Jellyfish Filter

Technical Design Guide

Table of Contents

Introduction

The Ocean Protect Jellyfish® filter is a compact, below ground stormwater treatment device, configured offline to capture pollutants in stormwater run-off. The Jellyfish filter uses high flow rate membrane filtration at low driving head with a large surface area to filter stormwater. By incorporating pre-treatment with light-weight membrane filtration, the Jellyfish Filter removes floatables, litter, oil, debris, TSS, fine silt-sized particles, and a high percentage of particulate-bound pollutants; including phosphorus and nitrogen, metals and hydrocarbons. The large surface area membrane cartridges, combined with up flow hydraulics, frequent backwashing, and rinsable/reusable cartridges ensure long-lasting performance.

Operational Overview

During a storm, the upstream bypass structure directs low flows to the Jellyfish. The system builds driving head, traps floating pollutants behind the Maintenance Access Wall (MAW) and drives flow below the cartridge deck where a separation skirt around the cartridges isolates oil, litter and debris outside the filtration zone. As a result of the upstream driving head, water is conveyed up from the treatment chamber through membrane tentacles and into the backwash pool. Once the water has filled the backwash pool, water overflows the weir and exits via the outlet pipe.

Once the rain event subsides flow reverses such that the water in the backwash pool flows back into the lower chamber. This passive backwash extends cartridge life and prepares the system for the next rainfall event. The drain down cartridge(s) located outside the backwash pool enables water levels to balance.

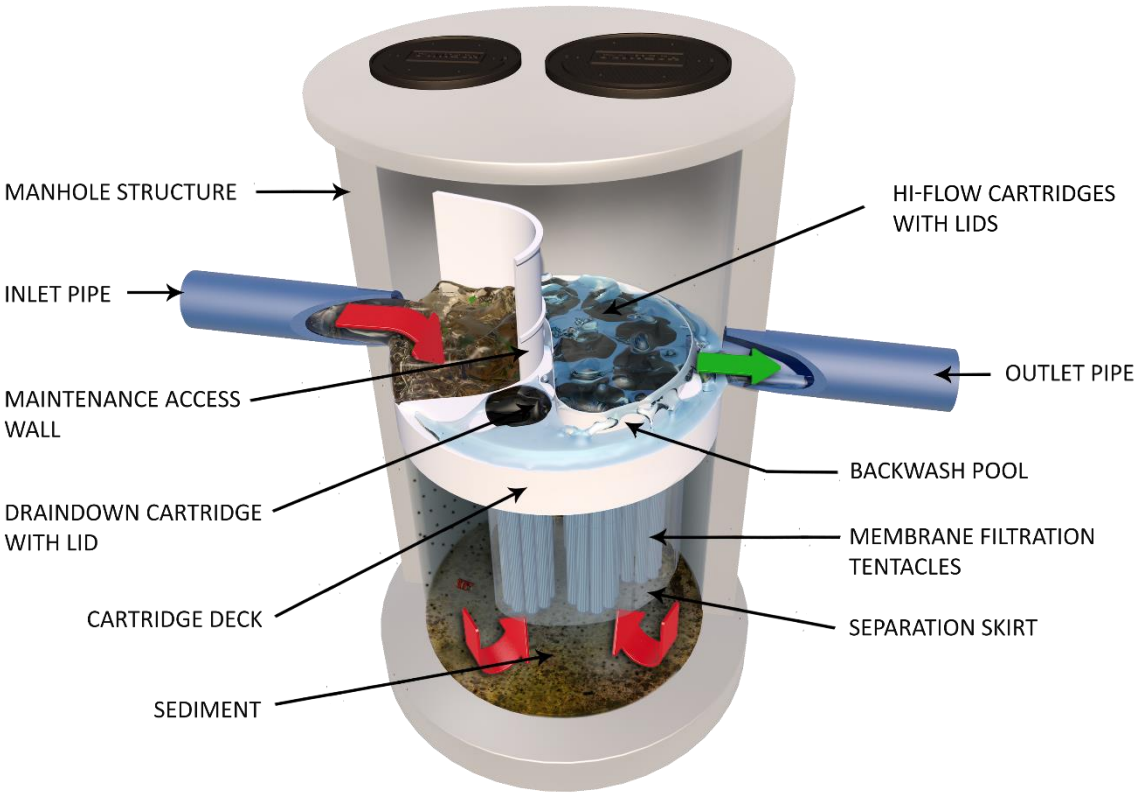

Figure 1: Jellyfish operation

Features

Each Jellyfish system consists of the following components:

