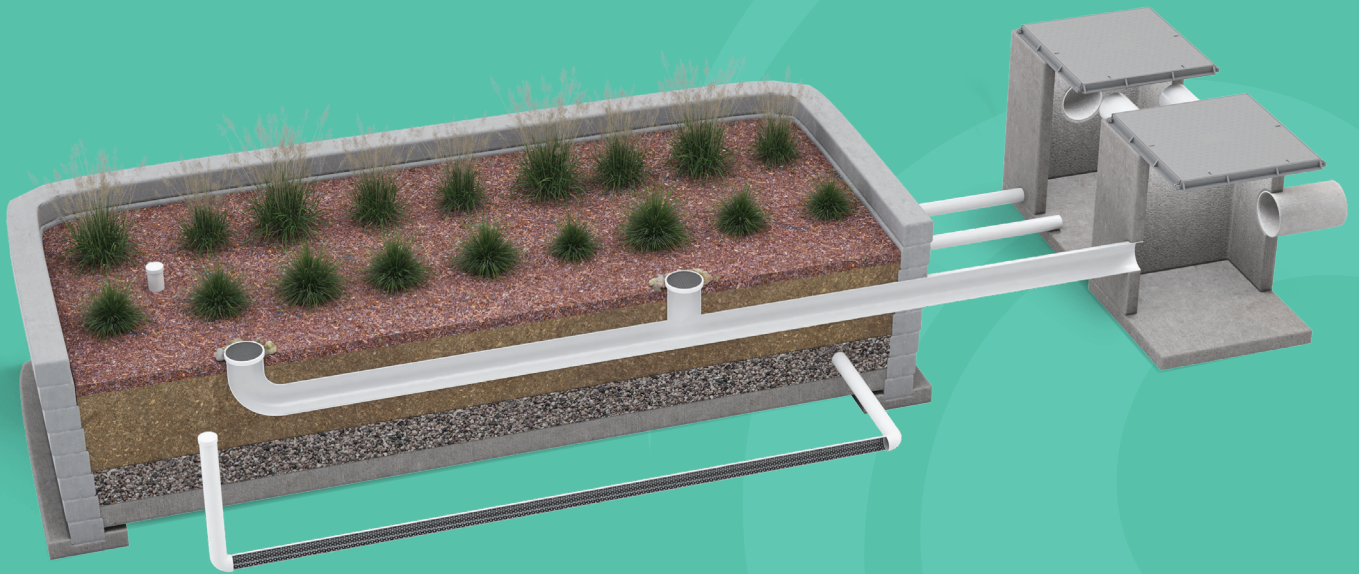
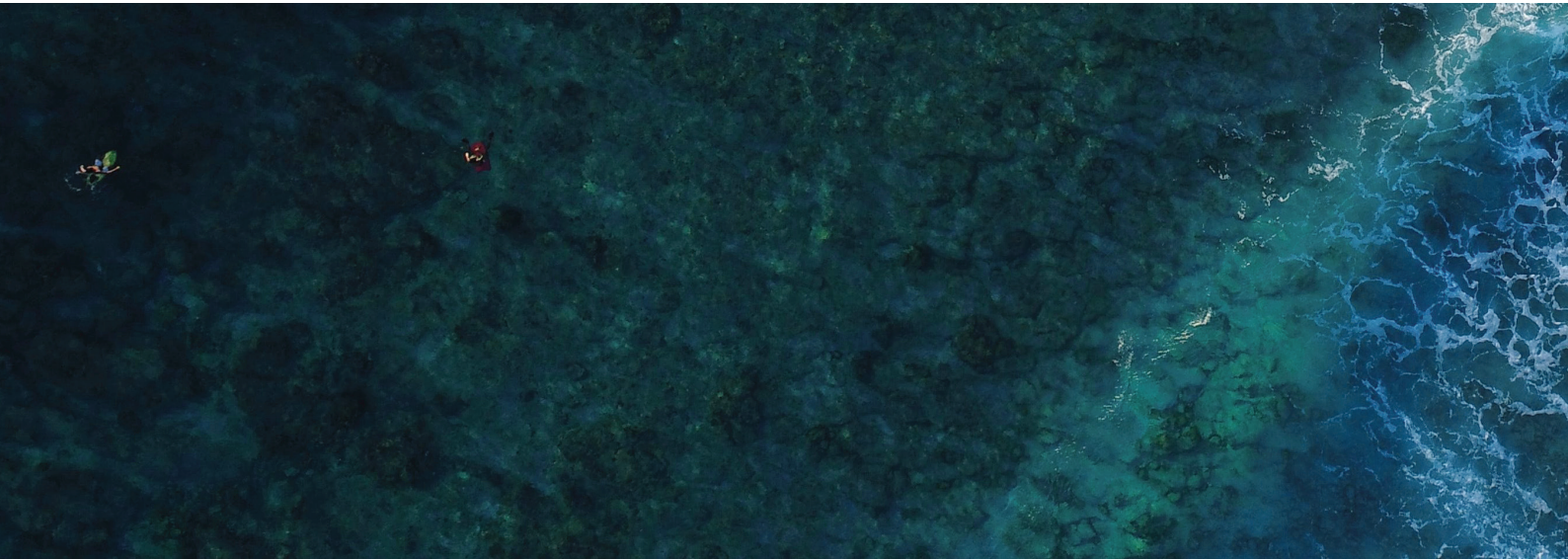


