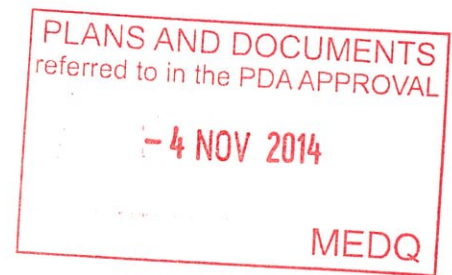




Prepared for:

Metro Property Development



SITE BASED STORMWATER MANAGEMENT PLAN

351 MacArthur Central Avenue, Hamilton

Prepared by:

ACOR Consultants (QLD) Pty. Ltd.

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Dated: Friday, 8th September 2014

Project No: BR140079

ACOR Consultants (QLD) Pty. Ltd.

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DOCUMENT DETAILS

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EXECUTIVE SUMMARY

This site based stormwater management plans describes the stormwater quantity and quality assessment for the proposed development known as Lot 808, MacArthur Avenue, Hamilton.

Brisbane City Plan 2014 states the requirement for a detention basin in some cases can be waived if it is within the lower third of the catchment, if the development causes no adverse effects to neighbouring properties. Thus, it has been determined that no on site detention is required for this site.

The existing site peak discharges are presented in Table 2 of this report. Peak flows, as a result of the development are presented in Table 3 of this report. Flows from an external catchment are currently conveyed as a combination of underground pipe system and overland flow through the site towards the existing open channel adjacent to the east of the site. This configuration is proposed to be maintained by dedicating a 3m overflow easement over the existing pipe. There will be no adverse stormwater effects caused to upstream developments by constructing the proposed development.

The proposed stormwater quality treatment trains have been designed to sufficiently remove stormwater pollutants from the proposed developed runoff. Stormwater quality has been designed in accordance South East Queensland Healthy Waterways Partnership's Water by Design WSUD Technical Design Guidelines for South East Queensland Version 1 (2006) and MUSIC Modelling Guidelines for South East Queensland Version 1.0 (2010).

The proposed system will consist of a total of 22 x 690mm "StormFilter" cartridges, installed in two concrete manholes. This design meets the legislated Stormwater Quality pollution reduction targets (outlined in Section 4.1.2 of this report).

A maintenance plan has been prepared to ensure that the proposed treatment trains operate at its design capacities. Operation & Maintenance procedures and an example Maintenance Agreement template from Stormwater 360 have been added to Appendix 2 of this report for further information.

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1 INTRODUCTION

ACOR Consultants (QLD) Pty Ltd was engaged by the Metro Property Development to prepare a Site Based Stormwater Management Plan to support a DA application with Economic Development Queensland (EDQ) for their project located at 351 MacArthur Avenue, Hamilton, Queensland.

The project is a residential development and comprises of 19 dwellings within one lot managed by Body Corporate.

Refer to Figure 1 below for a copy of the Development Plan.

The site generally falls away from MacArthur Avenue in an eastern direction towards the existing open drainage channel.

This report identifies the impacts of the proposed development on the surrounding local environment and provides measures to ensure compliance with the relevant authority guidelines, the EDQ Decision Notice and the Brisbane City Council stormwater quantity and quality requirements.



Figure 1 - Site Layout Plan (n.t.s)

2 SITE DETAILS

2.1 Location

The proposed development is located at 351 MacArthur Avenue, Hamilton. The site is bound by an existing lot to the north and a drainage reserve to the east. To the south is an existing park, while MacArthur Avenue is located on the western boundary.



Figure 2 - Site Location Courtesy Google Maps (n.t.s)

2.2 Topography

The site currently falls east towards the existing open drainage channel. Elevations range from 4.25m AHD at the northern boundary to 3.00m AHD at the southern boundary. There is an existing open channel drain external to the eastern boundary that discharges to the Brisbane River. This open channel drain has an approximate invert level of 0.00m AHD. Currently the lot is a greenfield site with no existing developments.

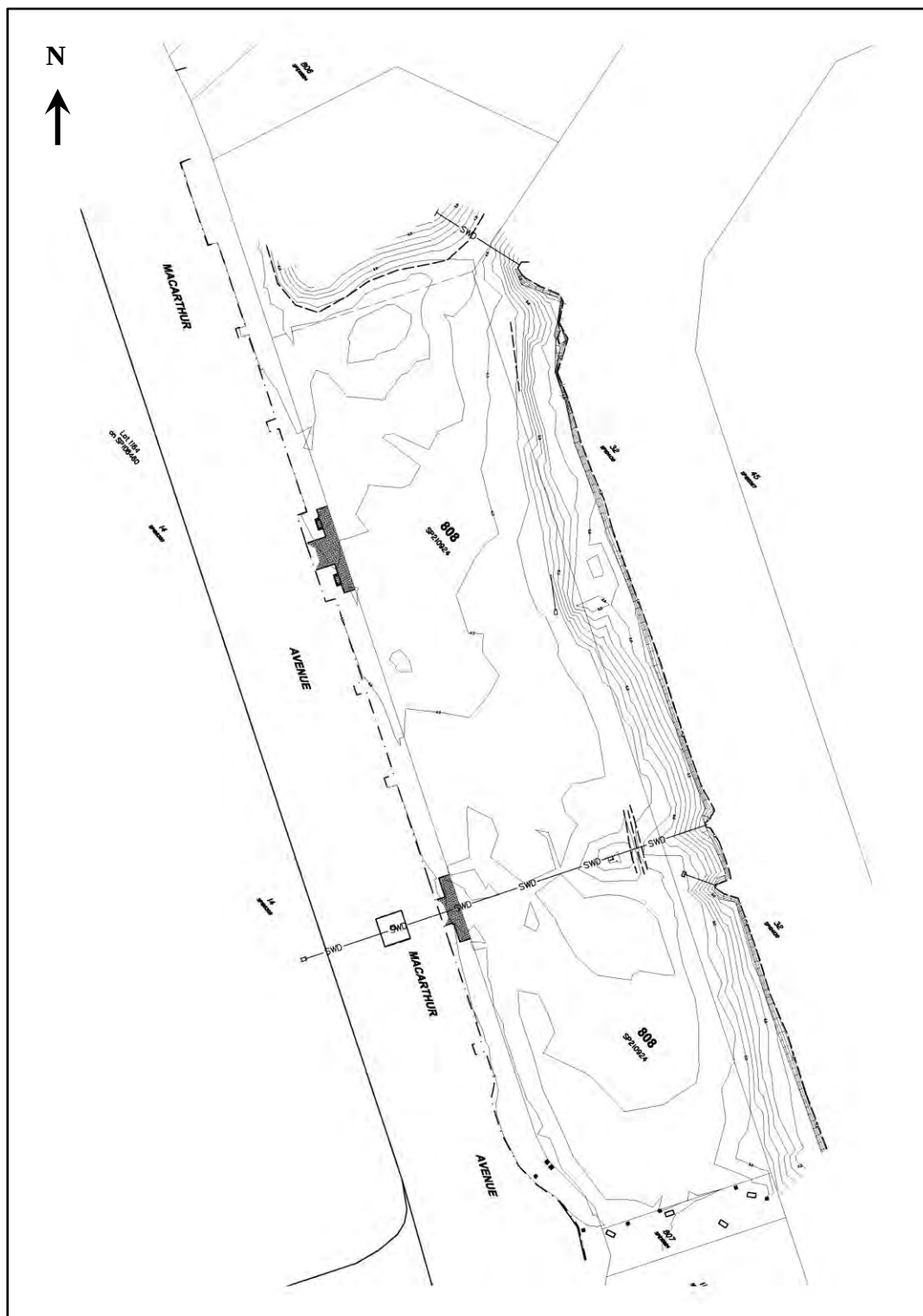


Figure 3 - Site Topography (n.t.s)

