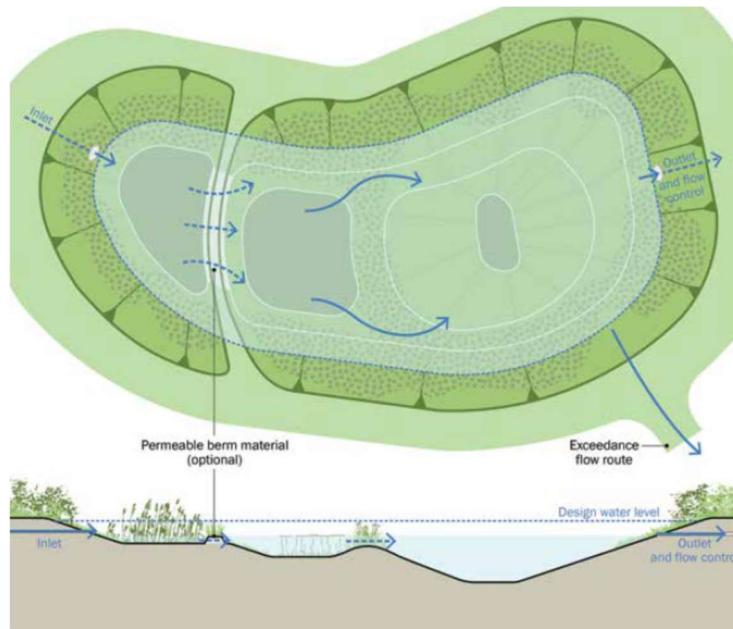
9 Basins, Ponds and Wetlands

Basins, ponds and wetlands are designed to collect water from pipe networks or from other SuDS upstream.

Detention basins are landscaped depressions that are normally dry except during and immediately following storm events. They can be on-line components where surface runoff from regular events is routed through the basin and when the flows rise, because the outlet is restricted, fills and provides storage of runoff and flow attenuation. They can be off-line components into which runoff is diverted once flows reach a specified threshold.



Ponds and wetlands are features with a permanent pool of water that provide both attenuation and treatment of surface water runoff. Attenuation storage is provided above the permanent pool and wetland areas. A flow control system at the outfall controls the rates of discharge for a range of water levels.



Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly or as required
	Cut the grass – public areas	Monthly during growing season
	Cut the meadow grass	6 monthly: Spring (before nesting season) and Autumn
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly at start the as required
	Inspect inlets, outlets, banksides, structures, pipework etc. for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May-October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies and undertake contamination testing once some build-up has occurred, to inform management and disposal options	6 monthly
	Check any mechanical devices, e.g. penstocks	6 monthly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of rowing season (note: tree maintenance is usually part of overall maintenance contract)	Annually
	Remove any sediment from any forebay	Every 1 – 5 years or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays	Every 5 years or as required
Occasional Maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment this will only be required rarely, e.g. every 25 - 50 years
Remedial Actions	Repair erosion or other damage	As required
	Replant where necessary	As required

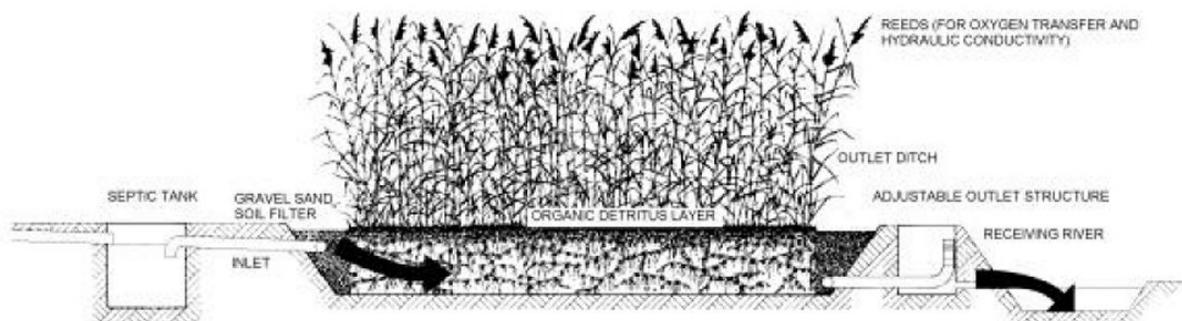
	Aerate pond when signs or eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair/rehabilitate inlets, outlets and overflows	As required

