Stormwater360

# Filterra® & Filterra® Bioscape

## Operation and Maintenance Manual

DRAFT (for site-specific guidelines email maintenance@stormwater360.co.nz)

# INTRODUCTION

This document, and the information within, are provided to be used only as a guide. This document is intended to provide general information for the operation and maintenance of the Filterra device ("the product"). This document is not intended to be comprehensive health and safety guidelines for the operation and/or maintenance of the Filterra device, which are the responsibility of the owner of the device. Users of this document are encouraged to consult professional advice before taking any course of action related to information, ideas or opinions expressed in this document.

**Disclaimer** Information in this document is subject to change without notice and does not represent a commitment on the part of Stormwater360 New Zealand. Stormwater360 New Zealand makes no representations or warranties, implied or otherwise, that, amongst others, the information available from this document are free from errors or omissions. Nothing in this document should be construed as an expressed warranty or an implied warranty of Merchantability or fitness for any particular purpose.

# Table of Contents

## Site Specific Details

This section is to be filled out by the asset owner following installation and commissioning of Filterra devices. For assistance in filling out this form please contact our Maintenance Manager via 0800 STORMWATER. Please return completed forms via email to maintenance@stormwater360.co.nz.

**Project Name:**

**Project Address:**

**Resource Consent Number:**

**Building Consent Number:**

**Consent/Site Owner:**

**Consent/Site Owner Address:**



Table 1; Summary of Installed Filterra

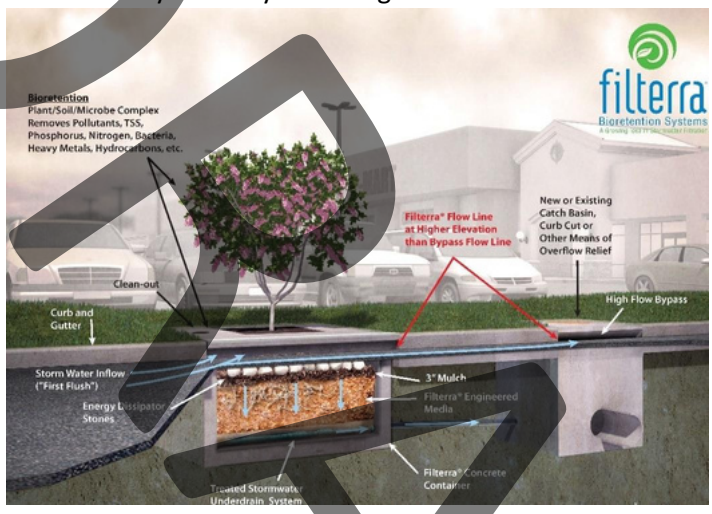
| Stormwater360 Filterra Reference # | Filterra® Model | Commissioning Date | Max Catchment Area (m2) | Estimated Maintenance Frequency |
|---|---|---|---|---|
| | | | | 6 Months |
| | | | | 6 Months |
| | | | | 6 Months |
| | | | | 6 Months |
| | | | | 6 Months |
| | | | | 6 Months |
| | | | | 6 Months |

# General Description

The following general specifications describe the general operations and maintenance requirements for the Stormwater360 New Zealand stormwater biofiltration systems, the Filterra® and Filterra® Bioscape. The systems utilise physical, chemical, and biological mechanisms of a soil, plant, and microbe complex to remove pollutants typically found in urban stormwater runoff.

## Filterra®

Stormwater flows through a specially designed filter media mixture contained in a landscaped concrete container. The mixture immobilises pollutants which are then decomposed, volatilised, and incorporated into the biomass of the Filterra® system's micro/macro fauna and flora. Stormwater runoff flows through the media and into an underdrain system at the bottom of the container, where the treated water is discharged. Typically, higher flows bypass the Filterra® to a downstream catchpit. Maintenance is a simple, inexpensive, and safe operation that does not require confined space access, pumping or vacuum equipment or specialised tools. Properly trained landscape personnel can effectively maintain Filterra® Stormwater systems by following the instructions in this manual.




## Filterra® Bioscape

The Filterra® Bioscape shares all the same mechanisms as the Filterra, however, it offers a custom solution for larger catchment areas (i.e., 1 hectare or larger). It does not require a concrete structure; a permeable or impermeable liner can be used depending on site conditions and requirements. The Filterra® Bioscape requires a collaborative approach between the consulting engineer, contractor, and Stormwater360. It follows the same maintenance approach as the Filterra®.