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2.3 Existing surface conditions

Currently the lot is a greenfield site with no existing developments.

2.4 Drainage patterns on site

The site is at the downstream end of a large catchment discharging to the open drainage channel to the east of the site. This catchment generates flows from surrounding developments, including a stretch of MacArthur Avenue. All flows from MacArthur Avenue and the surrounding surface are captured by various field inlet pits. The legal point of discharge of this catchment is the open drainage channel adjacent to the site eastern boundary. The associated stormwater catchments are indicated in Figure 4 and 5 below.

Catchment A contains a large portion of pervious grassland. The other percentage of catchment A consists of existing impervious development including MacArthur Avenue. All flows generated by this catchment are conveyed via swales within the road reserve of MacArthur Avenue and overland flow through surrounding lots. Discharges from this catchment are directed into an existing 750mm diameter pipe running directly through the site, west to east discharging to the open drainage channel adjacent to the site. Catchment A is highlighted in Figure 4 below.

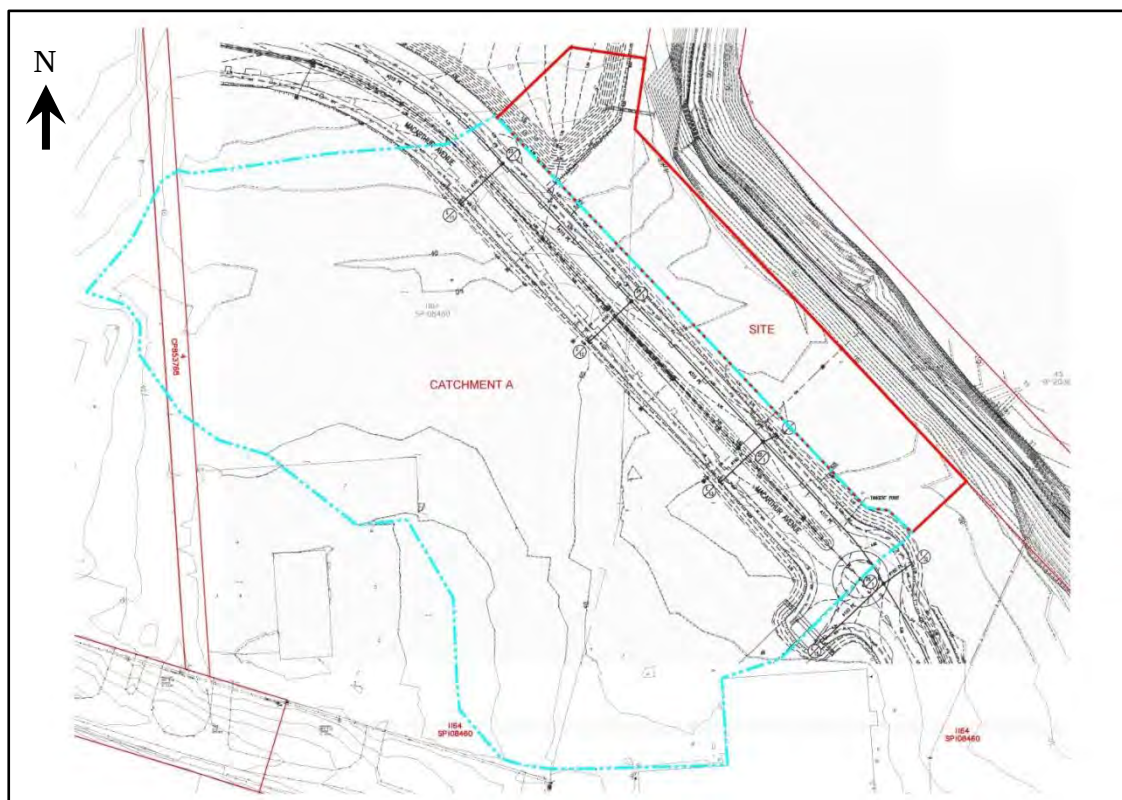


Figure 4 - Catchment A (n.t.s)

Catchment B consists of 100% pervious areas, all stormwater travels overland to the sag located on the south eastern side of the lot. A field inlet pit is located in the sag, it is assumed a small amount of flows is collected and directed into the existing 750mm diameter underground stormwater pipe. The combined flows from both catchments discharge to the existing open drainage channel by combination of underground drainage network (750mm dia pipe) and overland flow. Catchment B is highlighted in Figure 5 below.

