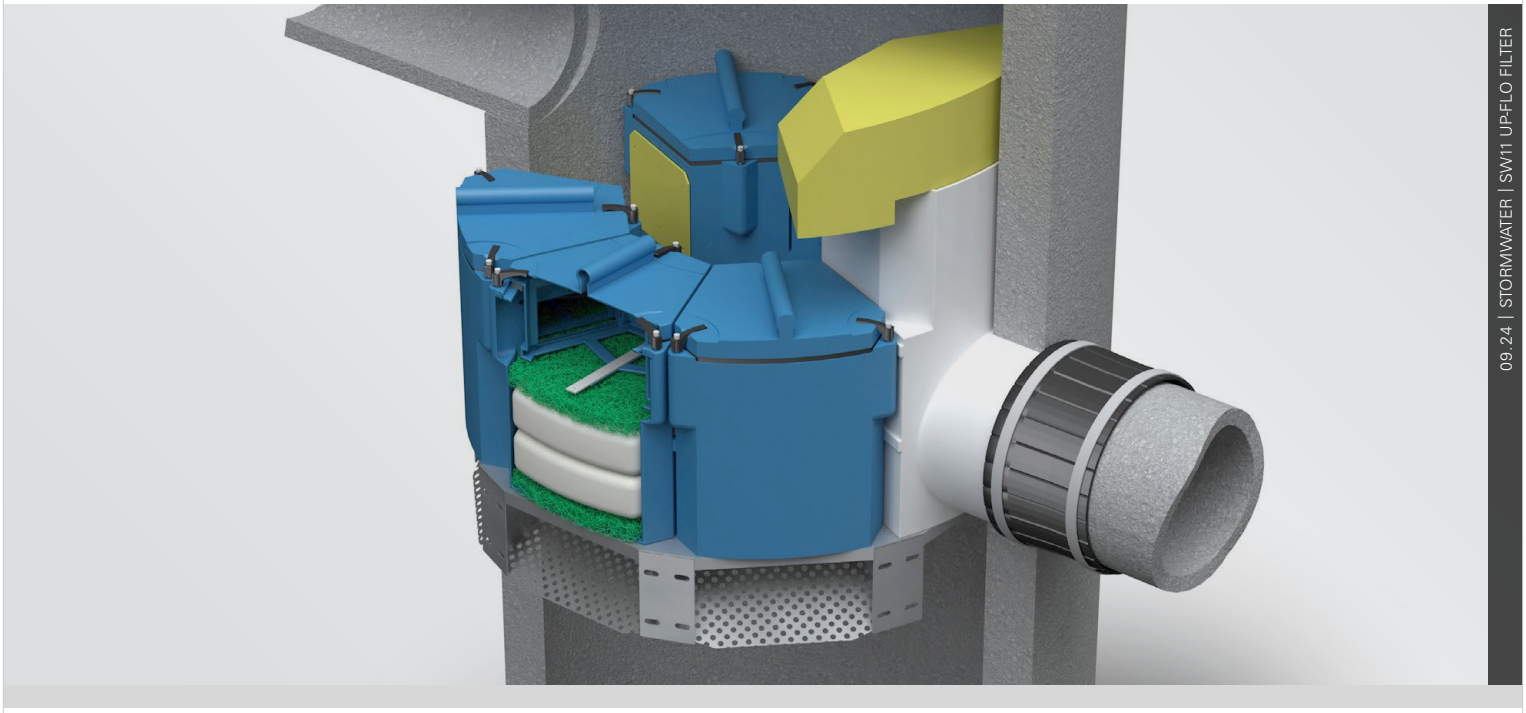
The Up-Flo® Filter

(Stormwater Treatment)

Technical Guide SW 11

This technical guide is designed for Land Developers, Civil Engineering Consultants, Councils and Installers to assist in the understanding of the Up-Flo® stormwater filter. This includes key design attributes, indicative sizing, hydraulic requirements, and FAQ's



Applications

- Small commercial carparks
- Large industrial hardstand areas
- Residential sub-divisions
- Municipal roadways
- Retrofit into existing urban catchments
- Upstream of wetland or river discharge

Product Attributes

- Designed to remove 90% TSS with a mean particle size of 20 microns
- Small footprint to maximise land use
- Simple and cost-effective maintenance
- In-line or off-line configurations
- Internally bypasses storms

Approvals/Standards

- Auckland Council Approval for Private & Public sites (PDEP)
- Christchurch City Council Approved Private & Public treatment device
- New Jersey Department of Environmental Protection, NJCAT Program
- ARC TP10 approval for removal of greater than 75 percent TSS

We are the supply partner of choice for New Zealand's stormwater management and treatment solutions.

