

Operation & Maintenance Plan for Sustainable Drainage Systems Proposed Residential Development Barfs Road Distington

Thomas Armstrong Construction Ltd and Home Group

Ref: K42601.OM/002

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1 INTRODUCTION

1.1 BACKGROUND

R. G. Parkins & Partners Ltd (RGP) has been appointed by Thomas Armstrong on behalf of Home Group to provide an Operation and Maintenance plan for surface water drainage systems for a proposed residential development at Barfs Road in Distington.

In reviewing the enclosed information, reference should be made to the latest revisions of the following RGP drawings:

- K42601-42 Outline Foul & Surface Water Drainage Plan – 1 of 3
- K42601-43 Outline Foul & Surface Water Drainage Plan – 2 of 3
- K42601-43 Outline Foul & Surface Water Drainage Plan – 3 of 3
- K42601-44 Typical Drainage Construction Details – 1 of 2
- K42601-45 Typical Drainage Construction Details – 2 of 2

1.2 SUDS COMPONENTS

The proposed residential development at Queens Park, Millom utilises Sustainable Drainage Systems (SuDS) as part of the overall surface water drainage strategy for the site. This can be summarised as follows:

- Surface water runoff from roofs, driveways and private access roads shall discharge into 2no. geocellular tanks located within the new private road accessed from Rectory Place.
- A flow control chamber containing a proprietary vortex flow control device will be located downstream of the geocellular tanks which will restrict discharge flows to the new offsite adopted surface water sewer network.
- A proprietary hydrodynamic separator is to be provided downstream of the flow control chamber prior to discharge into the new adopted offsite surface water sewer. This system is specifically designed to remove suspended solids, hydrocarbons and floatable debris from stormwater runoff.
- The geocellular tanks and associated pipework and inspection chambers, flow control chamber and hydrodynamic vortex separator within the development site will be private and maintained by Home Group.
- The offsite surface water sewer will be adopted by United Utilities under a S104 Agreement. As such, future maintenance will be with United Utilities and is not covered here.

All drainage systems have been designed to provide sufficient storage for the critical duration, 1 in 100-year design storm event with a 50% allowance for the future effects of climate change.

2 OPERATION AND MAINTENANCE REQUIREMENTS

As with all traditional drainage systems, SuDS need to be inspected and maintained regularly to ensure that they operate correctly and efficiently. If SuDS are not properly maintained, then there is a risk that the components become overloaded during periods of prolonged heavy rainfall potentially resulting in localised flooding within the development. Recommendations for the maintenance of the SuDS components are detailed in the following section.

As part of this process it is recommended that inspection and maintenance records are retained by the Management Company to track the progressive performance of the SuDS over time. The inspection records should include the following:

- Sediment condition and depth
- Water observations (sheen, smell, etc.)
- Unscheduled maintenance needs
- Components that do not meet performance criteria and require immediate maintenance
- Common problem areas, solutions and general observations
- Aesthetic conditions

For Health and Safety reasons as well as practicality, SuDS systems should be maintained during periods of dry weather wherever possible. Adhering to the recommended maintenance regimes will minimise the risk of maintenance activities being required when a fault becomes apparent, usually during a rainfall event. An example of a drainage maintenance inspection checklist is included in Appendix A for reference (see Table B.25 from The SuDS Manual ^[1]).

All maintenance activities should be detailed in the Health and Safety Plan and a risk assessment should be undertaken in accordance with CDM regulations.

2.1 GEOCELLULAR ATTENUATION STORAGE SYSTEMS & FLOW CONTROL CHAMBER

Regular inspection and maintenance is important for the effective operation of below ground storage systems. The tanks will be protected from sediment loads by the use of upstream silt traps with sumps. The highest risk of blockage and siltation is during and immediately after construction. The geocellular tanks will be fitted with access turrets to allow inspection and maintenance of the inside of the tank. Maintenance responsibility for the attenuation systems will be placed with Home Group. The following requirements refer to the recommendations in The SuDS Manual (CIRIA C753) ^[1].