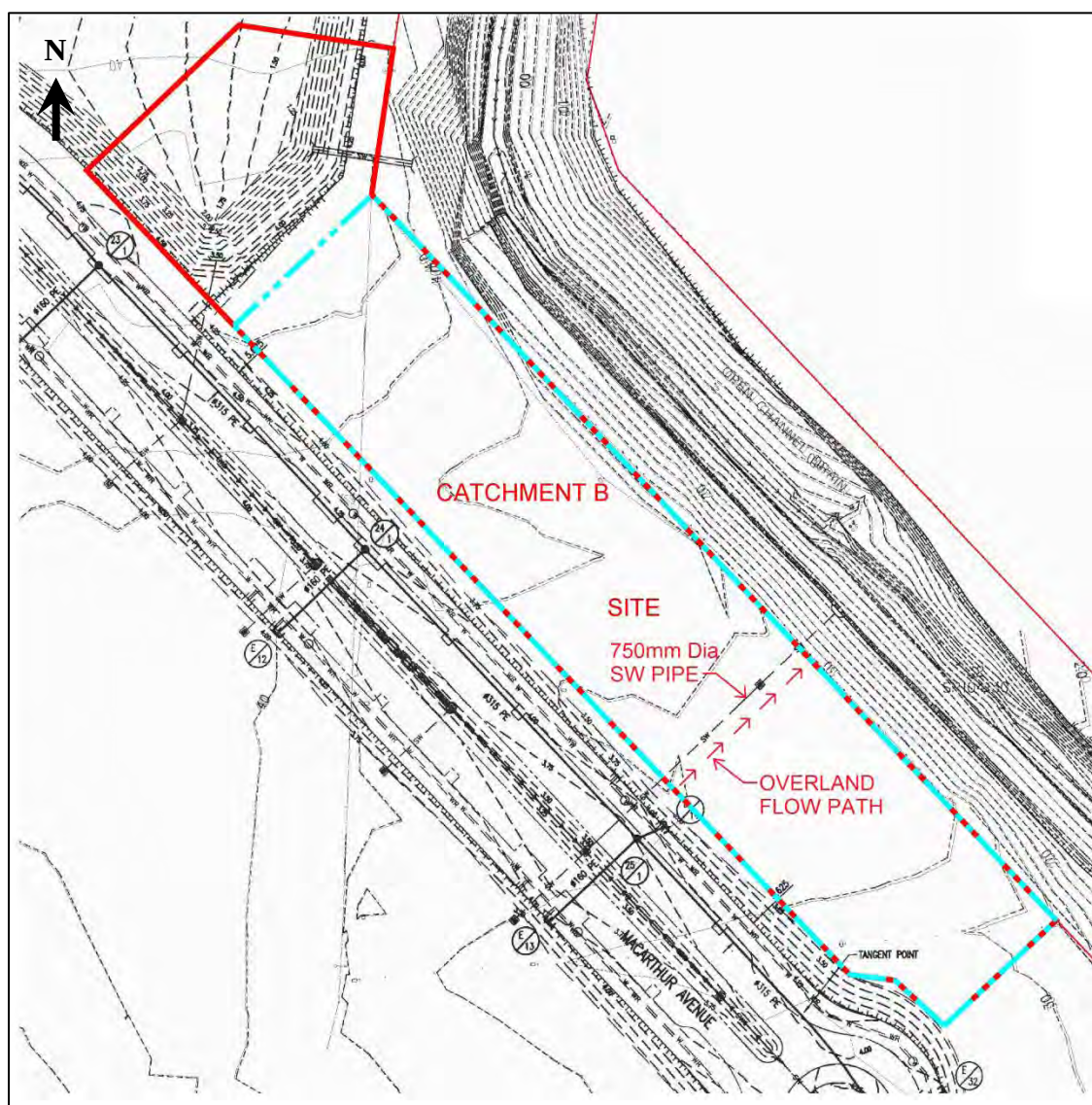


Figure 5 - Catchment B (n.t.s)

2.5 Proposed Development

The development is a single stage development which consists of nineteen body corporate managed dwellings.

2.6 Watercourses

No watercourses run through the site.

2.7 Water Body

The Brisbane River is located approximately 500 meters south of the site. A review of the Brisbane City Council eBimap indicates that the site is located outside the Brisbane River Corridor. There is an existing open drainage channel located adjacent to the eastern boundary of the site.

2.8 Vegetation within the waterway corridor

No waterway corridor exists on or adjacent to the site

2.9 Flooding

A Brisbane City Council FloodWise report cannot currently be produced for this property. A current FloodWise report was produced for the nearest recognised property, 305 MacArthur Avenue. As the source of highest flooding is a storm tide from Brisbane River (no data provided from the adjacent channel), it is assumed the same defined flood level can be adopted for the proposed development.

The FloodWise report for the nearest recognised lot indicates a maximum flooding level of 2.5m AHD during a 100 years ARI flood event. A small portion of the site is currently below 2.5m AHD and can be considered subject to flooding. Some very minor fill will be undertaken in this area to allow batter to match existing adjoining levels. It is considered that this filling will have no adverse impact to the existing flood levels. The developable pad area of the site, however, will be above 3.0m AHD (minimum 500mm freeboard above defined flood level).

Refer appendix 4 for a copy of the FloodWise report.

3 STORMWATER QUANTITY ASSESSMENT

3.1 Rainfall Data

Rainfall intensity-frequency-distribution (IFD) data for the site has been obtained from the *Brisbane City Plan 2014 – Chapter 7 Stormwater Drainage*, dated 2014, prepared by Brisbane City Council.

3.2 Existing Catchments

As described on Sections 2.2 – 2.4, the site is divided into two separate catchments which directly discharge into the Local Authority's stormwater drainage infrastructure.

The minor flows discharged from the external catchment are already diverted through underground stormwater pipes to the open drainage channel. All major flows are conveyed by overland flow through the sag of the proposed site. Refer to Section 3.4 for further detail.

3.3 Lawful Point of Discharge

The legal point of discharge for the site is the Local Authority stormwater open drainage channel adjacent to the sites eastern boundary.

3.4 External Flow Management

As shown on Figure 4, Section 2.4, there is an external catchment that discharges to the site from MacArthur Avenue and the lots located to the west of the site. The runoff from this catchment is currently directed to the field inlet pit located in the road reserve on MacArthur Avenue. It is noted an existing overland flow path traverses the site directly above the underground stormwater network. This overland flow path is utilised if there is a blockage up stream or in the occurrence of a major storm event.

3.5 Existing Hydrologic Calculations

To evaluate the potential impacts of the proposed development on the existing downstream receiving infrastructure/waterways, calculations have been undertaken on both existing and proposed developed cases for the affected catchments.

Peak discharge flow rates generated from the existing conditions were calculated using the Rational Method and Friend's equation for overland sheet flow time calculations in accordance with QUDM for the 1, 2, 5, 10, 20, 50 and 100 annual recurrence intervals (ARI) rainfall events.

Table 1 below provides the input parameters for each catchment:

Catchment	Area (m ²)	C ₁₀	Time of Concentration (min)
A	48740	0.76	42.6
B	7634	0.7	27.3

Table 1: Existing Parameters

Table 2 below provides the peak flows obtained for the catchment and ARI:

Catchment	Area (m ²)	1 yr ARI (m ³ /s)	2 yrs ARI (m ³ /s)	5 yrs ARI (m ³ /s)	10 yrs ARI (m ³ /s)	20 yrs ARI (m ³ /s)	50 yrs ARI (m ³ /s)	100 yrs ARI (m ³ /s)
A	48740	0.366	0.502	0.727	0.879	1.079	1.406	1.646
B	7634	0.067	0.092	0.134	0.161	0.196	0.254	0.298

Table 2: Existing Peak Flows

Catchments A and B have different Times of Concentration, however, they discharge to the same location. Ultimately the discharges from Catchment A will combine with the discharges from Catchment B.

Based on the above peak discharge figures, it can be estimated that the existing 750mm diameter stormwater pipe collecting the discharge from catchments A and B has capacity to convey up to a Q5 storm event (estimated pipe capacity at 0.67% is 1.1m³/s as per QUDM Chart).

In the case of a network blockage or a major storm event, all excess flows greater than Q5 will bypass the 750mm diameter pipe by way of overland flow through the site of interest.