HYNDS STORMWATER

The Up-Flo® Filter is a stormwater remedial device that incorporates gravitational separation and absorption of fine sediment, nutrients, heavy metals, oils & organics. It offers pre-screening and upward flow path filtration of polluted stormwater to achieve treatment train capabilities in a standalone small footprint device. Each Up-Flo® device consists of a highly configurable array of modules that are supplied as a complete system generally encased in a concrete manhole.

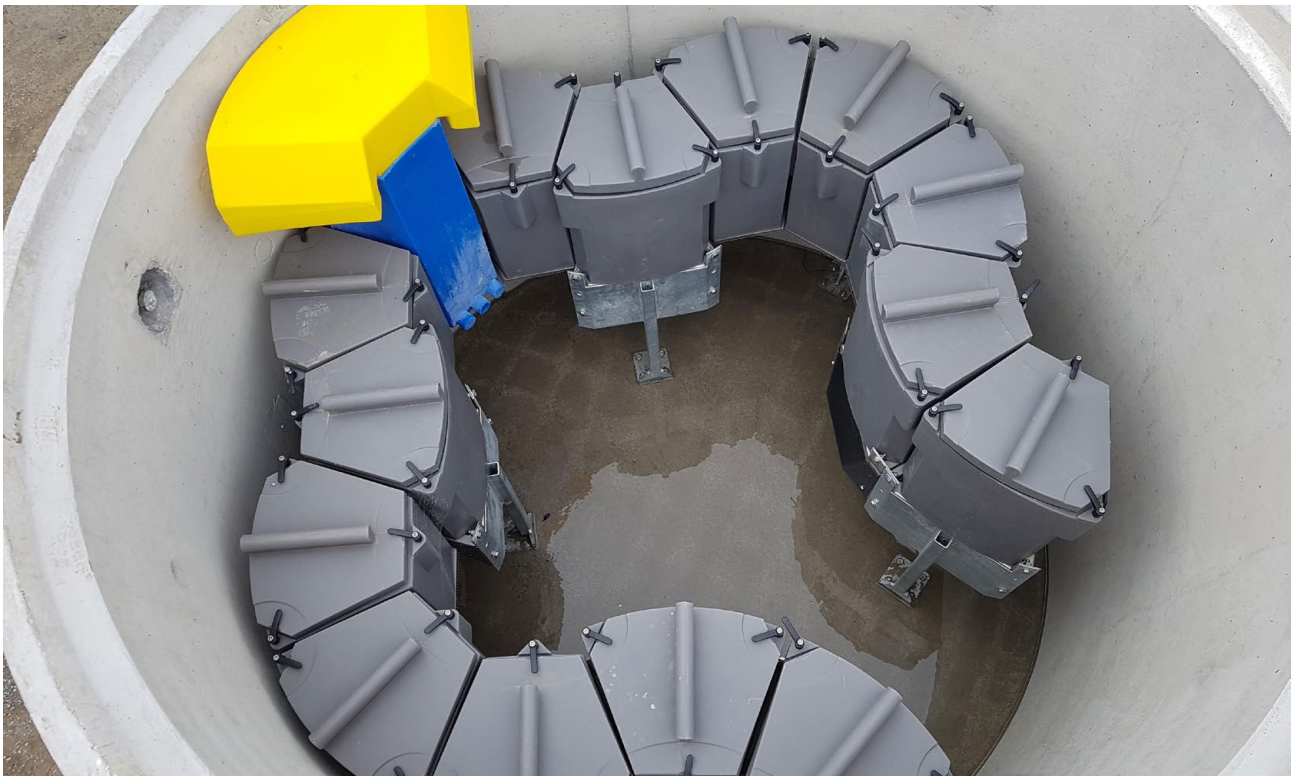


FIG. 1 14 module Up-Flo inside 2.3m dia manhole delivered to site and ready to operate. No assembly required.