Table 2.1 Geocellular Attenuation Storage Maintenance Activities and Schedule

Maintenance Schedule	Required Action	Recommended Frequency
Regular maintenance	Inspect and identify any areas upstream of the system that are not operating correctly (i.e. rainwater pipe gullies, silt traps, inspection chambers). If required, take remedial action	Monthly for first 3 months, then six monthly thereafter
	Remove debris from any upstream catchment surfaces (may cause risks to performance)	Monthly for first 3 months, then six monthly thereafter (and after large storm events)
	Remove sediment from pre-treatment structures	Annually, or as required.
	Visual inspection of silt traps, distribution pipes and flow control chamber to ensure no obvious build-up of silt or other blockages. De-silt as required. Check to ensure there is no standing water in the chambers	Monthly for first 3 months, then six monthly thereafter (and after large storm events)
	Inspect external vent pipe and associated pipework to ensure free from blockage or damage	Annually, or as required
Remedial actions	Repair/rehabilitation of inlets, outlets and vents. De-silt as required.	As required
Monitoring	Inspect/check all upstream drainage inlets, outlets, vents and gullies to ensure that they are in good condition and operating effectively. Inspect access turrets and de-silt inside of tank if required	Monthly for first 3 months, then six monthly thereafter (and after large storm events)
	Survey inside of tank for sediment build up and remove if necessary	Every 5 years or as required.

The geocellular tanks will connect into a flow control chamber with a Hydro-brake device limiting flows to a max. 27.9 lit/sec. The Hydro-brake will require little, if any, maintenance and has a design life in exceedance of the upstream drainage systems. In the unlikely event that the device blocks and the flow control chamber floods the device is fitted with a pivoting by-pass door which can be accessed and opened from ground level via a pull handle and operating steel rope. This will allow the chamber to be drained down to provide access for maintenance. Hydro International Ltd provides guidance for the operation and maintenance of their flow control devices as included in Appendix B.

2.2 HYDRODYNAMIC SEPARATOR

A proprietary hydrodynamic separator will act as an additional form of treatment to the stormwater run-off from roofs, highways and driveways. It is to be located directly downstream of the flow control chamber within the open space landscaped area. The hydrodynamic separator will remain private and maintenance responsibility will be placed with Home Group.

The maintenance requirements for hydrodynamic separators are fairly low due to no moving parts. The only required maintenance as informed by the manufacturer is to employ a vacuum truck to remove floatables trapped on the top and sediment captured in the sump. As the frequency of maintenance can vary significantly between sites it is recommended to check and vacuum every 6 months for the first year and determine the standard maintenance frequency from this. Most typically a maintenance frequency of once per year or following a spill in the drainage facility is adequate. Details of the proposed maintenance activities are presented in Appendix C.

3 REFERENCES

- [1] CIRIA, *The SuDS Manual*, Report C753, 2015.