3.6 Post Development Hydrology

The proposed development will result in the majority of the site becoming fully impervious. Minor flows from the site are proposed to be drained to the existing 750mm diameter pipe running west to east through the site, major flows will be conveyed to the open drainage channel as overland flow. Major flows from the external catchment exceeding the 750mm diameter pipe capacity will be discharged through the site by way of overland flow through a dedicated easement. As discussed in Section 3.4, minor flows from the external catchment will continue to discharge through pipe work under the site to the open drainage channel.

Post development peak flows have been calculated using the Rational Method, in accordance with QUDM for the 1, 2, 5, 10, 20, 50 and 100 annual recurrence intervals (ARI) rainfall events. Tables 4 below provide the peak flows obtained and ARI for the catchment:

Catchment	1 yr ARI (m ³ /s)	2 yrs ARI (m ³ /s)	5 yrs ARI (m ³ /s)	10 yrs ARI (m ³ /s)	20 yrs ARI (m ³ /s)	50 yrs ARI (m ³ /s)	100 yrs ARI (m ³ /s)
B	0.154	0.211	0.299	0.354	0.429	0.553	0.644

Table 3: Developed Peak Flows

As shown on Tables 2 and 3 the proposed development will result in significant peak flow increase from the site.

3.7 Development Impacts

The catchment is currently partially pervious. Analysis of the proposed development has identified an increase in peak flows from the site to the legal point of discharge due to the introduction of impervious areas. As noted in the Brisbane City Plan 2014, section 7.5.2, stormwater detention is less likely to be required at the bottom one-third of the catchment. Additional requirements stated in the Brisbane City Plan 2014 support that as the lot is located directly adjacent to an existing large open drainage channel it is proposed that no on site detention is required. It is understood that by discharging the site flows quicker into the open channel prior to the upstream peak flows no adverse effect to existing upstream catchments will be present.

The site is located approximately 500 meters from the Brisbane River. It is the ultimate discharge point for all flows from the catchment. An underground 750mm diameter pipe exists within the proposed development and is responsible for draining all minor flows from both catchment A and B. Due to the difference in Time of Concentration between the peak flows from external catchment A and the post development peak flows from the site, it is expected there will be no increase in peak flows into the existing pipe. The minor and major flow paths are represented in Figure 5.

A major overland flow route through the site is also well defined directly above the underground stormwater pipe. As the site is located at the end of the drainage system, no downstream properties are affected by maintaining this overland flow path.

Manning's equation has been used to determine the overland flow depth within the proposed development easement. All major flows generated by catchment A will be conveyed through the proposed site 3m easement. As shown in Table 4 below, a proposed concrete lined easement through the site would be adequate to convey the over flow from catchment A (flows in excess of Q5 ARI).

Q (m ³ /s) (Q100-Q5)	Width of Easement	Slope %	Manning's Roughness (n)	Flow Depth	$v \times d < 0.6$
0.919	3m	0.7	0.013	0.170	0.312

Table 4: Overland Flow Path Calculations



Figure 6 - Minor and Major Flow Paths (n.t.s)

Based on the calculations provided within this report it can be determined that the existing drainage system is adequate to cater for the increase in flows from the development without causing impacts to properties upstream of the site. No detention system is required for the development.

4 STORMWATER QUALITY ASSESSMENT

The site is located within the Brisbane City Council area. Water quality parameters and the proposed limits applicable to this site have been selected in accordance with South East Queensland Healthy Waterways Partnership's Water by Design WSUD Technical Design Guidelines for South East Queensland Version 1 (2006) and MUSIC Modelling Guidelines for South East Queensland Version 1.0 (2010).

4.1 Water Quality Objectives

4.1.1 Construction Phase

Control measures will be put in place to protect downstream ecosystems and infrastructure including the incorporation of sediment control fences to intercept runoff prior to leaving the site and a shaker grid at the construction access point. Re-vegetation of landscaped and exposed areas will be completed by means of seeding, turfing or mulching.

4.1.2 Operational Phase

Best Management Practices (BMP) are required to be demonstrated for all development applications within the South East Queensland area. The following load reduction targets must be achieved when assessing the post-developed sites treatment train (comparison of unmitigated developed case versus developed mitigated case):

- | | |
|--------------------------------|--------------------------------------|
| • Total Suspended Solids (TSS) | 80% reduction is average annual load |
| • Total Phosphorus (TP) | 60% reduction is average annual load |
| • Total Nitrogen(TN) | 45% reduction is average annual load |
| • Litter/gross pollutants | 90% reduction is average annual load |

In addition to the above, the following permanent stormwater quality best management practices have been identified for the operational phase of the development to assist in the protection of water quality.

- Rubbish Bins provided on site
- Street sweeping of pavement areas
- Maintenance of all stormwater quality improvement devices

4.2 MUSIC Modelling

4.2.1 Modelling Guidelines

MUSIC Version 6 was used to assess pollutant generation and the performance of stormwater treatment measures for the proposed residential development. Selection and testing of stormwater management options was undertaken in accordance with *"MUSIC Modelling Guidelines Version 1.0 - 2010"*, Water By Design (2010).

4.2.2 Rainfall Data

MUSIC Modelling Guidelines provide advice on meteorological data for different climatic regions of South East Queensland. Six minute step rainfall data from Brisbane East (station 40223) from 1980 to 1989 were adopted for the site.