## Basic Operations

Contaminated stormwater runoff enters through the inlet and spreads over the 75mm layer of mulch on the surface of the filter media. As the water passes through the mulch layer, most of the larger sediment particles and heavy metals are removed through sedimentation and chemical reactions within the organic material in the mulch. Water passes through the soil media where the finer particles are removed, and other chemical reactions take place to immobilise and capture pollutants in the soil media. The cleansed water passes into an underdrain and flows to a pipe system or other appropriate discharge point. Once the pollutants are

in the soil, the bacteria begin to break down and metabolise the materials and the plants begin to uptake and metabolise the pollutants. Some pollutants such as heavy metals, which are chemically bound to organic particles in the mulch, are released over time as the organic matter decomposes to release the metals to the feeder roots of the plants and the cells of the bacteria in the soil where they remain and are recycled. Other pollutants such as phosphorus are chemically bound to the soil particles and released slowly back to the plants and bacteria and used in their metabolic processes. Nitrogen goes through a very complex variety of biochemical processes where it can ultimately end up in the plant/bacteria biomass, turned to nitrogen gas or dissolved back into the water column as nitrates depending on soil temperature, pH and the availability of oxygen. The pollutants ultimately are retained in the mulch, soil, and biomass with some passing out of the system into the air or back into the water.

### Design and Installation

Each project presents different scopes for the use of Filterra®/Bioscape systems. To ensure the safe and specified function of the stormwater BMP, Stormwater360 reviews each application before supply. Information and help may be provided to the design engineer during the planning process. Correct sizing (by rainfall region) is essential to predict pollutant removal rates for a given area. The engineer shall submit calculations for approval by the local jurisdiction. The contractor is responsible for the correct installation of Filterra units as shown in approved plans.

## Maintenance

### Why Maintain?

All stormwater treatment systems require maintenance for effective operation. Insufficient maintenance (of any stormwater treatment system) can result in:

- Clogging due to debris or sediment, leading to reduced flow or storage capacity.
- A reduction in system pollutant removal ability.
- Failure to comply with local authority regulations.
- Costly repairs.

Simple maintenance of the Filterra® is required to continue effective pollutant removal from stormwater runoff before discharge into downstream waters. This procedure will also extend the longevity of the living biofilter system. The unit will recycle and accumulate pollutants within the biomass, but is also subjected to other materials, such as trash, silt and leaves etc. Too much silt may inhibit the Filterra's® flow rate, which is why the site must be stabilised before commissioning can occur. Regular replacement of the mulch stops accumulation of such sediment.

## When to Maintain?

Stormwater360 includes a 1-year maintenance plan with each system purchase. Annual included maintenance consists of a maximum of two scheduled maintenances. Additional maintenance may be necessary depending on sediment and trash loading (by Asset Owner at additional cost). The start of the maintenance plan begins when the system is activated for full operation, i.e., commissioned by Stormwater360. Commissioning cannot be carried out until the site is fully stabilized (full landscaping, grass cover, final paving and street sweeping completed).
It has been found that in regions which receive between 750-1300mm of annual rainfall, two maintenances are generally required; regions with less rainfall may only require one visit per annum (please discuss with Stormwater360 to determine whether this is applicable for your site). Varying land uses can affect maintenance frequency, e.g., some fast-food restaurants require more frequent trash removal. Contributing drainage areas which are subject to new development wherein the recommended erosion and sediment control measures have not been implemented may require additional maintenance visits.

Some sites may be subjected to extreme sediment or trash loads, requiring more frequent maintenance visits. This is the reason for detailed notes of maintenance actions per unit, helping the Asset Owner predict future maintenance frequencies, reflecting site-specific conditions.

Owners must promptly notify the (maintenance) Supplier of any damage to the plant(s), which constitute(s) an integral part of the biofiltration technology. Owners should also advise other landscape or maintenance contractors to leave all maintenance to the Filterra® maintenance Supplier (i.e., no pruning or fertilizing).

## Media Replacement

Assuming the Filterra or Filterra® Bioscape is regularly maintained in accordance with this manual no significant replacement of media should be required excluding an event outside the design scope, i.e., excessive sediment (e.g., from construction runoff), flooding, vandalism, oil or chemical spills, high concentration stormwater from illicit discharges, or toxic substances outside design parameters such as herbicides.

## Plant Health

Vegetation is an integral part of the system as it remediates the filter media of the captured pollutants to then be incorporated into the plants biomass. If the plant(s) health is compromised and requires replacement contact Stormwater360. If this is during the first year of operation Stormwater360 will replace the plant(s) assuming reasonable care of the unit/plant(s) has been taken. If this occurs outside the first year of operation the plants should be replaced with the same plant(s) originally used, otherwise contact Stormwater360.

## Exclusion of Services

It is the responsibility of the owner to provide adequate irrigation, when necessary, to the plant of the Filterra® system. Clean up due to major contamination such as oils, chemicals, toxic spills, etc. will result in additional costs and are not covered under the Supplier maintenance contract. Should a major contamination event occur the Owner must block off the outlet pipe of the Filterra® (where the cleaned runoff drains to) and block off the inlet of the Filterra®. Stormwater360 should be informed immediately for instructions on how to assess damages and possible remedial works.

