



SAND FILTERS

Operation & Maintenance Guide

STORMWATER DEVICE INFORMATION SERIES

What are sand filters?

Sand filters are holding tanks that collect and filter stormwater flowing off hard surfaces before it flows to the drainage system. Sand filters slow the amount of stormwater entering the drainage system as well as removing some contaminants. They are usually installed where stormwater runoff may collect high levels of contaminants, such as from roads, carparks and industrial areas.

Sand filters are designed to separate debris from the runoff, filtering the remaining flow. The most commonly used sand filters in Auckland are prefabricated sand filter units, fitted with components and predrilled for connections. These sand filters are usually buried underground, saving space in built-up areas.



Pre-cast sand filter chambers being installed
(Photo: Hynds Environmental Ltd)



Open sand filter constructed in-situ
(Photo: NZTA)

How and when should maintenance be carried out?

Sand filters work well when maintained regularly. How often maintenance is needed depends on the size of the sand filter and amount of stormwater it drains. The maintenance schedule lists a general guide for what needs to be done and when. An operation and maintenance manual covering detailed maintenance of the rain garden should be supplied by the designer of the rain garden.

WARNING - CONTAMINATED SOIL

Sand filters treat stormwater run-off from roads, carparks, driveways and other hard surfaces, collecting pollutants. Sand filter material will accumulate these pollutants, contaminating the mix. Material removed from these sites **MUST** be disposed of at a secure landfill.

Six key components of a sand filter (Washington sand filter)

The six main elements of a sand filter vault are shown in the diagram below. Because sand filter vaults are the most common in Auckland, this type is illustrated. Other types of sand filter have similar elements set out to suit their design.

1. Inlet

Stormwater runoff enters the sand filter through a manhole inlet. A weir diverts heavy storm flows to bypass the sand filter.

3. Filtration chamber

Stormwater flows over a weir to enter the filtration chamber to seep through the sand mix. This mix may also have some compost, peat or other specialist material added to capture dissolved heavy metals. Some filters have a spreader channel to spread the flow across the filter bed.

5. Overflow system

Flows from larger storms or overflows are diverted to local drainage system via a weir or pipes set at a level higher than the normal operating level of the sand filter.

2. Sedimentation chamber

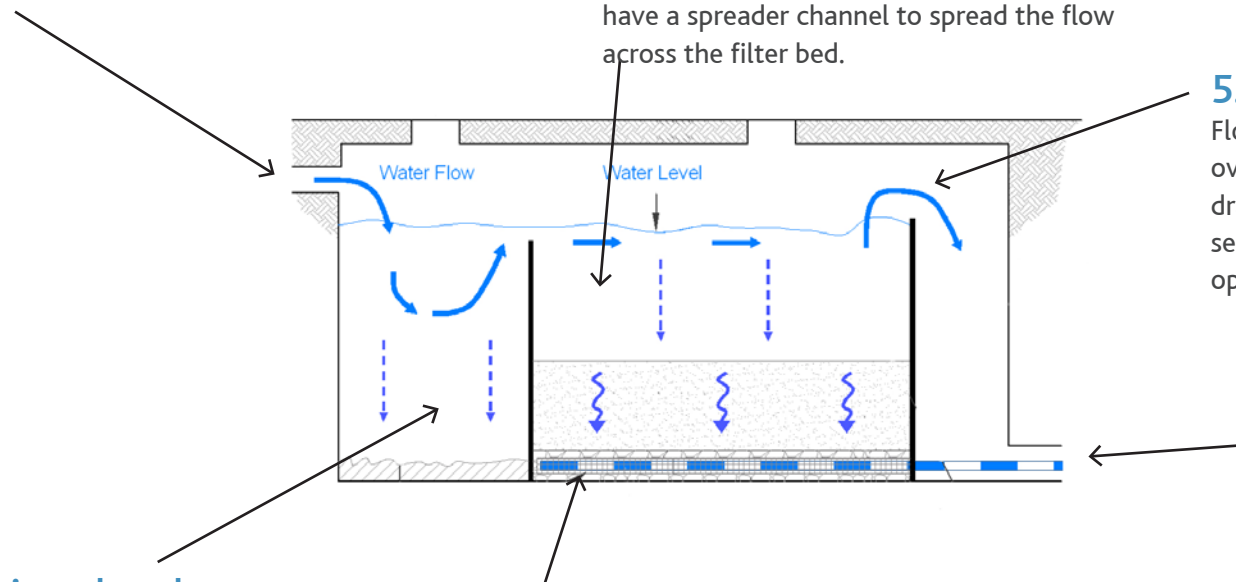
Runoff slows and large sediment settles on the bottom of the chamber. If included, plates in the chamber act as baffles to help sediment settle, and to trap litter and other floating material.

4. Under-drainage system

Filtered stormwater trickles down to perforated pipes beneath the filter bed, connected to the outlet.