APPENDIX A

EXAMPLE OF DRAINAGE MAINTENANCE INSPECTION CHECKLIST

General information								
Site ID								
Site location and co-ordinates (GIS if appropriate)								
Elements forming the SuDS scheme				Approved drawing reference(s)				
Inspection frequency				Approved specification reference				
Type of development				Specific purpose of any parts of the scheme (eg biodiversity, wildlife and visual aspects)				
Inspection date								
	Details	Y/N	Action required	Date completed	Details	Y/N	Action required	Date Completed
General inspection items								
Is there any evidence of erosion, channelling, ponding (where not desirable) or other poor hydraulic performance?								
Is there any evidence of accidental spillages, oils, poor water quality, odours or nuisance insects?								
Have any health and safety risks been identified to either the public or maintenance operatives?								
Is there any deterioration in the surface of permeable or porous surfaces (eg rutting, spreading of blocks or signs of ponding water)?								
Silt/sediment accumulation								
Is there any sediment accumulation at inlets (or other defined accumulation zones such as the surface of filter drains or infiltration basins and within proprietary devices)? If yes, state depth (mm) and extent. Is removal required? If yes, state waste disposal requirements and confirm that all waste management requirements have been complied with (consult environmental regulator)								
Is surface clogging visible (potentially problematic where water has to soak into the underlying construction or ground (eg underdrained swale or infiltration basin)?								
Does permeable or porous surfacing require sweeping to remove silt?								
System blockages and litter build-up								
Is there evidence of litter accumulation in the system? If yes, is this a blockage risk?								
Is there any evidence of any other clogging or blockage of outlets or drainage paths?								
Vegetation								
Is the vegetation condition satisfactory (density, weed growth, coverage etc)? (Check against approved planting regime.)								
Does any part of the system require weeding, pruning or mowing? (Check against maintenance frequency stated in approved design.)								
Is there any evidence of invasive species becoming established? If yes, state action required								
Infrastructure								
Are any check dams or weirs in good condition?								
Is there evidence of any accidental damage to the system (eg wheel ruts)?								
Is there any evidence of cross connections or other unauthorised inflows?								
Is there any evidence of tampering with the flow controls?								
Are there any other matters that could affect the performance of the system in relation to the design objectives for hydraulic, water quality, biodiversity and visual aspects? (Specify.)								
Other observations								
Information appended (eg photos)								
Suitability of current maintenance regime								
Continue as current								
Increase maintenance								
Decrease maintenance								
Next inspection								
Proposed date for next inspection								

APPENDIX B

HYDRO-BRAKE FLOW CONTROL DEVICE OPERATION AND MAINTENANCE GUIDE

HYDRO-BRAKE® FLOW CONTROL MAINTENANCE AND SAFETY DATA SHEET

MAINTENANCE

Normally, little maintenance is required as there are no moving parts within the Hydro-Brake® Flow Control. Experience has shown that if blockages occur they do so at the intake, and the cause on such occasions has been due to a lack of attention to engineering detail such as approach velocities being too low, inadequate benching, or the use of units below the minimum recommended size. Hydro-Brake® Flow Controls are fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur. The smaller type conical units, below the minimum recommended size, are also available with rodding facilities or vortex suppressor pipes as optional extras.

Following installation of the Hydro-Brake® Flow Control it is vitally important that any extraneous material ie. building materials are removed from the unit and the chamber. After the system is made live, and assuming that the chamber design is satisfactory, it is recommended that each unit be inspected monthly for three months and thereafter at six monthly intervals with hose down if required. If problems are experienced please do not hesitate to contact the company so that an investigation may be made.

Hydro-Brake® Flow Controls are typically manufactured from grade 304 Stainless Steel which has an estimated life span in excess of the design life of drainage systems.

COSHH

Hydro-Brake® Flow Controls are manufactured from Stainless Steel, which is not regarded as hazardous to health and exhibits no chemical hazard when used under normal circumstances for the stated applications.

MANUAL HANDLING

The handling of Hydro-Brake® Flow Controls should be in accordance with current legislation and regulations:

- The Health and Safety at Work etc. Act 1974.
- The Management of Health and Safety at Work Regulations 1999 (amended 2003).
- The Manual Handling Operations Regulations 1992 (amended 2002).

All published and printed by the Health and Safety Executive.

HRD-FM04/16 J/0610



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STH Range of
Hydro-Brake® Flow Controls

APPENDIX C

HYDRODYNAMIC SEPARATOR OPERATION AND MAINTENANCE GUIDE



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INTRODUCTION

This document serves as a comprehensive insight in to the operation as well as a guide to efficient maintenance of the StormCleanser™ Hydrodynamic Vortex Separator, once installed on site. The details and instructions provided are to be followed as mentioned, any deviation could potentially affect the performance of the StormCleanser™. The maintenance guide reflects the frequency based on nominal rainfall conditions and may alter based on regional differences or anomalous rainfall events.