Up-Flo Filter Components

- The Up-Flo® Filter has no moving parts and requires no external power.
- The internal components consist of the following:
  - Angled stainless steel screens
  - Filter modules
  - Bypass Siphon with a floatables baffle
  - Outlet module with a drain down port
- The filter module houses the media pack which consists of two filter media bags and two layers of flow distributing media comprising:
  - Carbon (granular activated) for filtration
  - Peat (organic, loose, not palletised) for absorption)
  - Zeolite (aluminosilicate mineral) for dissolved metals & some Nutrients

Design and Sizing

The Up-Flo® Filter is sized for either a specified catchment area, or a design flow rate to meet a water quality flow (WQF). Each individual filter module has a WQF of up to 1.58 L/s to meet the manufacturer's performance and design requirements (ref: NJCAT, US 2015).

Multiple versions of the Up-Flo Filter can be supplied depending on the available driving head and outlet Depth to Invert (DTI). Please email our nationwide Hynds stormwater Engineering team at ***hswsupport@hynds.co.nz*** and they will complete this task for you.

Due to the reduced head of the shallow outlet design (and subsequently lower flow rate); more filter modules are required to treat the equivalent area. The following tables are for indicative use only to represent approximate catchment areas that can be treated based on number of Up-Flo modules.

TABLE 1 **Auckland Council PDEP Approved Standard Design**
1-6 modules (drawing T7511) 7-10 modules (drawing T7495)

Hynds Sales Code	Manhole dia (m)	Outlet DTI (m)	Total Headloss (mm)	Max WQF (L/s)	Max carpark area based on 10mm/hr rainfall intensity (m2)
UP-FLO.1CKIT	Ø1.2	1.44	792	1.58	599
UP-FLO.2CKIT	Ø1.2	1.44	792	3.16	1197
UP-FLO.3CKIT	Ø1.2	1.44	792	4.74	1796
UP-FLO.4CKIT	Ø1.2	1.44	792	6.32	2395
UP-FLO.5CKIT	Ø1.2	1.44	792	7.9	2994
UP-FLO.6CKIT	Ø1.2	1.44	792	9.48	3592
UP-FLO.7CKIT	Ø1.8	1.59	842	11.06	4191
UP-FLO.8CKIT	Ø1.8	1.59	842	12.64	4790
UP-FLO.9CKIT	Ø2.0	1.59	842	14.22	5389
UP-FLO.10CKIT	Ø2.0	1.59	842	15.8	5987

TABLE 2 **Christchurch City Council Approved Standard Design**
1-6 modules (drawing E1000) 7-10 modules (drawing E1001)

Hynds Sales Code	Manhole dia (m)	Outlet DTI (m)	Total Headloss (mm)	Max WQF (L/s)	Max carpark area based on 5mm/hr rainfall intensity (m^2)
UP-FLO.1KIT	Ø1.2	1.296	750	1.58	1197
UP-FLO.2KIT	Ø1.2	1.296	750	3.16	2395
UP-FLO.3KIT	Ø1.2	1.296	750	4.74	3592
UP-FLO.4KIT	Ø1.2	1.296	750	6.32	4790
UP-FLO.5KIT	Ø1.2	1.296	750	7.9	5987
UP-FLO.6KIT	Ø1.2	1.296	750	9.48	7185
UP-FLO.7KIT	Ø1.8	1.59	750	11.06	8382
UP-FLO.8KIT	Ø1.8	1.59	750	12.64	9580
UP-FLO.9KIT	Ø1.8	1.59	750	14.22	10777
UP-FLO.10KIT	Ø1.8	1.59	750	15.8	11975