- Maintenance Access Wall (MAW)
- Separation Skirt
- Filtration Zone (High-flow cartridges)
- Backwash Pool
- Drain-down cartridges

The Maintenance Access Wall is connected to the stormwater inlet pipe. It allows for the dissipation of flows and capture of floatable pollutants whilst reducing the quantity of coarse material and debris entering the Filtration Zone. The Separation Skirt provides further protection of the cartridges from coarse materials and hydrocarbons.

The High-flow and draindown cartridges available from Ocean Protect are offered in a 1375mm length. Each cartridge consists of 11 tentacles that are washable and re-usable. Each cartridge has a large surface area membrane together with a flow rate per cartridge of 5L/s providing the most compact footprint available on the market.

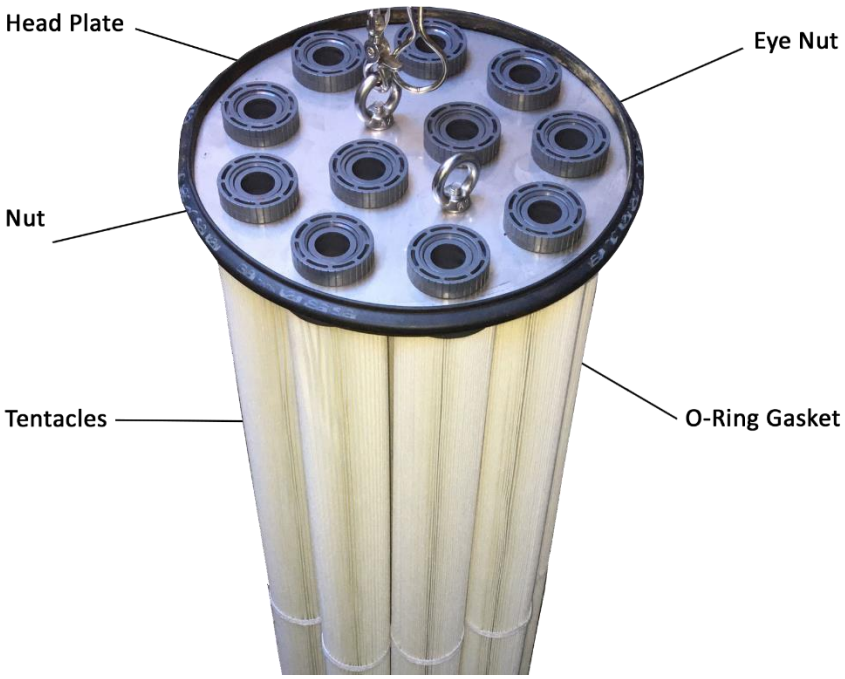

Figure 2: Jellyfish tentacle components

There are 2 hydraulic loss options for the Jellyfish system. Typically, 460mm of hydraulic loss is adopted, however for low drop sites, the designed hydraulic loss can be reduced to 230mm. The flow rates, head loss, and head drop for each system are shown in table 1 below.

Hydraulic Loss (mm)	High Flow cartridge flow rate (L/s)	Drain Down cartridge flow rate (L/s)	Minimum hydraulic drop (mm)
460	5.0	2.5	150
230	2.5	1.25	150

Table 1: Jellyfish cartridge details

Configurations

The Jellyfish treatment system can be housed in a variety of ways such that it suits the site specific requirements for flowrate, hydraulics, accessibility and footprint restrictions. The standard configuration offered by Ocean Protect is pre-cast concrete manholes. These systems are simple to install, as they arrive on site after being manufactured offsite to suit site specific requirements (pipe size, inlet/outlet orientation, levels etc.). Larger cast-in-place Jellyfish filter vaults are available to treat larger flows. Pre-cast Manhole Jellyfish Filter systems pre-configured (pipe size, location, unit height etc.) prior to arrival upon site for ease of installation.