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**PLEASE, CONTACT LOCAL YOUR FP MCCANN
SPECIALIST ENGINEER OR OUR HEAD OFFICE
ON 028 7964 2558 IN CASE OF ANY DOUBT OR
OPERATION & MAINTENANCE RELATED ISSUES.**

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PRODUCT DESCRIPTION

StormCleanser™ provides a cost-effective solution for designers, engineers and contractors involved in the provision of Sustainable Drainage Systems (SuDS). This unit has no moving parts, requires no power, and is constructed within standard precast concrete chambers. The units come factory fitted in precast chambers and could also be installed on-site as required. The modular stainless steel built assembly is designed to provide installation simplicity. The separator internal assembly is fabricated out of stainless steel (304L/316L), per BSI BS EN 10088-2-2014. Stainless Steel material grade and composition, provides exceptional longevity due to high corrosion resistance. The lifespan of the internal assembly outlasts the lifespan of a typical precast concrete structure (100+ years).



Figure 1 - StormCleanser™ Assembly and Exploded View

WORKING PRINCIPLE

The StormCleanser™ is specifically designed to remove suspended solids, hydrocarbons, and floatable debris from the stormwater run-off.

Water and pollutants enter the system via the inlet pipe, where the internal geometry enables low energy forced vortex flow patterns. This allows the floatables to gather and solids to settle to the bottom of the treatment chamber for subsequent removal.

Settled sediment is retained within the sump storage of the unit, allowing easy access for suction cleaning. Re-suspension of the solids is minimised by the provision of a baffle plate (Catch Skirt), positioned above the sediment storage sump. A central core allows for convenient suction hose entry down to the sump for cleaning and maintenance. If there is a stormwater surge in excess of maximum treatment flow rate, it overflows a weir, bypasses the treatment zone and directly discharges through the outlet pipe. This helps to minimize the effects of scour within the treatment region and prevents wash out of retained sediment downstream.

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The generic configuration of the StormCleanser™ consists of the following main components:

- Inlet Sub-Assembly
- Core Sub-Assembly
- Catch Skirt
- Sump Unit

INLET SUB-ASSEMBLY:

The internal assembly comprises of the main components diverting the flow tangentially, at an angular velocity designed to be most conducive to separation of sediment particles. The inlet assembly also enables the StormCleanser™ to be configured for different inlet angles with respect to the outlet pipe, ranging from 90° – 270°. Moreover, multiple inlet sub-assemblies could also be stacked to form a multiple inlet configuration of StormCleanser™.

CORE SUB-ASSEMBLY:

The sub-assembly consists of a circular core that provides annular separation zone as well as an outlet channel that discharges the cleaner water out of the system. It also consists of the structural mounting surfaces to enable steadfast and safe installation.

CATCH SKIRT:

The Catch Skirt, also known as sump tray or baffle plate, minimizes the resuspension as well as escape of the captured sediment. The Catch Skirt also hydrodynamically directs the flow vortices towards the sump region.

SUMP UNIT:

The sump or catchment zone is the solids or denser sediment storage region. The separated particles are retained in the sump until cleaned during the maintenance process.

The combination of the discharge rate from surface runoff and the target pollutant load are the key variables governing the diameter of the separator and the height of the base unit respectively. These two values are determined by the designer as per the individual site requirements.

MODELS

The table below provides the maximum treatment flow rates and sediment/oil storage capacities for standard StormCleanser™ units.