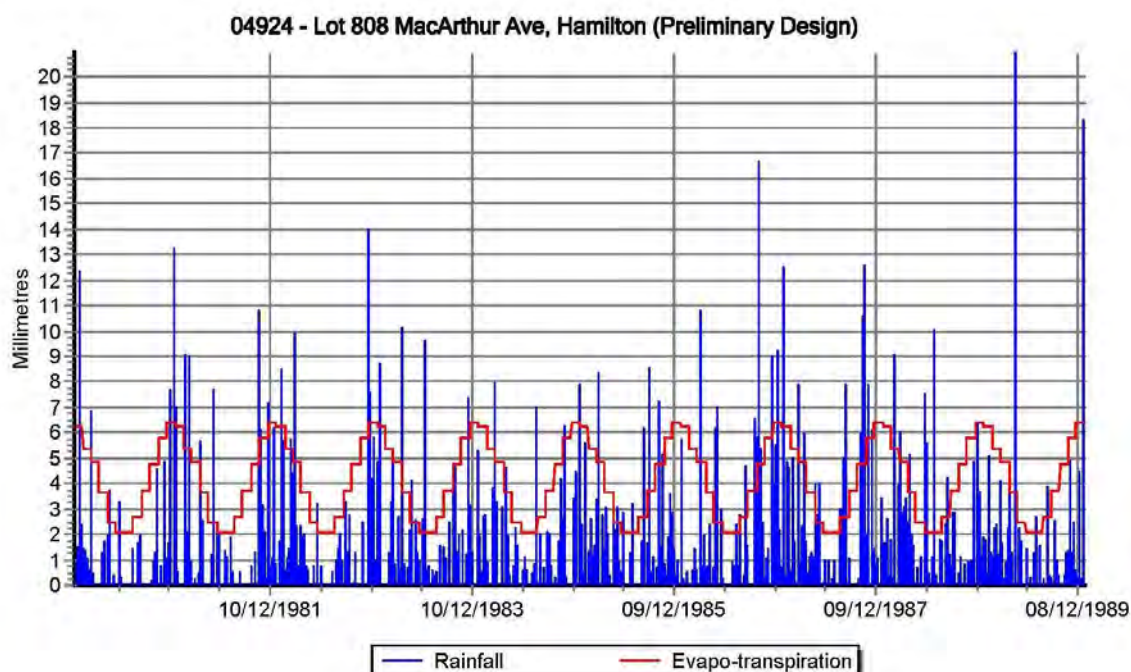


Figure 7 - Rainfall Data

4.2.3 Model Selection, assumption and removal effectiveness

In accordance with the Water By Design MUSIC Modelling Guidelines, split catchment methods were used for the source Nodes utilizing modified % impervious area. Also rainfall threshold, soil properties & pollutant concentration input values were sourced from the guideline.

The MUSIC modelling inputs for the rainfall source nodes are shown below.

Source Node Parameters – Sub Catchments		Urban Residential
Rainfall-Runoff	Rainfall Threshold (mm/day)	1
	Soil Storage Capacity (mm)	500
	Initial Storage (% of Capacity)	10
	Field Capacity	200
	Infiltration Capacity Coefficient - a	211
	Infiltration Capacity Exponent - b	5
	Initial Depth (mm)	50
	Daily Recharge Rate (%)	28
	Daily Base flow Rate (%)	27
	Daily Deep Seepage Rate (%)	0

Table 5: MUSIC Source Parameters

Base flow and Storm flow parameters for TSS, TP and TN for Roofs, roads and ground level were sourced from Water by Design MUSIC Modelling Guidelines (v1 Dated 2010) page 16. Refer Below.

FLOW TYPE	SURFACE TYPE	TSS log ¹⁰ values		TP log ¹⁰ values		TN log ¹⁰ values	
		Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Urban residential							
Baseflow parameters	Roof	N/A	N/A	N/A	N/A	N/A	N/A
	Roads	1.00	0.34	-0.97	0.31	0.20	0.20
	Ground level	1.00	0.34	-0.97	0.31	0.20	0.20
Stormflow parameters	Roof	1.30	0.39	-0.89	0.31	0.26	0.23
	Roads	2.43	0.39	-0.30	0.31	0.26	0.23
	Ground level	2.18	0.39	-0.47	0.31	0.26	0.23
Industrial							
Baseflow parameters	Roof	N/A	N/A	N/A	N/A	N/A	N/A
	Roads	0.78	0.45	-1.11	0.48	0.14	0.20
	Ground level	0.78	0.45	-1.11	0.48	0.14	0.20
Stormflow parameters	Roof	1.30	0.44	-0.89	0.36	0.25	0.32
	Roads	2.43	0.44	-0.30	0.36	0.25	0.32
	Ground level	1.92	0.44	-0.59	0.36	0.25	0.32
Commercial							
Baseflow parameters	Roof	N/A	N/A	N/A	N/A	N/A	N/A
	Roads	0.78	0.39	-0.60	0.50	0.32	0.30
	Ground level	0.78	0.39	-0.60	0.50	0.32	0.30
Stormflow parameters	Roof	1.30	0.38	-0.89	0.34	0.37	0.34
	Roads	2.43	0.38	-0.30	0.34	0.37	0.34
	Ground level	2.16	0.38	-0.39	0.34	0.37	0.34

Figure 8 - Source Node MUSIC Input Parameters

4.2.4 Treatment Trains

The proposed stormwater treatment train shall include specific devices aimed at achieving the water quality objectives at each of the discharge locations.

The stormwater treatment train for each discharge location shall include a combination of the following treatment devices:

- Stormwater360 EnviroPods Series 200 filters or approved equivalent;
- Stormwater360 StormFilters or approved equivalent.

4.2.5 Stormwater360

Stormwater360 has provided a water treatment solution for the site. The proposed solution includes installation of Stormwater360 EnviroPods Series 200 filters and Stormwater360 StormFilters.

Stormwater360 EnviroPods provide primary treatment by removing litter, debris and other gross pollutants from urban runoff. Each inlet pit is to have an EnviroPod installed to prevent gross pollutants from entering the pipe system.

Stormwater360 StormFilters have been designed to remove stormwater pollutants, including fine solids, soluble heavy metals, oil and total nutrient. A number of 22 StormFilters cartridges have been indicated by Stormwater360 to be sufficient to treat the stormwater generated within the catchment.

All parameters adopted in the MUSIC model for Stormwater360's products have been provided by Stormwater360.

4.2.6 External Catchment

No runoff from MacArthur Avenue enters the site during minor storm events. Where a major storm event occurs, the external catchment discharges via overland flow through the site.

4.2.7 MUSIC Model Layout

The layout of the site and the proposed drainage pattern were considered in the creation of the MUSIC model. All treatment node parameters were provided and sized by Stormwater360. Figure below presents the layout of source, treatment and receiving nodes used in the modelling.

