

1.1 Operation and maintenance requirements

1.1.1 Inspections - Frequency and methodology

At least one scheduled inspection should take place per year with maintenance following as warranted. Ideally, inspection should be performed prior to the winter season. During the inspection, the need for maintenance should be determined. It is also important to check the condition of the StormFilter™ after major storms for potential damage caused by high flows and for sediment accumulation that may be caused by localised erosion in the drainage area. This is recommended for all stormwater BMP's and is not a weakness of the StormFilter™ technology. It may be necessary to adjust the inspection/maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time. Ideally, maintenance should occur in summer when flows into the system are less likely to be present.

1.1.2 Maintenance triggers and rationale

The need for maintenance is typically based on the results of an inspection. The following criteria should be used as a guideline for when maintenance is required:

- * Sediment loading on vault floor could be an indication that the mass loading capacity of the system has been reached. If there is greater than 150mm of accumulated sediment, maintenance is required.
- * Sediment loading on top of the cartridges could be an indication that the influent water is not passing through the cartridges at the design flow rate (suspended sediment has time to settle out instead of passing through the filtration media). If there is greater than 10 mm of accumulated sediment on top of the cartridges, maintenance is required. This recommendation does not apply to volume or detention StormFilters where temporary storage is provided in the vault above the cartridges.
- * Submerged cartridges could indicate that the cartridges are completely plugged. However, this could also be due to backwater conditions caused by high groundwater, plugged pipes, or high hydraulic grade lines. Completely plugged cartridges could also be associated with heavy oil and grease loading, which might require additional source control measures. If there is greater than 150mm of static water in the cartridge compartment for more than 24 hours after the end of the rain event, maintenance is required.

- * Plugged media could be an indication that the mass loading capacity of the system has been reached. If pore space between the media granules is absent, maintenance is required.
- * Prolonged bypass flow could indicate that the cartridges are in bypass and that the mass loading capacity of the system has been reached. If an inspection is conducted during an average rainfall event and the StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
- * The presence of hazardous materials could indicate a spill. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
- * The presence of a pronounced scum line could indicate excessive bypass. If a pronounced scum line (greater than 10 mm thick) is present about the cartridge top cap, maintenance is required. This recommendation does not apply to volume or detention StormFilters where temporary storage is provided in the vault above the cartridges.
- * Finally, a history of the maintenance of all systems is kept in maintenance files held by Stormwater360. This helps to provide an understanding of maintenance requirements over time. If a system has not been maintained for 3 years, maintenance is recommended.

1.1.3 Maintenance methodology

Depending on the configuration of the particular system, maintenance personnel may be required to enter the system to perform maintenance. If this is required, OSH rules for confined space entry must be followed.

The first step in maintaining the StormFilter system is to open and vent the system (as applicable) and then perform a visual inspection of the system, both internally and externally. Next, the cartridges and spent media are removed from the system. This may be accomplished in one of two ways:

- 1) the full cartridges can be detached from the under-drain manifold and removed from the vault using appropriate lifting equipment, or
- 2) the cartridges can be detached from the under-drain manifold, tipped to the side to dump the spent media onto the floor of the vault, and then the empty cartridges are manually removed from the vault. Once the cartridges have been removed, the accumulated sediment (and spent media) on the floor of the vault and in the forebay (if applicable) are removed. Typically, this is most easily achieved using a "vactor" truck. Alternatively, an 80mm "vactor" hose can be used to remove the spent media directly from the cartridge. The structure should then be inspected for structural conditions and new cartridges are lowered into the system and connected to the under-drain manifold. This is most easily achieved with lifting equipment.

Collected sediment and spent media should then be disposed of in accordance with applicable regulations. Consideration should be made for the disposal of both liquid and solid wastes. Empty cartridges are returned to Stormwater360 to be cleaned, refurbished, and/or updated for use at another site. More information is provided on maintenance in the appendices

1.1.4 Maintenance area accessibility by people and equipment

Depending on the type of StormFilter system installed, confined space entry may be required. If this is the case, personnel should follow appropriate confined space entry procedures and use appropriate equipment. Maintenance equipment, such as "vactor" trucks and/or lifting equipment should have full access to the system.

1.1.5 Estimated maintenance frequency and basis for determination

Generally, the design maintenance frequency for the StormFilter is between 1 and 3 years, based on extensive experience with rainfall conditions, typical site loadings, and multiple system installations in the Auckland area. On a site-by-site basis however, maintenance frequency should be determined during the site evaluation and inspection process.

Additionally, maintenance should be performed in the event of a spill or other unusual loading event. The design life of the concrete structures is typically 50 years. The design life of the cartridges is typically 25 years, assuming annual maintenance has been performed. Cartridges have a life time warranty when Stormwater360 provides a full service or the StormFilter cartridge exchange programs are used for every service.

1.1.6 Maintenance service contract availability

Maintenance service contracts are available through Stormwater360 or approved service providers. These providers have been trained to provide inspections and maintenance of all StormFilter systems. Stormwater360 can offer replacement cartridges directly to the owner, or to the service provider. The service provider typically provides all field services related to maintenance. Costs vary by size and type of the system, as well as location of the site, and are managed by the service provider. Costs vary in terms of the filtration media options.

1.1.7 Cartridge Exchange

Optimum performance of the StormFilter relies on correctly functioning cartridges. This in turn relies on correct and full maintenance of the cartridge. This includes:

- * Correctly sourced media
- * Correctly prepared media
- * Cleaning of the cartridge
- * Correct disposal of cleaning residues
- * Replacement of cartridge disposals e.g. mesh

It should be noted that all stormwater BMP's require specialised activities. For example, a rain garden needs weeding, pruning, plant and mulch replacement, watering and soil infiltration, and/or tests to ensure the BMP is working as designed and not creating additional management issues.

To address this issue and protect the integrity of the product, Stormwater360 offers two maintenance options viz the full service and cartridge exchange options. For the full-service option, Stormwater360 manages the complete maintenance operation. Full-service reports and maintenance photographs are provided to the owner/resource consent holder. With cartridge exchange, spent and empty cartridges are returned to Stormwater 360 for refurbishment and refilling and a service report is not supplied by Stormwater360.

In order to ensure that the cartridge is fully functional, Stormwater 360 offers a lifetime warranty (conditions apply) on the cartridges provided that either of these maintenance services are employed.