## Inspection After Large Storm Event

In the event of rainfall of more than 20mm over a 24-hour period, the System must be inspected. If this occurs within the first year of operation an inspection report must be sent to SW360 within 15 days.

## Maintenance Visit Summary

Each maintenance visit consists of the following simple tasks (detailed instructions below). 1. Inspection of Filterra® and surrounding area. 2. Lift tree grate (if applicable) and remove energy dissipating rocks. 3. Removal of debris, trash, and mulch. 4. Mulch and energy dissipating rock replacement. 5. Plant health evaluation and pruning or replacement as necessary. 6. Clean area around Filterra®. 7. Complete paperwork.

## Maintenance Tools, Safety Equipment and Supplies

Ideal tools include: camera (phone), bucket, shovel, broom, pruners, hoe/rake, and tape measure. Appropriate Personal Protective Equipment (PPE) should be used in accordance with local or company procedures. This may include high visibility clothing, hard hats, steel-capped boots, impervious gloves where the type of trash is unknown, and barricades when working near traffic.



### Mulch

Most visits require minor trash removal and a full replacement of mulch. See below for actual number of bagged mulch that is required in each unit size.

Only Stormwater360 approved mulches should be used, for example Daltons “megamulch”. The approved mulches have been tested to ensure:

- Less than 25% floating material.
- Possess a shape and structure that is conducive to matting together.
- Minimal fines.
- No release of dissolved ortho-phosphorus.

| Box Length (m) | Box Width (m) | Filter Surface Area ($m^2$) | Volume at 75mm ($m^3$) | # of 40L Mulch Bags |
|---|---|---|---|---|
| 1.2 | 1.2 | 1.44 | 0.108 | 3 |
| 1.8 | 1.2 | 2.16 | 0.162 | 5 |
| 2.4 | 1.2 | 2.88 | 0.216 | 6 |
| 1.8 | 1.8 | 3.24 | 0.243 | 7 |
| 2.4 | 1.8 | 4.32 | 0.324 | 9 |
| 3.0 | 1.8 | 5.40 | 0.406 | 11 |
| 3.6 | 1.8 | 6.48 | 0.486 | 13 |
| 4.0 | 2.1 | 8.40 | 0.636 | 16 |

# Maintenance Visit Procedure

Keep sufficient documentation of maintenance actions to predict location specific maintenance frequencies and needs. An example blank comprehensive Maintenance Report is included in the appendices (Appendix A). Key considerations are listed below in the grey boxes.

### 1. Inspection of Filterra® and surrounding area

- **Record asset ID before maintenance accompanied by a photograph. Record on Maintenance Report (see key considerations below) the following:**

Record on Maintenance Report the following:

| | |
|---|---|
| Standing Water Evident | Y/N |
| Structural Damage | Y/N |
| Bypass Clogged | Y/N |

If yes answered to any of these observations, record with close-up photograph

### 2.Lift tree grate (if applicable) and remove energy dissipating rock

- Lift tree grate (if present) to gain entry to the Filterra.
- Assess the unit's general condition.
- Remove energy dissipating rock, keep nearby for future replacement.

Record on Maintenance Report the following:

| | |
|---|---|
| Sufficient Energy Dissipating Rock | Y/N |
| Silt/Clay Present | Y/N |
| Trash/Litter | Y/N |
| Leaves/Organic Debris | Y/N |

Additional Notes/Concerns:

### 3.Removal of debris, trash, and mulch

- After removal of mulch and debris, measure or approximate the distance from top of media to bypass level, this will provide the ponding depth. This should be 230mm for standard units and 165mm for shallow units.

Record on Maintenance Report the following:

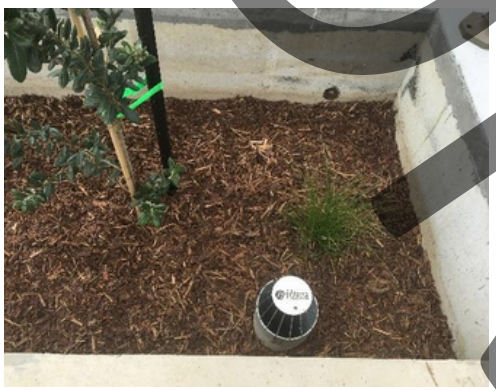
Ponding Depth (mm) _____

## 4. Mulch and energy dissipating rock replacement

- Please see mulch specifications.
- Add double shredded mulch evenly across the entire unit to a depth of 75mm.
- Ensure correct repositioning of energy dissipating rock by the Filterra® inlet to minimise the risk of scour.
- Replace Filterra® grates (if applicable).
- Measure the distance from the high point of the Filterra to the top of the mulch layer, this will provide the Filterra depth.