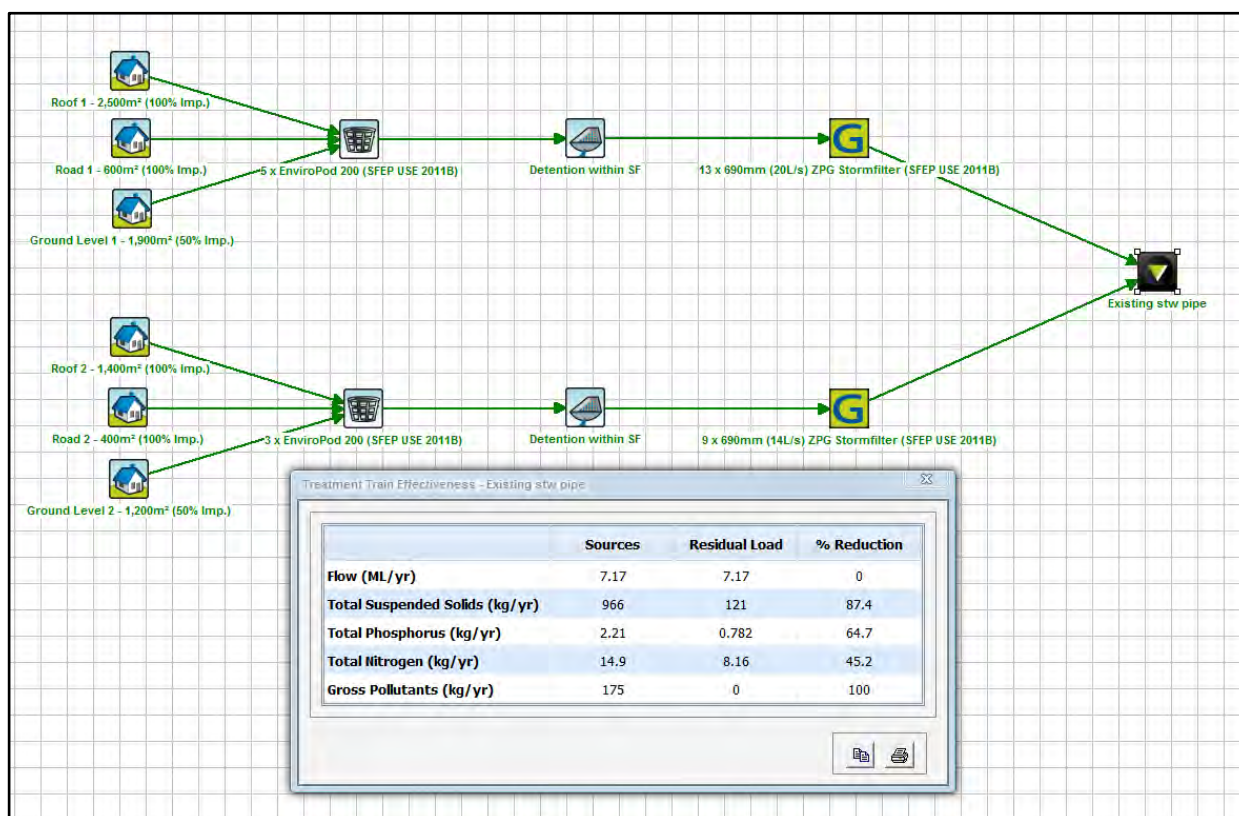


Figure 9 - MUSIC Model Layout used by Stormwater360

4.2.8 Modelling results, comparisons and compliance

The MUSIC modelling results are shown on the tables below. They are in the form of % reduction achieved with the proposed stormwater quality treatment train.

Source Pollutants	Targeted Reduction	Treatment Train Reduction*
Total Suspended Solids (kg/yr)	80%	87.4%
Total Phosphorus (kg/yr)	60%	64.7%
Total Nitrogen (kg/yr)	45%	45.2%
Gross Pollutants (kg/yr)	90%	100%

Table 6: MUSIC Modelling Results

As seen above, it is apparent that the proposed stormwater quality treatment devices would be adequate to meet the Council stormwater quality objectives.

4.3 Life Cycle Cost Assessment

A life cycle costing assessment for the treatment train has been undertaken using MUSIC version 6, in accordance with the Music Modelling Guidelines. The life cycle costing include total costs for establishment and maintenance.

The costing data (acquisition and maintenance) adopted in MUSIC has been obtained directly from Stormwater360.

The tables below summarize the life cycle cost parameters adopted and the results for each individual treatment and for the entire train.

Life Cycle Costing Properties	
Real Discount Rate	5.50%
Annual Inflation Rate	2.00%
Base Year for Costing	2014
Span of Analysis	50 years

Table 7: MUSIC Life Cycle Costing Global Properties

Costing Element	Stormwater 360
Life Cycle	50 years
Acquisition Cost (\$)	\$89,767.00
Annual Maintenance	\$7,152.00
Annual Establishment	\$0
Annualized Renewal / Adaptation	\$0
Renewal / Adaptation Period	25 years
Decommissioning	\$0

Table 8: MUSIC Bio-Filtration Life Cycle Costing

Costing Element	Cost
Life Cycle Cost of Treatment Train	\$232,034
Equivalent Annual Payment Cost of Treatment Train	\$4,641
Equivalent Annual Payment per m ³ /s maximum flow reduction	-
Equivalent Annual Payment/ML flow reduction/annum	-
Equivalent Annual Payment/kg Total Suspended Solids/annum	\$8.86
Equivalent Annual Payment/kg Total Phosphorous/annum	\$5,251.02
Equivalent Annual Payment/kg Total Nitrogen/annum	\$1,104.46
Equivalent Annual Payment/kg Gross Pollutant/annum	\$42.37

Table 9: MUSIC Treatment Train Life Cycle Costing

4.4 Construction Phase Water Quality

During the construction phase of the development, an Erosion and Sediment Control Program will be implemented to minimise water quality impacts. The sediment control measures shall include silt fences, cut-off drains for polluted stormwater and diversion channels for clean stormwater run-off, gully pit sediment barriers, field inlet and sediment traps

Details of the required construction phase water quality control measures will be provided on the engineering drawings and shall be in accordance with the Queensland Stat Planning Policy for Healthy Waters (SPP4/10). However, the contractor shall be responsible for the provision of the construction phase water quality objectives which shall be enforced by the preparation and implementation of an Erosion and Sediment Control Program.

The following information is provided to identify controls and procedures, and who is responsible for them, which will be incorporated into the Erosion and Sediment Control Program:

4.4.1 Pre-Construction

- Establish a single stabilised entry/exit point (rumble pad) for each stage of construction. This point should also include a vehicle shakedown device to mitigate the transportation of dust and dirt.

- Sediment fences are to be placed along the low side of the site to slow flows, reduce scour and capture some sediment runoff.
- Sediment fences are to be constructed at the base of fill embankments.
- Divert up-slope water around the work site and appropriately stabilise any drainage channels.
- Areas for plant and construction material storage are to be designated along with associated diversion drains and spillage holding ponds.
- Diversion banks are to be created at the upstream boundary of construction activities to ensure upstream runoff is diverted around any areas to be exposed. Catch drains are to be created at the downstream boundary of construction activities.
- Construction of temporary sediment basins.
- Site personnel are to be educated to the sediment and erosion control measures implemented on site.

4.4.2 During Construction

- Progressive stabilisation of filled areas and fill batters.
- Construction activities are to be confined to the necessary construction areas.
- The provision of a construction exit to prevent the tracking of debris from tyres of vehicles onto public roads. Only one construction exit will be nominated to limit the movement of construction equipment.
- The topsoil stockpile location will be nominated to coincide with areas previously disturbed. A sediment fence is to be constructed around the bottom of the stockpile to trap sediment. A diversion drain is to be installed upstream of the stockpile if required.
- Roof downpipes should be installed as soon as practicable after the roof is laid.
- Transport loads that are subject to loss through wind or spillage shall be covered or sealed to prevent entry of pollutants to the stormwater system.
- Regular inspection and maintenance of silt fences, sediment basins and other erosion control measures. Following rainfall events greater than 50mm inspection of erosion control measures and removal of collected material should be undertaken. Replacement of any damaged equipment should be performed immediately.