6. Outlet

Stormwater discharges from the sand filter to the local drainage systems such as pipes, stream or coast.



TYPES OF SAND FILTER

There are three main sand filter types.

- **Sand Filter Vaults (also known as Washington Sand Filter)**

The most common type used in Auckland. Generally these filters are installed where there is limited space. These are usually prefabricated concrete units supplied by manufacturers (Hynds Environmental or Humes) to treat areas of up to 10,000m². On larger sites more than one may be used, or constructed on site. Stormwater enters the Sand Filter via a semi-submerged sedimentation chamber before passing through a sand filter bed prior to discharge. These can be designed to work on-line or off-line.

- **Source Control Sand Filter (also known as Delaware Sand Filters and Perimeter Sand Filters)**

Used on some fuel station forecourts or small carparks. These have two chambers. Stormwater enters through surface grates into the first settling chamber, then flows over a weir into the second chamber. Here, it drains down through sand to perforated pipes before discharging to the stormwater drainage system. Suitable for small, highly impervious flat areas with relatively low available head.

- **Austin Sand Filters – present on new motorways in Auckland.**

Constructed on site. These have a wide inlet bay with a weir to slow runoff before flowing to covered sediment basin, and then passing through open sand filter before discharge. These filters are designed to receive runoff from larger drainage areas.

MAINTENANCE SCHEDULE

IMPORTANT: Only people fully certified for confined space entry can enter sand filter chambers.

TIMING	COMPONENT	ACTION
Following storms	Inlet weir (if present)	<ul style="list-style-type: none"> • Check weir is not blocked with debris – clear if necessary
	Sediment chamber	<ul style="list-style-type: none"> • Use hatch to check for floatables, and remove by hand or using sucker truck. • Check sediment level. If depth is over half height of weir (more than 200mm) then remove using sucker truck.
	Filter bed	<ul style="list-style-type: none"> • Clear surface of rubbish and leaf litter. • Check filter material has not been eroded. If level is below weir, top up with fresh filter material (do not compact). • Check filter is not clogged – see troubleshooting, below.
	Underdrain	<ul style="list-style-type: none"> • Check underdrain for blockage using inspection well (if installed) or CCTV camera via outlet pipe. If blocked, see troubleshooting, below.
	Weir and spreader (if included)	<ul style="list-style-type: none"> • Remove any debris.
	Inlet and outlet pipes	<ul style="list-style-type: none"> • Check for debris and clear if necessary.
3 monthly	Inlet weir (if present)	<ul style="list-style-type: none"> • Check weir is not blocked with debris – clear if necessary.
	Sediment chamber	<ul style="list-style-type: none"> • Use hatch to check for floatables, and remove by hand or using sucker truck.
	Weir and spreader (if included)	<ul style="list-style-type: none"> • Remove any debris.

MAINTENANCE SCHEDULE

IMPORTANT: Only people fully certified for confined space entry can enter sand filter chambers.

TIMING	COMPONENT	ACTION
6 monthly	Sediment chamber	<ul style="list-style-type: none"> • Check sediment level in chamber. If built up to more than half the height of weir between chambers (or over 200mm,) then remove using sucker truck.
	Filter bed	<ul style="list-style-type: none"> • Clear surface of rubbish and leaf litter. • Check surface for algae and weed growth. Do not spray - remove manually. Rake and shovel top surface of algae or use sucker truck if possible and top up filter material (do not compact). • Check filter material has not been eroded. If level is below weir, top up to level of weir with fresh filter material (do not compact). • Check filter material is not clogged – see troubleshooting, below.
	Underdrain	<ul style="list-style-type: none"> • Check underdrain for blockage using inspection well (if installed) or CCTV camera via outlet pipe. If blocked, see troubleshooting, below.
	Inlet and outlet pipes	<ul style="list-style-type: none"> • Check for erosion at outlet. Replace or repair damaged erosion protection (rip-rap or geotextile) and repair erosion.
Annually	Inlet and outlet pipes	<ul style="list-style-type: none"> • Inspect for blockages – clear pipes using sucker truck if necessary. Debris to be removed off-site, not disposed of through filter or downstream.
	Hinges, lids and covers	<ul style="list-style-type: none"> • Check all in working order. Oil hinges and remove rust. Check covers can be lifted and placed back easily. • Remove any debris.