Table 1 - StormCleanser™ Performance Table

MODEL	TANK DIAMETER	MAX TREATMENT FLOW RATE	PIPE SIZE	MIN. SEDIMENT STORAGE CAPACITY	MIN. OIL STORAGE CAPACITY	MAX. HEAD LOSS AT TREATMENT FLOW RATE
	(mm)	(L/s)	(mm)	(m³)	(L)	(mm)
PRE-SC900	900	25	150	0.28	150	120
PRE-SC1050	1050	33	225	0.39	238	180
PRE-SC1200	1200	43	300	0.50	320	240
PRE-SC1500	1500	67	375	0.82	630	300
PRE-SC1800	1800	96	450	1.23	1085	360
PRE-SC2100	2100	131	525	1.75	1725	420
PRE-SC2400	2400	172	600	2.38	2575	480
PRE-SC2700	2700	217	675	3.13	3670	540
PRE-SC3000	3000	268	750	4.01	5035	600
PRE-SC3600	3600	387	900	6.20	8703	720
PRE-SC4000	4000	477	900	8.00	11938	800

Notes: Sediment storage capacity could be extended as required, per the desired maintenance frequency

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OPERATION

StormCleanser™ operates without any external power or moving parts, hence seamless and effective operation is a function of hydrodynamics as well as the material and structure. The inlet flow openings are designed to permit passage of large floatable objects, which gather in the region above the main separation zone. The hydraulic losses are minimized by smooth channelling of flow through the annular region, at the specific design velocity. A StormCleanser™ unit consisting of multiple inlets, uniquely, provides flow direction selection to allow the longer unencumbered flow path to be taken and thus avoid any clogging of floatables.

Figure 2 demonstrates the two different separation mechanisms during normal operation. The hydrocarbons and floatables gather at the top by virtue of lower density, and could be accessed and removed first. The solid suspended sediment undergoes vortex separation phenomena and is captured in the sump region, to be extracted conveniently through the central cylindrical opening.