10 Filters and Silt Traps

Engineered sand filters designed to remove pollutants from surface water run-off

11 Reed Beds

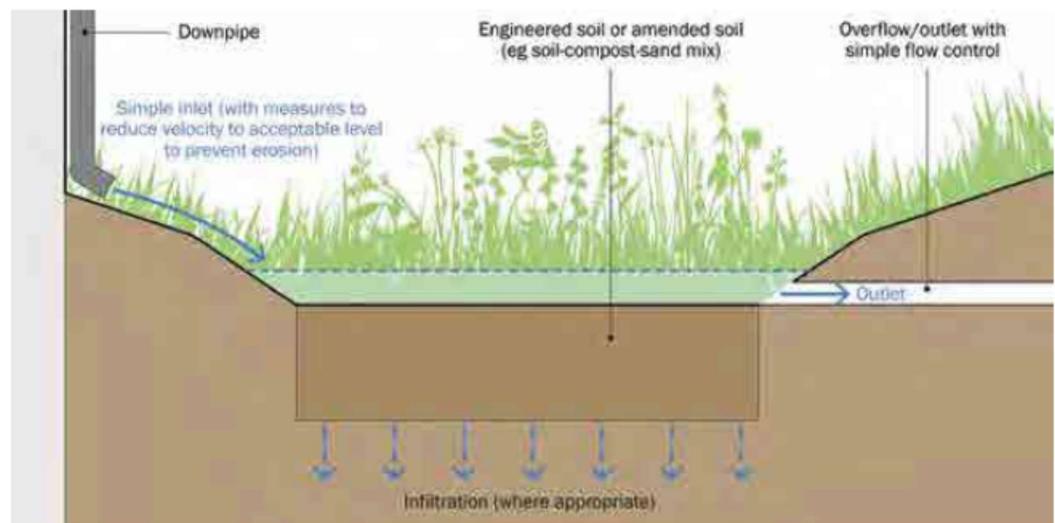
Engineered reed beds are designed to remove pollutants from surface water run-off, usually installed as part of a wetlands system.



Reed bed treatment system (horizontal flow)

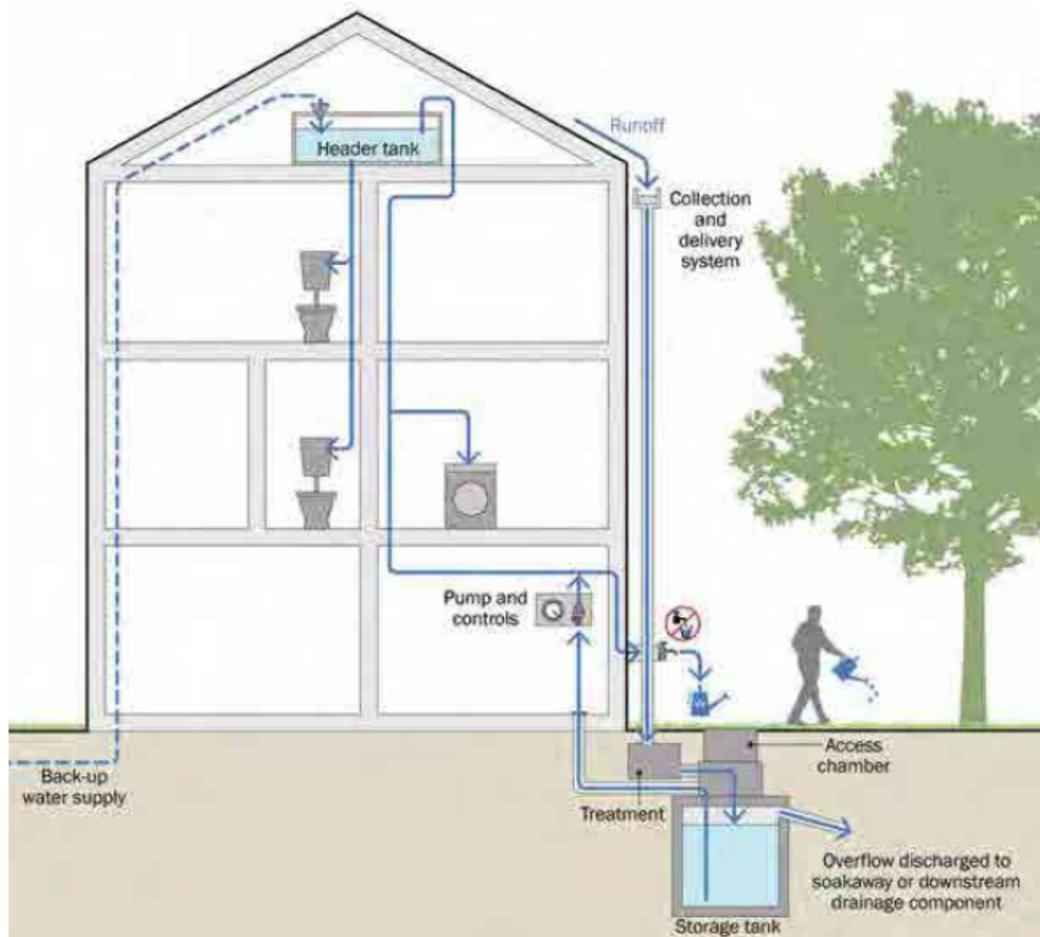
12 Rain Gardens

A rain garden is a vegetated area designed to collect and treat water before discharging via a piped system.