Filterra®

Operations & Maintenance Manual



Stopping Pollution Entering Waterways



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Overview

General Description

The following general specifications describe the operations and maintenance requirements for the Ocean Protect stormwater biofiltration system, the Filterra®.

The system utilises physical, chemical and biological mechanisms of a soil, plant and microbe complex to remove pollutants typically found in urban stormwater runoff. The treatment system can be a fully equipped, pre-constructed drop-in place unit or a Bioscape basin system designed for applications in the urban landscape to treat contaminated stormwater runoff.

Stormwater flows through a specially designed filter media mixture where pollutants are immobilized, decomposed, volatilized and incorporated into the biomass of the Filterra® system's micro/macro fauna and flora. Stormwater runoff flows through into an underdrain pipe at the bottom of the system where the treated water is discharged. Higher flows are designed to bypass the Filterra® to a downstream structure.

Maintenance is simple, inexpensive and a safe operation that does not require confined space access, pumping or vacuum equipment or specialized tools. Properly trained landscape personnel can effectively maintain Filterra® Stormwater systems by following instructions in this manual.

Basic Operations

During a storm, stormwater enters the Filterra® biofiltration system through a pipe, kerb inlet, or sheet flow and ponds over the pre-treatment mulch layer, capturing heavy sediment and debris. Organics and microorganisms within the mulch layer trap and degrade metals and hydrocarbons. The mulch also provides a water retention function for the system's vegetation.

Stormwater then flows through the engineered high flow media, filtering fine pollutants and nutrients. Organic material in the media remove dissolved metals and act as a food source for root-zone microorganisms. Treated water exits through an underdrain pipe or infiltrates (if designed accordingly).

Design and Installation

Each project presents different scopes for the use of Filterra® systems. To ensure the safe and specified function of the stormwater BMP, Ocean Protect reviews each application before supply. Information and help may be provided to the design engineer during the planning process. Correct Filterra® sizing (by MUSIC and/ or mass load analyses) is essential to predict pollutant removal rates for a given area. The contractor is responsible for the correct installation of Filterra precast units as shown in approved plans. At any time, Ocean Protect staff and engineers are available to meet during planning stages to run through installation procedures.