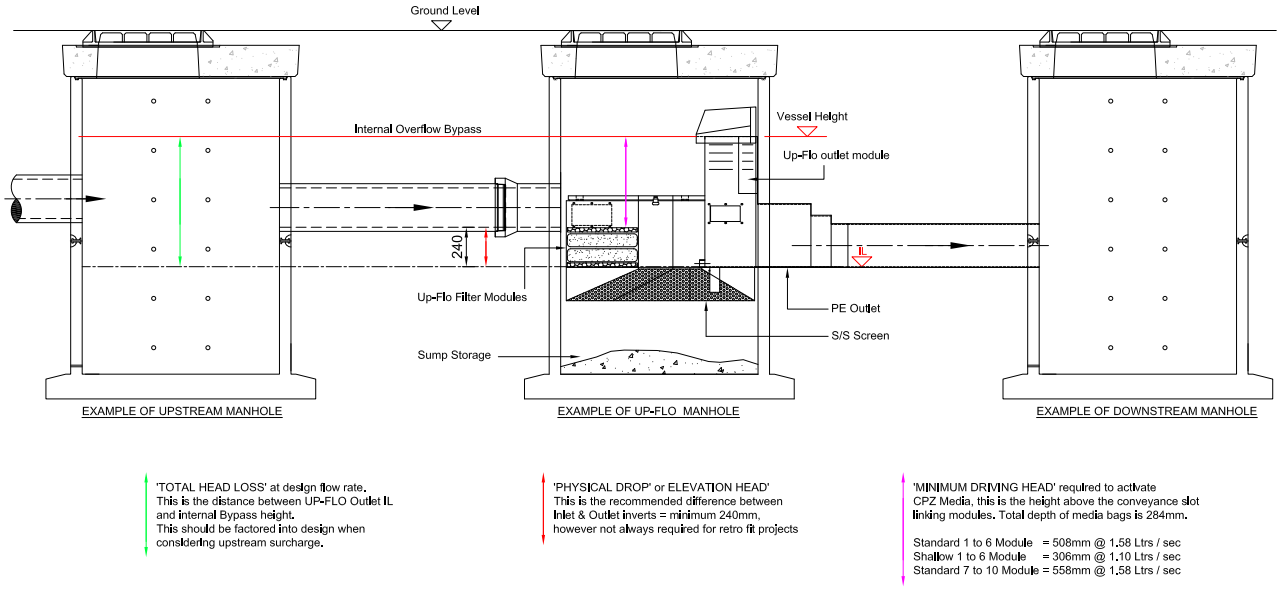
TABLE 3 **Low Driving Head Shallow Outlet Design South Island (Drawing E1122) North Island (T8669)**

Hynds Sales Code	Manhole dia (m)	Outlet DTI (m)	Total Headloss (mm)	Max WQF (L/s)	Max carpark area based on 10mm/hr rainfall intensity (m2)	Max carpark area based on 5mm/hr rainfall intensity (m2)
UP-FLO.1SKIT	Ø1.2	1.0	590	0.90	341	681
UP-FLO.2SKIT	Ø1.2	1.0	590	1.80	681	1363
UP-FLO.3SKIT	Ø1.2	1.0	590	2.90	1098	2195
UP-FLO.4SKIT	Ø1.2	1.0	590	3.80	1438	2876
UP-FLO.5SKIT	Ø1.2	1.0	590	4.70	1779	3558
UP-FLO.6SKIT	Ø1.2	1.0	590	5.80	2195	4390

NOTES:

- *Rainfall intensities of 5mm/hr and 10mm/hr as provided by Auckland, Wellington and Christchurch City Councils*
- *Carpark area based only on runoff coefficient value (c value) of asphalt = 0.95*
- *Calculations above based on accepted rational method equation as an indication of stormwater runoff*
- *These carpark areas are indicative only, Hynds is not liable for any sizing without supplying a formal Hynds calc sheet*
- *To size Up-Flo's for areas outside of Auckland and Christchurch please email* ***hswsupport@hynds.co.nz***
- *Larger Up-Flo standard designs for 10 modules + are available upon request*
- *North Island Up-Flo's supplied in Pinnacle Cast Manholes ex Pokeno*
- *South Island Up-Flo's supplied in Hyspec Spun Manholes ex Hornby*