Record on Maintenance Report the following:

Filterra Depth (mm) _____



## 5. Plant health evaluation and pruning or replacement as necessary

- Examine the plant's health and replace if dead.
- Prune as necessary to encourage growth in the correct directions.

Record on Maintenance Report the following:

Type of Plant(s) _____
Height of Plant(s) (mm) _____
Width at Widest Point (mm) _____
General Health of Plants _____

## 6. Clean area around Filterra®

- Clean area around unit and remove all refuse to be disposed of in accordance with local regulations.

## 7. Complete paperwork

- Measurements, detailed comments on concerns, and photographs are key inputs for a good maintenance report.
- Deliver Maintenance Report and photographs to appropriate location (Stormwater360 during maintenance contract period, otherwise Asset Owner).
- Some jurisdictions may require submission of maintenance reports in accordance with approvals. It is the responsibility of the Owner to comply with local regulations.

## Maintenance Checklist

| Drainage System Failure | Problem | Conditions to Check | Condition that Should Exist | Actions |
|---|---|---|---|---|
| Inlet | Excessive sediment or trash accumulation. | Accumulated sediments or trash impair free flow of water into Filterra. | Inlet should be free of obstructions allowing free distributed flow of water into Filterra. | Sediments and/or trash should be removed. |
| Mulch Cover | Trash and floatable debris accumulation. | Excessive trash and/or debris accumulation. | Minimal trash or other debris on mulch cover. | Trash and debris should be removed, and mulch cover raked level. Ensure bark nugget mulch is not used. |
| Mulch Cover | "Ponding" of water on mulch cover. | "Ponding" in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils. | Stormwater should drain freely and evenly through mulch cover. | Recommend contact manufacturer and replace mulch as a minimum. |
| Vegetation | Plants not growing or in poor condition. | Soil/mulch too wet. Evidence of spill. Incorrect plant selection. Pest infestation. Vandalism to plants. | Plants should be healthy and pest free. | Replace plant with current plant selection. Contact Stormwater360 if unsure. |
| Vegetation | Plant growth excessive. | Plants should be an appropriate species to the location of the Filterra. | Plants should clump and be an appropriate size. | Trim/prune plants in accordance with typical safety needs. |
| Structure | Structure has visible cracks. | Cracks wider than 15mm or evidence of soil particles entering the structure through the cracks. | Structure should be uncompromised and sound. | Containment structure should be repaired. |
| *Maintenance is ideally to be performed twice annually.* | | | | |

# APPENDIX A: Filterra® Maintenance Report

**Asset Owner:**
**Company Owner: Contact Name:**

**Phone Number:**
**Email Address:**

## Site Details:

**Site address:**
**Start time:**
**Date of inspection:**
**Asset ID:**
**Weather:**
**Travel time:**

**Location of FT:** GPS coordinates
**SW360 job ID:**
**Reason for visit:**
**Personnel:**
**PPE:**

## System Observation:

**Filterra name plate present:**
**Months in service:**
**Bypass clear:**
**Mulch breaking down:**
**Removed trash:**
**Grate damage:**
**Remove silt and clay:**
**Energy dissipation rock present:**
**Filterra depth (mm):**
**Amount of media added:**
**Additional information general:**

**Is the Filterra aesthetically pleasing?:**
**Needs maintenance: Mulch still in place: Structural damage: Standing water: Excessive sediment build up: Inspection port: Sufficient rocks: Media to bypass (mm):**

## Plant Health:

**Plant type:**
**Tree health:**
**Width at widest point:**
**Damage to plants:**
**Organic matter/leaf litter build up:**
**Weeds present:**
**Planting height less than design water depth:**
**Vegetation is in good density:**

**Tree/plant height:**
**Shrub Health:**
**Plant spreading:**
**Tree replaced:**
**Plant replaced:**
**Mowing/slashing required:**
**Evidence of erosion:**
**Additional information on vegetation:**

## Inlet/Pipes/Bypass:

**Are inflow areas in good condition:**
**Are perforated pipes in good condition:**

**Are bypass grates in good condition:**
**Additional information on Inlet/Outlet Pipes:**

## Other Details

**Mulch replaced:**
**Issues requiring attention:**
**Presence of construction material:**
**Comments:**

**Amount replaced:**
**Presence of vandalism:**
**Finish time:**
**Next maintenance:**

**Images:**

**~~Before Maintenance~~:**
**General:**
**Issues (if present):**

**After Maintenance:**
**General:**
**Inlet:**
**Bypass:**
**Mulch:**
**Vegetation:**