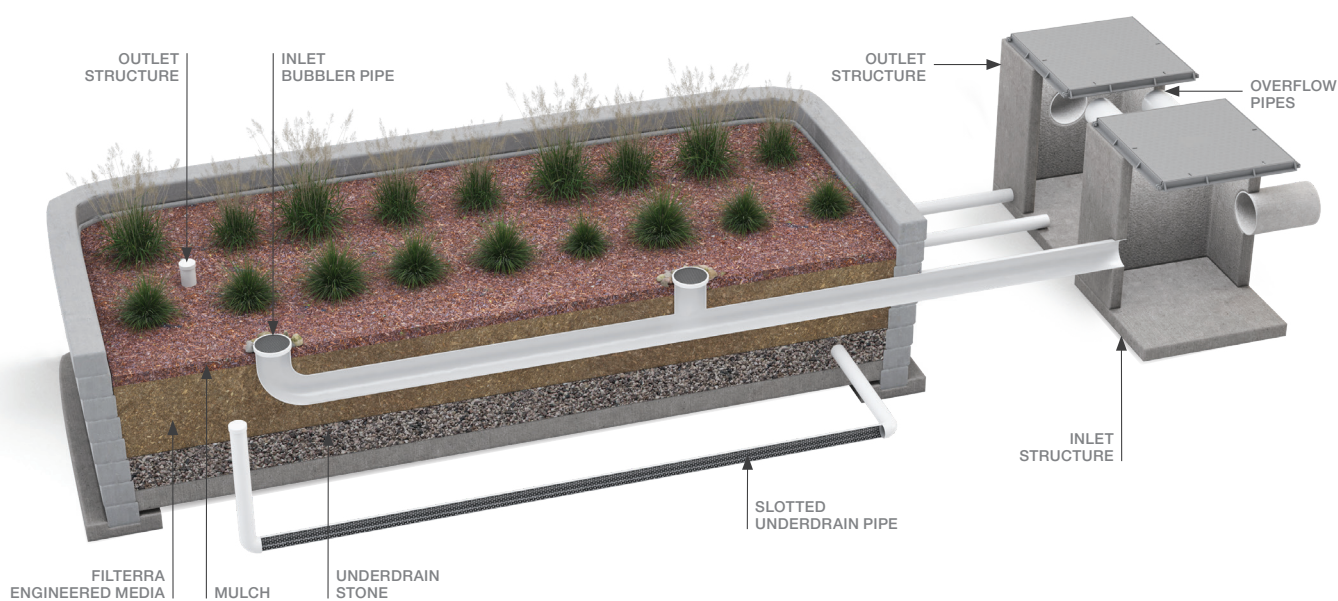


Figure 1: Filterra® components

Maintenance

All stormwater treatment systems require maintenance for effective operation. This necessity is often incorporated within the development approval process and documentation as a legally binding BMP maintenance agreement.

- Avoid legal challenges from your Council's maintenance enforcement program
- Prolong the expected lifespan of your Filterra® media
- Avoid more costly media replacement
- Help reduce pollutant loads leaving your property

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 system will recycle and accumulate pollutants within the biomass, but is also subjected to other materials collected during stormwater runoff. This may include litter, silt, leaves etc. which will be contained on top of the mulch layer. Too much silt may inhibit the Filterra's flow rate, which is the reason for site stabilisation before activation. Regular replacement of the mulch stops accumulation of such sediment.

Ocean Protect includes a minimum 1-year maintenance plan with each system purchase. Annual included maintenance consists of a maximum of one to two (1-2) scheduled visits. Additional maintenance may be necessary depending on sediment and litter loading (by Owner or at additional cost). The start of the maintenance plan begins when the system is activated for full operation. Full operation is defined as the system installed, kerb and gutter and transitions in place and activation (by Ocean Protect) when mulch and plant/s are added and temporary protection/offline baffles removed.

Activation cannot be carried out until the site is fully stabilised (full landscaping, grass cover, final paving and street sweeping completed). Maintenance visits are scheduled by Ocean Protect.

A first inspection to determine if maintenance is necessary should be performed at least twice annually or after every major storm event of greater than (25-40mm) twenty-five to forty millimetres total depth (subject to regional climate). Please refer to the maintenance checklist for specific conditions that indicate if maintenance is necessary.

It has been found that in regions which receive greater than 760mm of annual rainfall (without rainwater tanks installed on-lot), (2) two visits are generally required. Regions with less rainfall often only require (1) one visit per annum. Varying land uses can affect maintenance frequency (e.g. some fast food restaurants require more frequent litter removal). Contributing drainage areas which are subject to new development wherein the recommended erosion and sediment control measures have not been implemented require additional maintenance visits.

Some sites may be subjected to extreme sediment or litter loads, requiring more frequent maintenance visits. This is the reason for detailed notes of maintenance actions per unit, helping the Supplier and Owner predict future maintenance frequencies, reflecting individual site 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 Ocean Protect (i.e. no pruning or fertilizing).

Exclusion of Services

It is the responsibility of the owner to provide adequate irrigation when necessary to the plant of the Filterra® system. Please contact Ocean Protect for advice on water requirements if prolonged dry periods or abnormally low rainfall occur.