Example of typical Up-Flo Filter Long Section Whilst Operating



Hydraulic Parameters

- Total head loss = upstream surcharge height above outlet invert during max WQF
- Internal bypass height = Total head loss
- Multiple inlet pipes = Yes
- Maximum online bypass flow rate = 115.0L/s*
- Recommended 'hydraulic drop' between inlet and outlet = 240mm**

Shallow outlet maximum online bypass flow rate = 45 L/s

****Please contact Hynds stormwater Engineering team to discuss alternative arrangements as this is not always required.***

Engineered for Performance

- Longer filter runs
- Higher flow capacities
- Resistant to clogging
- 'Self-cleans' during drain-down period
- Media is not submerged between events
- Media does not re-release captured materials

Maintenance & Safety-led Design

- The ONLY filter with lightweight media bags for easy removal and maintenance
- The Up-Flo takes less time to replace the media when compared with floor mounted cartridge filters
- Removal of filter bags does not require any lifting apparatus
- Refer to quick reference maintenance guide

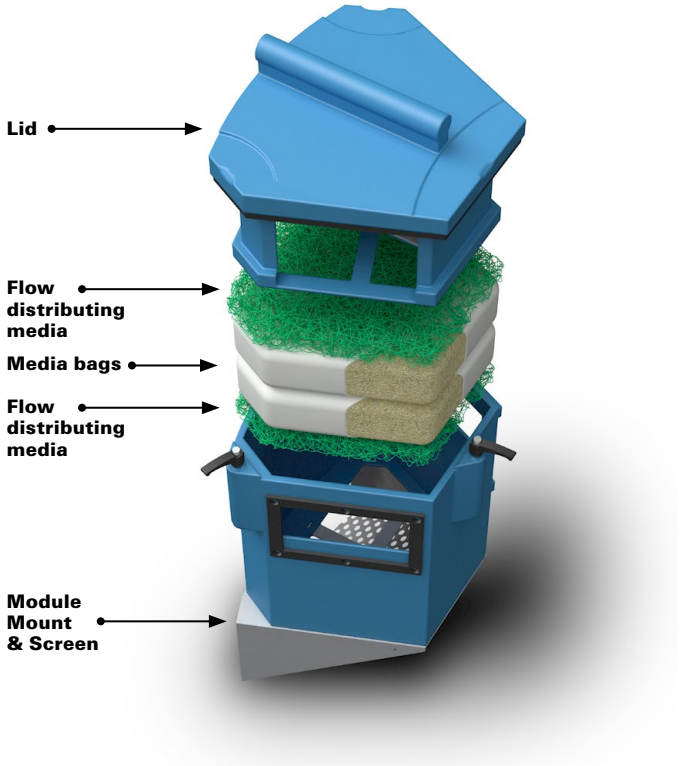


FIG. 2 Up-Flo® Filter Media Filter Module

How it Works

The Up-Flo® Filter comprises a three stage treatment train designed to achieve a high level of stormwater treatment. Coarse sediments are removed through settling. Gross pollutants are captured through screening, and fine particles are trapped through filtration. The function of the Up-Flo® Filter through each stage of a typical storm event is explained below.

- Treatment

During a rain event, stormwater runoff enters the chamber via an inlet pipe or overhead grate. Gross pollutants and sediment settle out in the sump. As water fills the chamber, flow is directed upwards through the angled screen into the filter module. Flow is evenly distributed across the media for maximum contact and treatment. Treated flow exits the filter module via a conveyance channel to a common outlet module.

- Siphonic Bypass

Flows in excess of the designed filtration capacity are discharged directly to the outlet using a siphonic bypass. The siphonic bypass also acts as a baffle, which prevents the escape of oils, grease, and buoyant pollutants. The shallow outlet design has a simple weir bypass, this also has a baffle to retain pollutants but at a reduced flow rate.