Figure 3: Jellyfish precast manhole

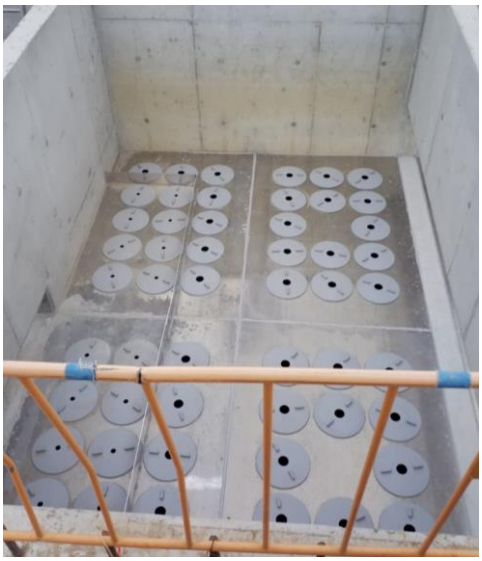

Figure 4: Jellyfish vault

Performance and Select Approvals

While laboratory testing provides a means to generate hydraulic and basic performance data, all filtration devices should also be complemented with long-term field data evaluations. As a minimum, field studies should generally comply with a recognised field testing protocol, for example, the Technology Acceptance Reciprocity Partnership (TARP) or the Technology Assessment Protocol – Ecology (TAPE) in the USA.

To be considered valid, all field monitoring programs should be peer reviewed by a reputable third party and replicate local pollutant concentrations including soluble fractions of nutrients together with rainfall. Ocean Protect has undertaken such field testing both locally in Australia and overseas, copies of the supporting articles are available upon request.

For almost 10 years the Jellyfish system has been successfully installed in a variety of applications to meet regulatory requirements set by authorities throughout Australia.

Specifically Jellyfish has been accepted by some of the most stringent stormwater quality regulators around the globe including;

- Brisbane City Council
- Wollondilly Shire Council
- Campbelltown City Council
- Blacktown City Council
- Washington State Department of Ecology (TAPE) GULD – Basic
- New Jersey Corporation of Advanced Technology (NJCAT)
    - Field Performance per TARP Tier II Protocol

- Canada ISO 14034 Environmental Management – Environmental Technology Verification (ETV)

Please contact your Ocean Protect representative to obtain the Jellyfish Filter approval status in your area.

Maintenance

Every manufactured filtration device will eventually need routine maintenance. The question is how often and how much it will cost. Proper evaluation of long-term maintenance costs should be a consideration when selecting a manufactured treatment device.

Jellyfish Filter cartridges are light weight and reusable and minor maintenance of the filter cartridges is performed by removing, rinsing and reusing the cartridge tentacles. Vacuum extraction of captured pollutants in the sump is recommended at the same time.

Full cartridge replacement intervals differ by site due to varying pollutant loading and type, and maintenance frequency and replacement is anticipated to be every 2-5 years.

Maintenance support

Ocean Protect provides flexible options and contract terms. A detailed maintenance guide and mass load calculation spreadsheet is available upon request.

For further information please refer to the Jellyfish Operations and Maintenance Manual (**click here**).

Design Basics

The design requirements of any Jellyfish system is detailed in 3 typical steps.

1. Hydraulic Design
2. Water Quality Design
3. Mass Load Design

1. Hydraulic Design

All Jellyfish systems must be designed to ensure that the hydraulic requirements of the system are met without adversely impacting the upstream hydraulics (limiting the likelihood of localised flooding). Table 1 (page 3) details the available head loss options. The designer must initially select an option and ensure the corresponding head loss can be catered for.

For a Jellyfish Filter head loss does not have to equal head drop. Head loss should be achieved through a differential of height between the inlet and outlet pipes, at a minimum of 150mm with the remainder created by an upstream diversion weir.