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, such as drop-inlet) and block off the throat/inlet of the Filterra®. The Supplier should be informed immediately.

Maintenance Visit Summary

Regardless of the type of Filterra® system (e.g. Precast Pit Filterra, Filterra Bioscape) the processes for maintenance is the same. Each maintenance visit consists of the following simple tasks (detailed instructions below).

- 1 Inspection of Filterra® and surrounding area
- 2 Removal of tree grate and erosion control stones (for precast systems)
Removal of pollutants from forebay area (for bioscape systems)
- 3 Removal of debris, litter and mulch
- 4 Mulch replacement
- 5 Plant health evaluation and pruning or replacement as necessary
- 6 Clean area around Filterra® as required
- 7 Complete paperwork

Maintenance Tools Safety Equipment and Supplies

Ideal tools include camera, 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 impervious gloves where the type of litter is unknown, high visibility clothing and barricades when working in close proximity to traffic and also safety hats and shoes. A T-Bar or crowbar should be used for moving the tree grates (up to 70kg ea.).

Ocean Protect should be contacted for details about the mulch volume required. Ocean Protect also offers complimentary laboratory testing for mulch if sourced independently ensuring compliant mulch is used in the system.

Maintenance Visit Procedure – Precast Filterra® System



1 Inspection of Filterra® and surrounding area

Record individual unit before maintenance with photograph (numbered). Record on Maintenance Report (see example on page 13) the following:

Record on Maintenance Report the following:	
Standing Water	Y / N
Damage to Box Structure	Y / N
Damage to Grate	Y / N
Is Bypass Clear	Y / N

If YES answered to any of these observations, record with close-up photograph (numbered)



2 Removal of tree grate and erosion control stones

Remove metal grates for access into Filterra® box.

Dig out silt (if any) and mulch and remove litter & foreign items.

Record on Maintenance Report the following:	
Silt / Clay	Y / N
Cups / Bags	Y / N
Leaves	Y / N
Buckets Removed	# of

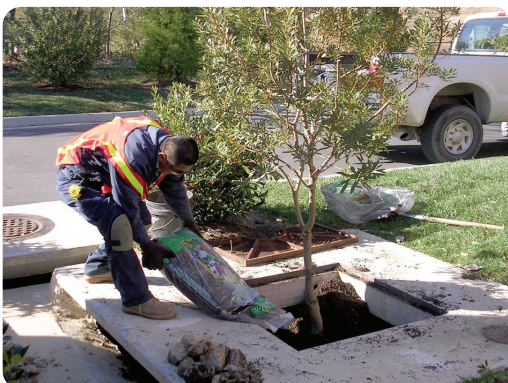


3 Removal of debris, litter and mulch

After removal of mulch and debris, measure distance from the top of the Filterra® engineered media soil to the bottom of the top slab.

If this distance is greater than 305mm, add Filterra® media (not top soil or other) to recharge to a 230mm distance.

Record on Maintenance Report the following:	
Distance to Bottom of Top Slab	(mm)
Buckets of Media Added	# of



4 Mulch replacement

Add double shredded mulch evenly across the entire unit to a depth of 75mm.

Ensure correct repositioning of erosion control stones by the Filterra® inlet to allow for entry of litter during a storm event.

Replace Filterra® grates correctly using appropriate lifting or moving tools, taking care not to damage the plant.



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:

Height above Grate	(mm)
Width at Widest Point	(mm)
Health	Alive/Dead
Damage to Plant	Y / N
Plant Replaced	Y / N



6 Clean area around Filterra®

Clean area around unit and remove all refuse to be disposed of appropriately.



7 Complete paperwork

Deliver Maintenance Report and photographs to appropriate location (normally Ocean Protect during maintenance contract period).

Some Council's may require submission of maintenance reports in accordance with approvals. It is the responsibility of the Owner to comply with local regulations.

Maintenance Visit Procedure – Bioscape Filterra® System



1 Inspection of Filterra® and surrounding area

Record individual unit before maintenance with photograph (numbered). Record on Maintenance Report (see *example on page 13*) the following:

Record on Maintenance Report the following:

Standing Water	Y / N
Damage to Forebay Structure	Y / N
Damage to Grate	Y / N
Is Bypass Clear	Y / N

If YES answered to any of these observations, record with close-up photograph (numbered)



2 Removal Forebay pollutions and erosion control stones

Dig out silt (if any) and mulch and remove litter & foreign items.