13 Rainwater Harvesting

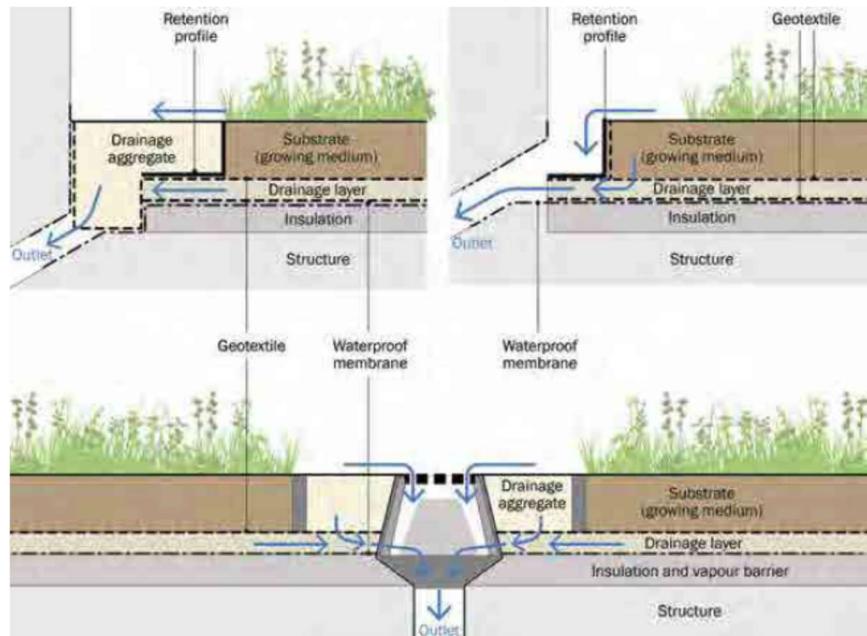
Rainwater harvesting is designed to collect rainwater runoff for reuse. Runoff can be collected from roofs and other impermeable areas, stored, treated (if required) and then used as a supply of water for domestic, commercial or industrial use.



Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspection of the tank for debris and sediment build-up	Annually and following poor performance
	Inspection of inlets, outlets, withdrawal devices, overflow areas, pumps and filters	Annually and following poor performance
Occasional Maintenance	Cleaning and/or replacement of any filters	3 monthly or as required
Remedial Actions	Repair of overflow erosion damage or damage to tank	As required
	Pump repairs	As required

14 Green Roofs

Green roofs are an area of living vegetation, installed on the top of buildings, for a range of reasons including visual benefit, ecological value, enhanced building performance and the reduction of surface water runoff. Green roofs can be divided into two main categories, Extensive roofs which have low substrate depths, simple planting and low maintenance requirements or Intensive roofs which have deeper substrates that can support a wide variety of planting and require more intensive maintenance programs.

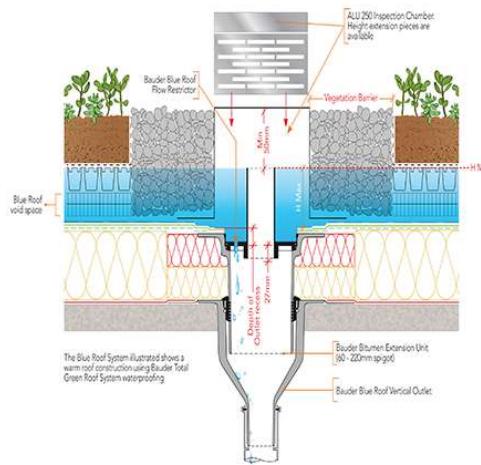


Maintenance Schedule	Required Action	Typical Frequency
Regular Inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems, membranes and roof structures for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect all soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular Maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	6 monthly and annually or as required
	During establishment (i.e. 1 year) replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment replace dead plants as required where >5% of coverage	Annually in Autumn

	Remove fallen leaves and debris from deciduous plant foliage	6 monthly or as required
	Remove nuisance and invasive vegetation including weeds	6 monthly or as required
	Mow grasses, prune shrubs and manage other planting as required – clippings should be removed and not allowed to accumulate	6 monthly or as required
Remedial Actions	If erosion channels are evident these should be stabilized with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

15 Blue Roofs

A blue roof is designed specifically to store water. This storage can be designed as attenuation storage, as storage for use, cooling water or non-potable use within the building. Blue roofs can include open water surfaces, storage within or below a porous medium or modular surfaces, or below a raised decking surface or impermeable cover.



16 Brown Roofs

Brown Roof are designed using a substrate material laid down on a flat roof and allowed to colonise naturally with rainfall allowed to evaporate back.

17 Rill

A rill is a small brook, rivulet or canal designed to convey water to either a piped system or other SuDS features.



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