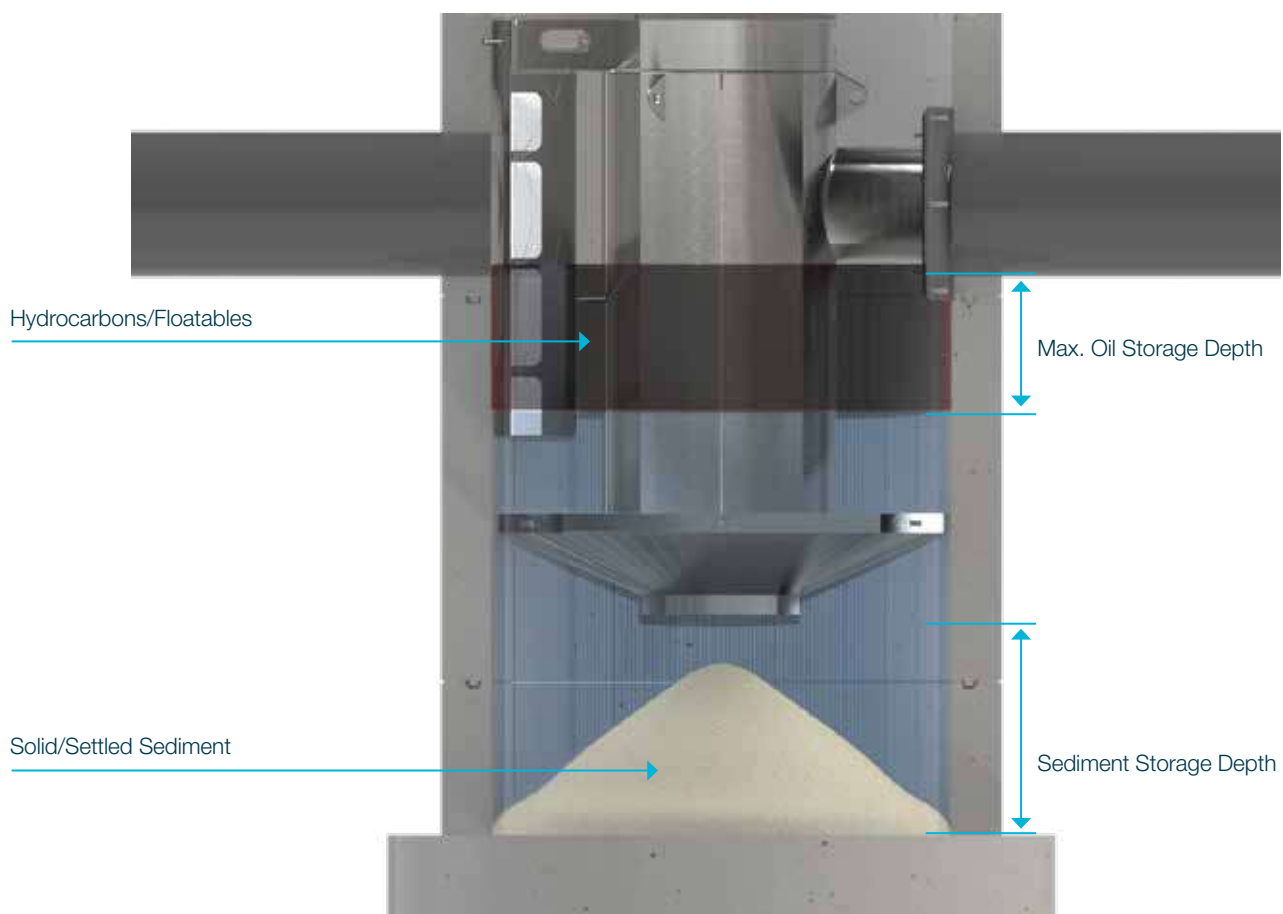


Figure 2 - StormCleanser™ sediment categorization during operation

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MAINTENANCE

Periodic checks and removal of stored sediments, floatables, and hydrocarbons is essential to the effective functioning of the StormCleanser™. Failure to provide adequate regular maintenance may limit the performance of the installed unit.

**** Maintenance does not require removal or re-installation of any part in the existing StormCleanser™ assembly. If a part appears damaged, please contact regional FP McCann office.**

MAINTENANCE FREQUENCY

- During installation, the sump unit should be cleaned for any existing mud and debris, collected during storage/pre-installation period
- At the time of installation, the unit should be checked against the installation sheet and information should be logged
- First regular maintenance check is advised between 6-12 months after installation, serving as a preventive check and sets respective periods of maintenance accordingly
- The amount of sediment, floatables, and hydrocarbons for each site is highly variable and could be gauged upon first few maintenance intervals

REQUIRED EQUIPMENT

- There is no confined space entry necessary for inspection or maintenance
- Access slab/lid hardware and tooling
- Vacuum truck with suction hose and tanker for foul water removal
- Pressure wash or cleaning equipment (if required)

**** Safe and environmentally responsible disposal of pollutants is the responsibility of the maintenance contractor**

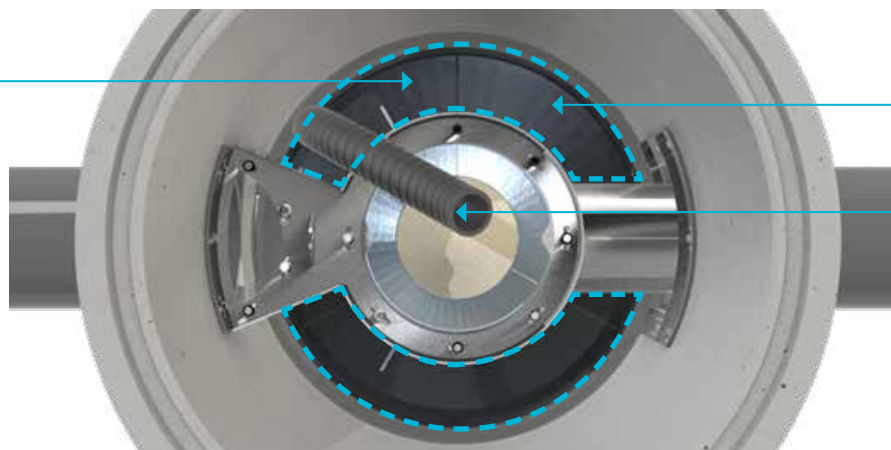
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MAINTENANCE INSTRUCTIONS