Record on Maintenance Report the following:

Silt / Clay	Y / N
Cups / Bags	Y / N
Leaves	Y / N
Buckets Removed	# of



3 Removal of debris, litter and mulch

After removal of mulch and debris, measure distance from the top of the Filterra® engineered media soil to the bottom of the top slab.

If this distance is greater than 305mm, add Filterra® media (not top soil or other) to recharge to a 230mm distance.

Record on Maintenance Report the following:

Distance to Bottom of Top Slab	(mm)
Buckets of Media Added	# of



4 Mulch replacement

Add double shredded mulch evenly across the entire unit to a depth of 75mm.

Ensure correct repositioning of erosion control stones by the Filterra® inlet to allow for entry of litter during a storm event.



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:

Height above Grate	(mm)
Width at Widest Point	(mm)
Health	Alive/Dead
Damage to Plant	Y / N
Plant Replaced	Y / N



6 Clean area around Filterra®

Clean area around unit and remove all refuse to be disposed of appropriately.



7 Complete paperwork

Deliver Maintenance Report and photographs to appropriate location (normally Ocean Protect during maintenance contract period).

Some Council's 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 For	Conditions That Should Exist	Actions
Inlet	Excessive sediment or litter accumulation	Accumulated sediments and litter impair free flow of water into Filterra®	Inlet should be free of obstructions allowing free distributed flow of water into Filterra®	Sediments and/or litter should be removed
Mulch Cover	Litter and floatable debris accumulation	Excessive litter and/or debris accumulation	Minimal litter or other debris on mulch cover	Litter and debris should be removed and mulch cover raked level. Ensure bark nugget /woodchip 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	Contact manufacturer for advice
Vegetation	Plant growth excessive	Plants should be appropriate to the species and location of Filterra®		Trim/prune plants in accordance with typical landscaping and safety needs
Structure	Structure has visible cracks	Cracks wider than ½ inch or evidence of soil particles entering the structure through the cracks		Vault should be repaired
<p>Maintenance is ideally to be performed twice annually. Inspection to be performed after every major storm event >25-40mm total depth, subject to climate.</p>				

Filterra® Project Maintenance Order

Project Address	
Directions	
Project Owner	
Company	
Contact Name	
Telephone#	
Owner Notified of Mtce on (date)	
Filterra Units on this Order Total	
Units on this Project	
Date of Maintenance	
Arrival Time	
Departure Time	
# of Workers	
Notes on Project	
Maintenance Supervisor	

Filterra® Structure Maintenance Report

Project		Structure Number	
Plant Type		Structure Size	
Date		GPS	
		Pre Mtce Photo #	

Initial Observations			
Standing Water	Y	N	Damage to Grate
(IF Yes, STOP NOW & call 1300 354 722)			Is Bypass Clear
			Notes
Damage to Box/Forebay Structure	Y / N		
(If YES to any observation take close-up photo)			

Waste			
Silt / Clay	Y	N	Buckets Removed (# of)
Cups / Bags	Y	N	Notes
Leaves	Y	N	
Other			

Media			
Distance to Bottom of Top Slab (mm)			Notes
Buckets of Media Added (# of)			

Mulch			
Netting Replaced	Y	N	Bags of Mulch Added (# of)
Stones Replaced	Y	N	Notes

Plant	#1	(#2)	#1	(#2)
Height above Grate (mm)			Plant Replaced	Y / N
Width at Widest Point (mm)			Notes	Y / N
Health	Alive/Dead	Alive/Dead		
Damage to Plant	Y / N	Y / N		
(If YES to plant damage, take close-up photo)				

Other Notes (use back if necessary)