4.4.3 Post Construction

- The Contractor/Developer will be responsible for the maintenance of erosion and sediment control devices from the possession of the site until the site is accepted as practical completion or until stabilisation has occurred to the satisfaction of the superintendent and Council.
- Key stormwater quality improvement devices requiring maintenance during the operational phase of the project following construction.

Maintenance requirements for these devices have been provided by Stormwater 360 and it is included in Appendix 1 of this report.

- The Sediment and Erosion Control Management Plans should be provided to all people involved with the site, including sub-contractors, private certifiers, home owners and regulators. These guidelines have been formed in accordance with the Healthy Waterways Fact Sheet 'Erosion and Sediment Control Management Plans' and the 'Best Practice Erosion and Sediment Control'.

4.5 Water Quality Monitoring Program

This development does propose the use of water sensitive practices and the associated stormwater quality management practices at the outlet areas. The stormwater runoff will eventually discharge into sensitive waterways, but there is no proposal for water quality monitoring within the drainage infrastructure downstream of the site to be undertaken. The stormwater treatment devices used in this plan are based upon the Healthy Waterways Technical Design Guidelines for South East Queensland and represent best management practices.

A form for release of sediment-laden stormwater from the site and an inspection record of stormwater quality improvement devices will be developed. It is intended that each release resulting from a storm event generating more than 100mm in a twenty-four hour period be recorded on the form to ensure ongoing monitoring, management and reporting of releases from the site.

4.6 Maintenance

Particular care has been taken in the design of the proposed stormwater treatment train to reduce the maintenance requirements. Stormwater360 has provided a Treatment Train Operations and Maintenance scope for the site, refer appendix 2 for details.

5 CONCLUSIONS

This proposed site based stormwater management plan was prepared to assess both the stormwater quantity and quality aspects of the site. The proposed stormwater systems have been calculated based on QUDM 2013 design criteria and Brisbane City Council City Plan 2014. Findings show that the peak discharges from the site in the post-development scenario are greater than the existing peak discharges from the site at the legal point of discharge, however because the site is located within the bottom one-third of the catchment, it is proposed that no on site detention is required. As there are no downstream developments proposed the current drainage will cater for the proposed development and not cause any negative effects to upstream properties.

The overland flow path traversing the site will be maintained and incorporated into the developments design.

The proposed stormwater treatment devices were modelled using MUSIC v6.0 software prepared by Stormwater360 and reviewed by ACOR Consultants. The modelling shows that the proposed stormwater drainage and treatment strategy meet the Council's Stormwater Quality Objectives in accordance with South East Queensland Healthy Waterways Partnership's Water by Design WSUD Technical Guidelines for South East Queensland Version 1.0 (2010).

6 REFERENCES

- Queensland Urban Drainage Manual, Queensland Government Natural Resources and Water, 2007
- Brisbane City Plan 2014, Chapter 7, 2014
- MUSIC Modelling Guidelines Version 1.0, Water By Design, 2010
- Water Sensitive Urban Design – Technical Design Guidelines for South East Queensland version 1, Health Waterways, June 2006

APPENDIX 1

Stormwater 360 - Maintenance Costs

Option proposal

To:	ACOR Baseline Consultants	Date:	2 September 2014
Attention :	Gustavo Pereira	Page :	1 of 2
Phone :	(07) 3844 5900		
Email/Fax :	gpereira@acor.com.au/(07) 3844 7588		
Subject/Ref :	04924 - Lot 808 MacArthur Ave, Hamilton		

Dear Gustavo

In response to your recent enquiry I'm pleased to offer two payment options for the provision of the stormwater solution designed for the above mentioned project.

Option 1: Equipment leasing

- No capital outlay
- All maintenance and consumables are included in one simple regular payment
- Tax deductible
- Guaranteed Environmental Compliance
- 25 year term

Option 2: Equipment purchase

- Outright purchase
- Separate maintenance cost delivering annual StormFilter service and quarterly EnviroPod service with annual, quarterly or monthly payment options
- Additional charges for consumables

Products designed		Option 1	Option 2
Product	Qty	MONTHLY LEASE	PURCHASE
13-Cardridge Manhole StormFilter (9c690SFMH.Q)	1.00	\$1,352.00	Purchase: \$89,767.00
9-Cardridge Manhole StormFilter (9c690SFMH.Q)	1.00		PLUS
EnviroPod to suit up to 900 x 900 Pit (A1-5)	8.00		
Freight of Goods to Site	1.00		Yearly Maintenance: \$7,152.00

Estimates exclude GST. Terms and conditions apply. Quote valid for 30 days.

NSW Office

PO Box 792, Botany, NSW 1455

Tel: 1300 354 722

Fax: 1300 971 566

QLD Office

PO Box 4471 Forest Lake QLD 4078

Tel: 1300 354 722

Fax: 1300 971 566

Email: enquiries@treatmentsolutions.com.au

Treatment Solutions Pty Ltd

ACN 155 928 966

Australian Credit Licence No. 4421117

Email: enquiries@stormwater360.com.au

IES Stormwater P/L trading as Stormwater360

ABN 79 101 258 182

www.stormwater360.com.au

Items included in estimate

Delivery (Free on Truck) to site of pre-cast components, filter cartridges and EnviroPods. Detention StormFilters requires the contractor to build the detention tank as specified by the consulting engineer. SW360 will install the underground manifold. Please contact your local representative for more detail if required.

Items to be provided by others

- Site earthworks
- Unloading and installation of vault/s
- Supply and installation of risers (if required)
- Supply and installation of pipe connections
- Fit-out of StormFilter cartridges once the site is stabilised and the drainage infrastructure cleaned
- Unloading and installation of EnviroPods, unless clearly stated otherwise

Maintenance

Stormwater360 selects easy-to-access treatment systems that have been designed for minimal maintenance. However regular cleaning and device maintenance are necessary to remove pollutants and ensure the proper performance of your stormwater management system and compliance with the local regulations.

The per annum maintenance estimate listed on page 1 is based on the following standard service intervals:

- StormFilter – 12 months
- EnviroPod – 4 months

Please note: the EnviroPod maintenance frequency may be influenced by landuse.

Next steps

For further information concerning **Option 1: Equipment leasing** please contact:

Jeremy Brown

Treatment Solutions Pty Ltd

m: 0414 903 268

p: 1300 354 722

e: jeremyb@treatmentsolutions.com.au

Australian Credit Licence No.: 442 1117

ACN: 155 928 966

For further information concerning **Option 2: Equipment purchase** please contact:

Lachlan Shackcloth-Bertinetti (NSW)

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APPENDIX 2

Stormwater 360 - O&M Details

Operations and maintenance

StormFilter® EnviroPod Treatment Train



Our waterways. Our future.