1. Lower down the suction hose and extract floatables and hydrocarbons via the annulus region of the separator tank

Hydrocarbons/
Floatable debris



Access for
Hydrocarbons/
Floatable debris

Vacuum Truck Hose

Figure 3 - Vacuum truck access region and cleaning of hydrocarbons and floatable debris

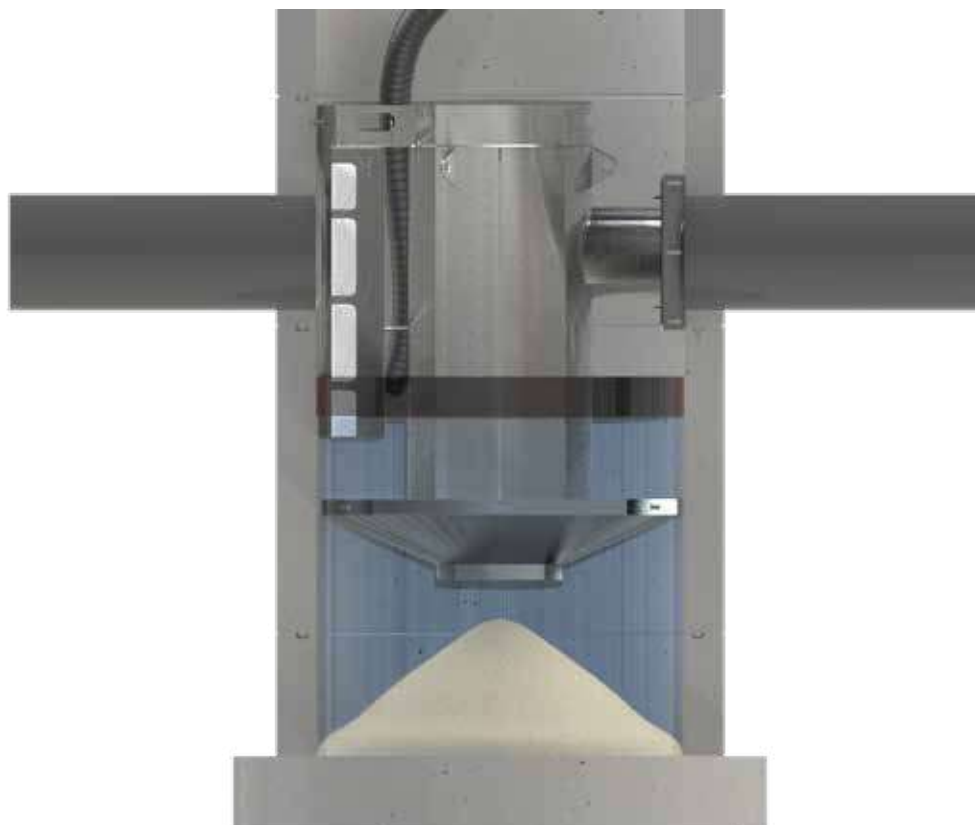


Figure 4 - Section view of vacuum suction hose, during hydrocarbons and floatable debris cleaning (Internal Assembly rendered transparent for visualization)

2. Suction hose should be placed beside the closed end of the inlet assembly to adequately capture all floatable debris and hydrocarbons
3. Once water level reduced down to the Catch Skirt level then lower the suction hose down to the sump region to suck the solid sediment out of the system
4. Continue lowering down the hose as it sucks the sediment until it hits the base of the sump