Resources

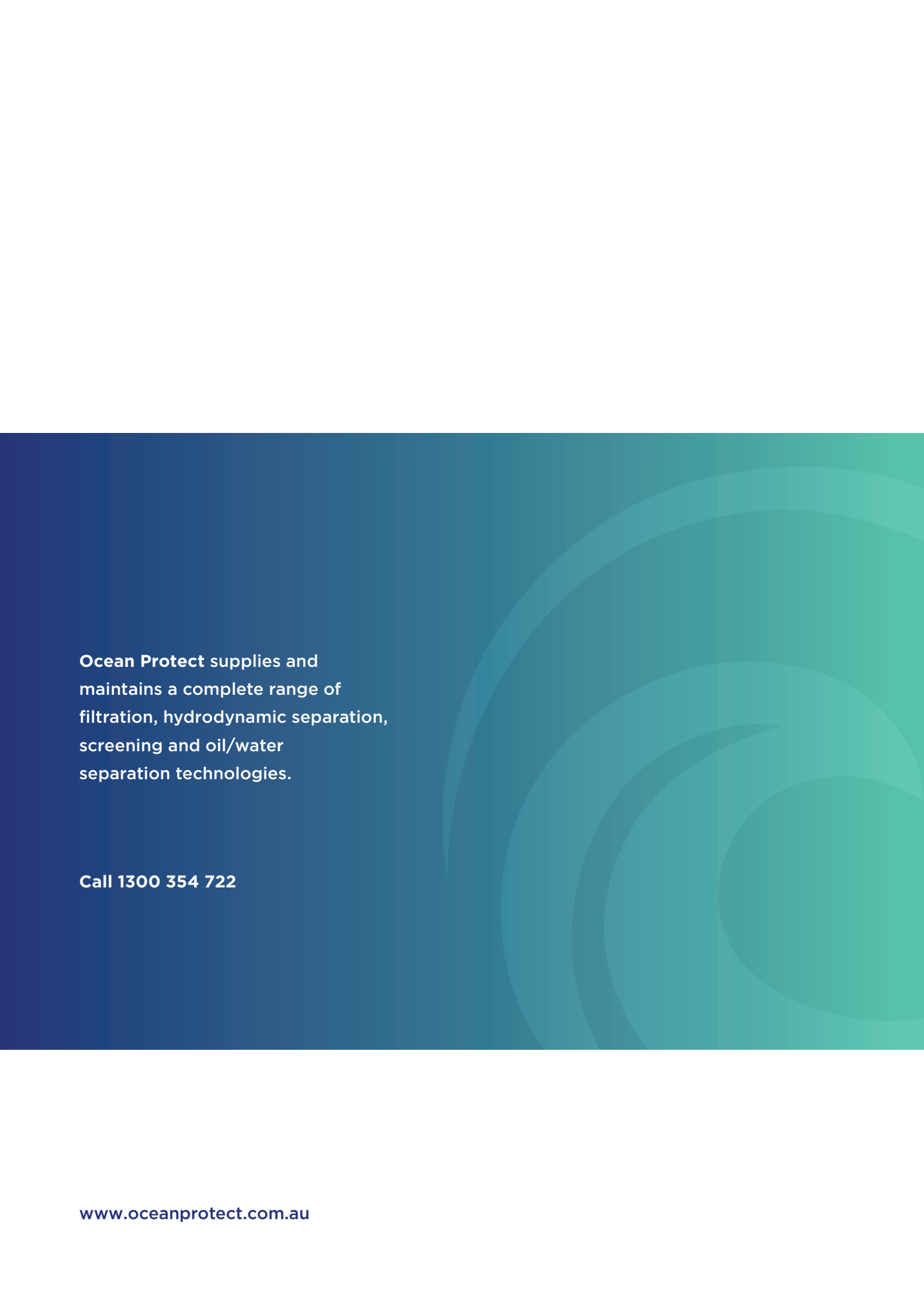
Filterra® Warranty

Seller warrants goods sold hereunder against defects in materials and workmanship only, for a period of (1) year from date the Seller activates the system into service. Seller makes no other warranties, express or implied.

Seller's liability hereunder shall be conditioned upon the Buyer's installation, maintenance, and service of the goods in strict compliance with the written instructions and specifications provided by the Seller. Any deviation from Seller's instructions and specifications or any abuse or neglect shall void warranties.

In the event of any claim upon Seller's warranty, the burden shall be upon the Buyer to prove strict compliance with all instructions and specifications provided by the Seller.

Seller's liability hereunder shall be limited only to the cost or replacement of the goods. Buyer agrees that Seller shall not be liable for any consequential losses arising from the purchase, installation, and/or use of the goods.



Ocean Protect supplies and maintains a complete range of filtration, hydrodynamic separation, screening and oil/water separation technologies.

Call 1300 354 722

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