- Drain-down

In traditional stormwater filters, the treatment media is often continuously submerged in water which may cause the media conditions to change resulting in anaerobic bacterial growth, degradation of the filter media, and the release of harmful leachates. The Up-Flo® Filter has a patented drain-down system to ensure the filter media is not submerged between storm events. As a storm subsides, filtered water drains out of the chamber through the drain-down port at the base of the outlet module. The reverse gravity flow backwashes filter media, ensuring continued high flow rate and removal efficiencies over the duty life of the filter module (between maintenance cycles).

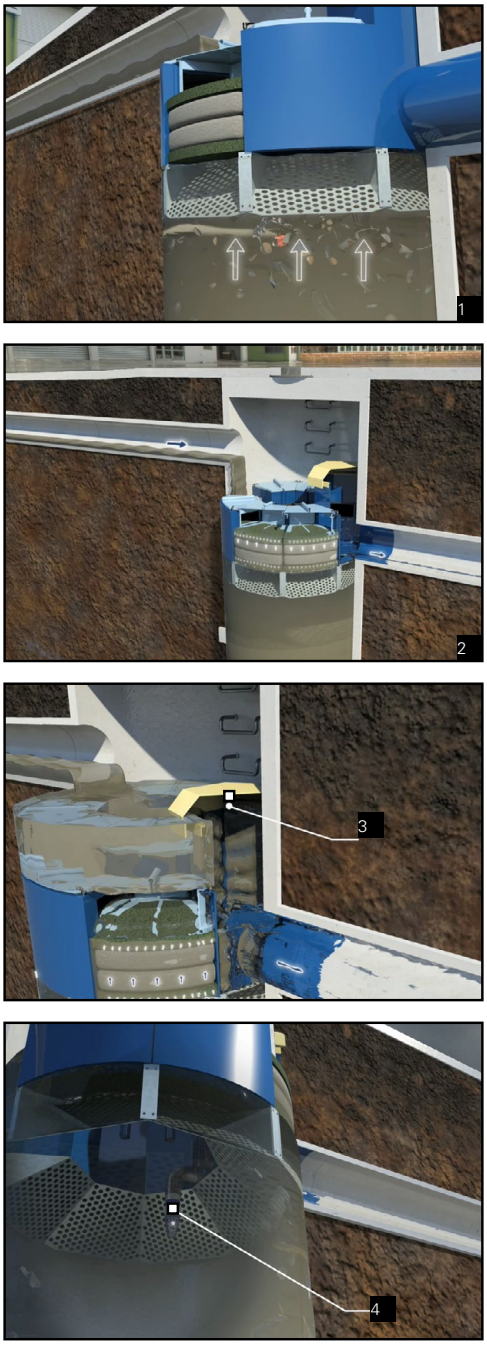


FIG. 3 Key functional stages of an Up-Flo® Filter in operation

Indicative Pollutant Removal Guide

The graph on the right indicates removal ranges based on ***Hydro International Up-Flo® Filter with CPZ™ Media Verification Statement***.

Verification is based on existing performance test data from two different locations with different rainfall characteristics, catchment areas and pollutant loadings. Supporting data were obtained from three independent performance monitoring studies.

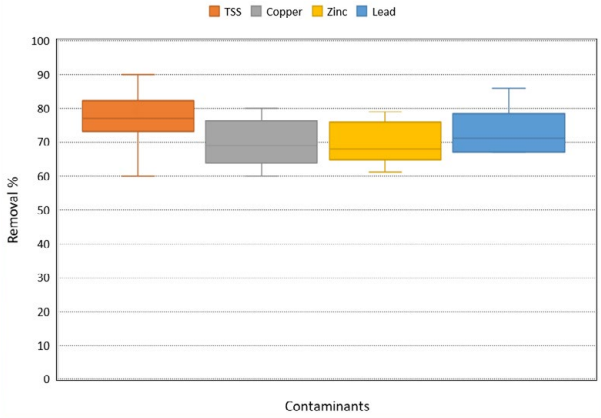


FIG. 4 Box and whisker graph depicting pollutant removal efficiency of the Up-Flo® Filter

Lifting and Handling

All Up-Flo® Filters incorporate Swiftlift lifting anchors for safe lifting and must be used with the correct lifting clutch.