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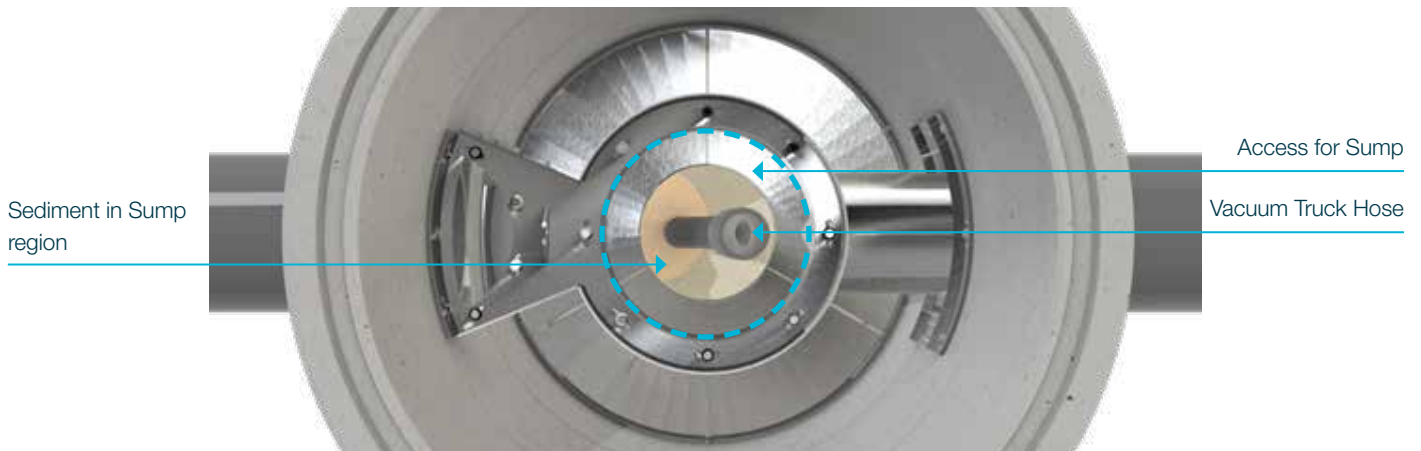


Figure 5 - Vacuum truck access region and cleaning of sediment stored in sump unit



Figure 6 - Vacuum Truck hose in the settled sediment sump region (Internal Assembly rendered transparent for visualization)

5. The sump region would ideally need frequent rotational repositioning of the suction hose against the base, to access the far ends
6. Retrieve the suction hose and check for any anomalies
7. Lastly, securely close the lid of the tank

It is recommended that the units are regularly checked after any unexpected stormwater run-off surges or chemically hazardous spills.

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STORMCLEANSER™ INSTALLATION RECORD

Model Ref#	
Installation Date	
Project Ref	
Installation Site	
Location	

Model	Check
PRE-SC1200	☐
PRE-SC1500	☐
PRE-SC1800	☐
PRE-SC2100	☐
PRE-SC2400	☐
PRE-SC2700	☐
PRE-SC3000	☐
PRE-SC3600	☐
PRE-SC4000	☐

CLIENT DETAILS

Company Name	
Contact Person	
Address	
Telephone	
Fax	

CONTRACTOR DETAILS

Company Name	
Contact Person	
Address	
Telephone	
Fax	

**Above record sheet is a only a reference template and not a controlled FP McCann document*

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Weston Underwood 01335 361269

BUILDING PRODUCTS

Cadeby 01455 290780

DOCK LEVELLER PITS

Weston Underwood 01335 361269

DRAINAGE

Ellistown 01530 240000 (England/Wales) Magherafelt 028 7954 9026 (Scotland/NI)

FENCING

Cadeby 01455 290780

FILTER BED SYSTEMS

Littleport 01353 861416

FLOORING

Weston Underwood 01335 361269 Uddingston 01698 803300 Magherafelt 028 7954 9026 (NI)

POWER & INFRASTRUCTURE

Littleport 01353 861416

RAIL

Littleport 01353 861416

SPECIALIST PRECAST

Littleport 01353 861416

STRUCTURAL PRECAST

Byley 01606 843500 Grantham 01476 562277

STORMTANK™ - TANKS & CHAMBERS

Weston Underwood 01335 361269

TUNNELS & SHAFTS

Cadeby 01455 290780

WALLING

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Uddingston 01698 803 300 (Scotland) Magherafelt 028 7954 9026 (NI)

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