Jellyfish cartridges have a unique backflush mechanism that is passively activated at the end of each storm peak to increase the longevity of each cartridge. Consequently, captured pollutants are stored within the system and in order to minimise scour peak flows into the cartridge bay need to be limited. Specifically when peak flows surpass the combined cartridge treatment flow rate the system needs to be arranged off-line.

It is also necessary to consider the impacts that tail water/submergence has on all stormwater treatment devices. In the case of the Jellyfish, tailwater can adversely affect the long term cartridge operation. As such measures should be implemented during design to ensure that the system can operate effectively. If this cannot be achieved on your project an alternative treatment option, such as StormFilter, should be considered

2. Water Quality Design

Ocean Protect recommends and uses the widely endorsed Model for Urban Stormwater Improvement Conceptualisation (MUSIC), which makes it easy to correctly sizing an appropriate Jellyfish system for your site.

A complimentary design service which includes MUSIC modelling is provided by the Ocean Protect engineering team. Simply email your project details to design@oceanprotect.com.au or alternatively you can always call one of our engineers for a discussion or to arrange a meeting in your office. The team will provide you with an efficient design containing details of the devices required to meet your water quality objectives together with budget estimates, product drawings and the MUSIC (.sqz) file.

Alternatively, you can download the MUSIC treatment nodes for the Ocean Protect products from our website (www.oceanprotect.com.au).

When designing/modelling a Jellyfish system for water quality purposes in MUSIC, a single generic treatment node is utilised. The generic treatment node is utilised with relevant removal efficiencies inserted. These parameters can vary based on the jurisdiction (authority) of your project, relevant details can be obtained from Ocean Protect. The high-flow bypass figure is adjusted within the node to represent the treatable flow rate required to obtain water quality targets. Once finalised this figure can be matched with the system flow rates provided in Appendix 1.

All details such as drawings, specifications and maintenance manuals can also be downloaded for integration into your project's documentation. Additionally the Ocean Protect team is available to review your model and provide additional assistance and guidance on the configuration of the StormFilter system(s) for your project.

3. Mass Load Design

At the completion of your water quality design process (as above) it is necessary that maintenance frequency is considered in order to prevent excessive ongoing maintenance requirements. Ocean Protect recommends a minimum minor maintenance frequency of 6 months (rinsing) for the Jellyfish.

All filtration devices occlude overtime, consequently they have a maximum sediment capacity (TSS load). By analysing the mean annual load figures for the Jellyfish generic treatment node, the total annual retained TSS can be determined. To determine the minimum cartridge quantity required by mass load design, the annual retained TSS should be divided by the relevant cartridge sediment capacity. The Ocean Protect team can provide assistance and details on this process.

In determining the final cartridge quantity for your project, you must utilise the largest number of cartridges obtained from undertaking Water Quality and Mass Load design steps.

Appendix 1 – Jellyfish Precast Manhole Standard Configurations

Unit ID	High-flow Cartridges	Drain-down Cartridges	Flow Rate (L/s)	Approximate unit Diameter (m)
JF1200-1-1	1	1	7.5	1.2
JF1200-2-1	2	1	12.5	
JF2250-3-1	3	1	17.5	2.25
JF2250-4-1	4	1	22.5	
JF2250-5-1	5	1	27.5	
JF2250-6-1	6	1	32.5	
JF2250-7-2	7	2	40	
JF2250-8-2	8	2	45	
JF2250-9-2	9	2	50	
JF2250-10-2	10	2	55	
JF3250-11-2	11	2	60	3.25
JF3250-12-2	12	2	65	
JF3250-13-3	13	3	72.5	
JF3250-14-3	14	3	77.5	
JF3250-15-3	15	3	82.5	
JF3250-16-3	16	3	87.5	
JF3250-17-3	17	3	92.5	
JF3250-18-3	18	3	97.5	
JF3250-19-4	19	4	105	
JF3250-20-4	20	4	110	
JF3250-21-4	21	4	115	
JF3250-22-4	22	4	120	
JF3250-23-4	23	4	125	
JF3250-24-4	24	4	130	
JF3250-25-5	25	5	137.5	
JF3250-26-5	26	5	142.5	
JF3250-27-5	27	5	147.5	
JF3250-28-5	28	5	152.5	