Hynds Pipe Systems has designed and manufactured the Up-Flo® Filter with a minimum dynamic factor of 1.2. This dynamic factor requires that all the following conditions are observed when lifting, moving or placing the units:

1. Lifting with mobile plant *(such as an excavator or similar)* where equipment is specifically exempt from the requirements of the PECPR Regulations 1999, subject to the conditions outlined in the New Zealand Gazette, No. 104, September 2015 and
2. Lifting, travelling and placing over rough or uneven ground where anchor failure is not anticipated to cause harm or injury, by adopting procedures such as:
   a. Transporting the element as close as practical to ground level (300mm recommended)
   b. Establishing and maintaining exclusion zones
   c. Transporting only precast concrete elements that are unlikely to topple if they were to hit the ground
   d. Inspecting lifting anchors both after transportation and before final lifting into place

Refer to "Safe work with precast concrete - Handling, transportation and erection of precast concrete elements" published by Worksafe New Zealand (October 2018)

Shock loads resulting from travelling with suspended Up-Flo® over rough terrain and uneven ground may exceed design, dynamic and safety factors of the lifting systems. It is essential that care is taken during lifting and transporting as additional stresses could result in anchor failure.

FIG. 5 18 module Up-Flo inside a 3.0m dia manhole treating a 6,500m2 carpark at Featherston Railway station. Credit SDCL for image.

Frequently Asked Questions

How will the Up-Flo manhole arrive to site?

The Up-Flo manhole should be treated like any other manhole. Manhole installation depth is governed by outlet DTI. The Up-Flo will arrive ready to operate with the filter bags pre-installed. The concrete lid and cast iron cover will be placed on the truck separately.

If excessive fine sediment/clay is present in runoff during construction, or if the site is expected to be unsealed for a prolonged period of time; it is advised to avoid filtering through the Up-Flo. Alternatively, the CPZ filter bags can easily be removed from the modules by the Installer and kept clean and secure until the surface is sealed.

How is the outlet connection achieved?

The Up-Flo's has a stepped PE outlet with three possible diameters (267mm, 318mm and 389mm). It is designed to be cut back to the closest pipe diameter. Recommended connection options include ***Flexseal Shear Band Pipe Couplers (Hynds Technical Guide D10.4)*** for concrete & PE pipes, and/or level invert reducers for PVC pipes. Please discuss with your closest Hynds branch.

Can the Up-Flo accept multiple inlet pipes?

Yes, please follow ***CPAA guidelines*** in relation to manhole spacing requirements of inlet pipe penetrations. For Up-Flo's with 2-6 modules and multiple inlets it is recommended to ensure pipes enter above the grey filter modules (435mm above outlet IL) to prevent obstruction to flow path. Alternatively, ensure the Up-Flo is manufactured with modules positioned accordingly to suit pipe orientations during order process by Contractor.

What is the total head loss of the Up-Flo?

Depends on the number of filter modules. The total head loss is the height from the outlet invert to the underside of the bypass baffle, please refer to relevant drawing.

Does the inlet have to be 240mm higher than the outlet?

No, it is not compulsory. The inlet pipe can match the same invert with the outlet pipe if available head allows. The preference is for the inlet pipe to be installed above 240mm to reduce the volume of stormwater untreated during the drain down process after the rain event.

Does the Up-Flo filter need to be commissioned?

No. Because the CPZ filter bags, matala screens and drain down valve is pre-installed there is no need for commissioning by any agent. The Up-Flo filter is designed to treat hardstand runoff only, post construction phase. If the Up-Flo is subject to prolonged construction phase sediment runoff (fine clays etc) filter performance is likely to be compromised. It is the Installers responsibility to ensure this does not happen, not Hynds.

How often do the filter bags need to be replaced?

The acceptable industry standard is every 12-18 months with a 3-6 monthly visual inspection. For heavily trafficked commercial & industrial sites 6 monthly filter bag replacement should be considered as best practice.

What is the maximum online flow rate?

The yellow internal bypass hood is designed to convey up to 115.0L/s. For any storm flows approaching this figure it is recommended the Up-Flo is positioned offline with an upstream weir diversion.

Branches Nationwide *Support Office & Technical Services 0800 93 7473*