MAINTENANCE SCHEDULE

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TIMING	COMPONENT	ACTION
Two yearly structural inspection	Drain down	<ul style="list-style-type: none"> • Undertake during dry weather, and when sand is due to be replaced or other clean out required. • Block off incoming and outgoing pipes to filter. • Pump out sedimentation chamber. • Use drain down valve (if present) to drain sand filter material. If no valve, remove as much ponded water as possible from surface.
	Remove filter material	<ul style="list-style-type: none"> • Carefully remove filter material avoiding damage to underdrain. Use sucker truck – material may also need to be loosened with shovel. • If necessary clear outlet and other components. • Geotextile around underdrain may need to be removed for inspection.
	Inspection	<ul style="list-style-type: none"> • Check inside of filter base, walls, weirs, spreader, baffles for cracking or damage. Minor hairline cracks may be repaired and reported to owner of sandfilter. More extensive damage may indicate unstable foundations. Report damage as soon as possible so structural inspection by engineer can be arranged. • Once inspection and repairs complete, reinstate sand filter and unblock inlet and outlet. (See Sand Filter Construction Guide).

TROUBLESHOOTING

SYMPTOM	POSSIBLE PROBLEMS	SOLUTION
Stormwater runoff bypasses sand filter	Diversion weir (if present) is blocked	<ul style="list-style-type: none">• Remove rubbish, leaves and debris
	Rubbish and debris blocking inlet pipe	<ul style="list-style-type: none">• Remove rubbish, leaves and debris.
Run off not draining through sand filter	Debris lying on filter – leaves, rubbish or crust formed on surface	<ul style="list-style-type: none">• Remove all debris.
	Layer of fine sediment crust formed on filter surface	<ul style="list-style-type: none">• Sediment crust may stop drainage – if this is present, rake off and remove.• Rake or till the surface of filter to minimum 50mm, and make surface level.• Replace with fresh material if necessary.
Overflow from filter chamber drains continually during small rainfall events	Filter bed is over-compacted	
	Filter not draining	<ul style="list-style-type: none">• To check filter drainage, fill the sediment chamber with low pressure water to overflow 200mm onto filter material, or monitor after rainfall fills to this level. If filter material is working, this should drain away within 48 hours.• If the filter is not draining, check the filter surface for crust (see above) or material for contamination – see below.• If still not draining, check underdrain – see below.
Filter chamber overflowing	Filter bed clogged or contaminants built up	<ul style="list-style-type: none">• Contaminants in the filter show up as darker material - dig into the surface to check. Remove using shovels or a sucker truck – remove minimum 50mm and replace with fresh material (do not compact).
	Underdrain clogged with material	<ul style="list-style-type: none">• Test drainage of filter by filling as described above, after changing filter material -see below.

TROUBLESHOOTING

TROUBLESHOOTING

SYMPTOM	POSSIBLE PROBLEMS	SOLUTION
Underdrain not flowing	Underdrain blocked	<ul style="list-style-type: none"> • Use CCTV via outlet manhole or inspection well to check for blockage or damage to underdrain. Use low pressure hose to gently backwash underdrain. • Use low pressure hose to gently backwash underdrain perforations and geotextile.
	Perforations in underdrain or geotextile clogged	
	Blocked diversion weir	<ul style="list-style-type: none"> • Remove rubbish, leaves and other debris.
	Debris blocking inlet pipe	<ul style="list-style-type: none"> • Clear debris.
Inlet submerged	Filter blocked	<ul style="list-style-type: none"> • See above.
	Underdrain damaged	<ul style="list-style-type: none"> • Refer to engineer for structural inspection.
Water level in filter is higher than usual	Overflow system may be blocked	<ul style="list-style-type: none"> • Clear overflow system of debris.
Sulphur smell	Organic material decomposing in filter material, or algae present on surface of filter bed.	<ul style="list-style-type: none"> • Rake and remove surface debris from filter bed. If algae present, rake or till top 50mm of material. • If smell persists, remove and replace top 50mm of filter material. • If smell still present, the filter bed may need full replacement.
Erosion of filter bed	Flow spitter is blocked creating unequal flow across filter.	<ul style="list-style-type: none"> • Clear flow splitter of debris.
	Filter surface is no longer at level of the weir between sediment and filter chamber	<ul style="list-style-type: none"> • Top up with fresh material and level off – do not compact.
	Part of underdrain blocked causing uneven drainage	<ul style="list-style-type: none"> • See underdrain blockage, above.
	Filter bed not level causing uneven flow across surface	<ul style="list-style-type: none"> • Top up with fresh material and level off – do not compact.

Quick checks

- ✓ Regularly remove rubbish, leaves, debris and weeds from inlet and outlets, weir baffles and surface of filter bed.
- ✓ Make sure filter material is levelled off after maintenance.
- ✓ Replace soil mix with a mix of sandy loam, sand or loam compost. Ready-made rain garden soil mix is available from some garden centres and horticultural suppliers.

Avoid

- ✗ DO NOT use sprays to kill vegetation or algae on filter bed surface as this will contaminate downstream waterways.
- ✗ DO NOT compact the filter material mix – use hydraulic compaction by filling sediment tank with low pressure water to gently overflow onto filter surface and draining away.
- ✗ DO NOT enter filter for maintenance unless trained and certified for confined space entry.

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