Stormwater360
AUSTRALIA

Device details			
Location of Device			
GPS Coord	N:	E:	D P Number:
Relevant Council			
Company			
Contact	Email		Ph
Engineer			
Contact	Email		Ph
SFEP Treatment			
1			
2			
Frequency of Inspection/Maintenance		Maintenance Estimated Annual Cost	
	Inspections (time/year)	Major Maintenance	StormFilter
StormFilter			EnviroPod
			TOTAL
EnviroPod			

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Maintaining the EnviroPod® Stormwater Gully Pit Insert

Maintenance is as integral to every stormwater management system as it is to any other item of machinery or equipment.

The primary purpose of the EnviroPod® Stormwater Gully Pit insert is to filter out and remove pollutants from entering our waterways. To ensure that the EnviroPod® continues to function effectively, it is important that the pollutants it captures are periodically removed, and the filtration components properly cleaned.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site, as well as the occurrence of events such as chemical spills or excessive sediment loading due to site erosion or extreme storms. Similarly, the system should be inspected after all major storm events.

Treatment Train Specifications



Performance Specification

The stormwater filtration treatment train shall consist of x 200 micron gully pit basket/s and x 460/690mm passive, siphon-actuated, radial flow, self cleaning media filtration cartridge system/s operating at a specific flow rate of not more than 1.5L/s/m².

The gully pit basket system shall consist of the following components;

- Removable 200 micron Nylon monofilament Precision woven Filtration Bag
- Fixed Galvanised Mesh Cage (no greater than 80mm x 80mm) around the Filtration Bag
- Recycled modified ABS plastic to seal the unit into the pit
- By-pass mechanism above the Filter with no moving parts
- System rigidly fixed to the walls of the pit.

The media filtration system shall be located within the following structure.

- Manhole
- DownPipe
- Linear
- Vault
- Large Box
- Detention.

Regardless of the system type, the media filtration system shall consist of the following components;

- Inlet energy dissipation
- Cartridge section
- Outlet section to bypass storm flows and convey treated stormwater
- Access Lids in roof slab for access to Cartridges
- Siphon actuated cartridges filled with proprietary ZPG™ filter media
- Specific flow rate of each individual cartridge limited not to exceed 1.5L/s/m²
- Air Lock Cap complete with one way Air Valve Flap
- Outer Hood complete with Scrubbing Regulators
- Automated high-energy turbulence on the screen face (only) at the end of storm flows to flush pollutants from the cartridge
- Centre Drainage Tube complete with Buoyancy Float
- Individual Cartridge Flow Restrictor Disc
- ¼ Turn Bayonet Fittings
- Under drain manifold to convey treated stormwater to the receiving environment.

Components of any proposed treatment train or technology



The components of any proposed the treatment train or technology, including a gully pit basket upstream of a radial flow cartridge filtration system, must be evaluated for a range of pollutants and these performance expectations must comply with current best practice guidelines, i.e. Water by Design "MUSIC Modeling Guidelines version 1.0 2010" for South East Queensland.

In short, the performance evaluation of any system must show:

- 1 Any reduction efficiencies are justified by rigorous scientific testing as determined by an independent peer reviewer and the results further peer reviewed and published in a credible scientific journal. Any potential or perceived conflicts of interest should be disclosed within the published article.
- 2 Published article providing insight into the pollutant composition (e.g. soluble vs particulate for nitrogen) and the mean concentration of inflow and outflow to compare to local and or regional conditions.
- 3 Performance evaluation undertaken in dry weather conditions or a method to take into account any potential leaching of nutrients that may occur in the system(s).
- 4 Evaluation is conducted using full-scale systems with details of treatable flow rates sampled and how they correlate to discrete removal efficiencies and comparisons to the designed treatable flow rates of the device. A comparison should also be made to the climatic conditions especially where un-restricted filters are used.

Maintenance Overview

The primary purpose of the Stormwater Treatment Train is to filter out and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the system to its full efficiency and effectiveness.

- * Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance must be performed in accordance with the Treatment Trains Operation and Maintenance Guidelines.

Introduction



This manual has been designed to assist you with cleaning and maintaining the EnviroPod Stormwater Gully Pit Insert, using the methods recommended by the manufacturer.

The cleaning process and methods described cover all aspects of the system, including:

- Removing the grate
- Cleaning the filter bag
- Inspecting the unit
- Rejuvenating the filter bag
- Re-installing the filter bags.

The manual should be used in conjunction with your site's traffic management and safety plans, as well as other appropriate Stormwater360 (IES) documents such as the IES Employee Health and Safety Manual. We also recommend that maintenance and cleaning contractors, or device owners, develop their own site-specific health and safety activity plans to ensure a safe work environment.

*** Please note:** This manual consists primarily of the processes and tasks associated with the hand maintenance and inductor maintenance procedures. It does not include details of the site's traffic management or occupational health and safety requirements. Contractors or IES staff should utilise their own Employee Health and Safety Manual, which details the policies and procedures for safe work.

Why cleaning and maintenance are so vitally important

Adhering to the inspection and maintenance schedule of each stormwater treatment device is essential to ensuring that it works properly throughout its estimated design life.

During each inspection and clean, details of the mass, volume and type of material that has been collected by the device should be recorded. This data will assist with the revision of future management plans and help determine maintenance interval frequency. It's also essential that qualified and experienced personnel carry out all maintenance (including inspections, recording and reporting) in a systematic manner. To ensure consistency, we recommend that one person be responsible for overseeing the management of the maintenance and cleaning process.

Maintenance of your stormwater management system is essential to ensuring ongoing at-source control of stormwater pollution. Maintenance also helps prevent structural failures (e.g. prevents blocked outlets) and aesthetic failures (e.g. debris build up).

Health and safety



The EnviroPod has been designed to trap and retain pollutants in stormwater runoff, helping to maintain the quality of water entering our aquatic ecosystems. Depending on the nature of your site, pollutants can range from organic material such as leaves and sticks through to debris such as broken glass, syringes or other potentially harmful materials.

Access to gully pits containing EnviroPods may require removing heavy protective grates, while cleaning such pits may entail working in confined spaces. For these reasons, all aspects of maintaining and cleaning your EnviroPod require careful adherence to Occupational Health and Safety (OH&S) guidelines. Doing so will ensure that all maintenance personnel are adequately protected and have been properly trained before taking part in any specialist activities. The same level of care needs to be taken to protect non-work personnel in and around the site, while appropriate traffic control measures must be put in place where collection pits are situated in, or adjacent to, roadways or car parks.

* The procedures indicated in the Operations section of this manual are recommended as the safest and most efficient manner of conducting the maintenance of EnviroPod units (Section 2), however contractors and cleaning staff may vary the procedure in response to the site conditions; varying work practices; or general preferences in the cleaning techniques. Please note that procedures outlined in this manual are not exhaustive, and that any changes made should always comply with general safe work practices.

Cleaning of EnviroPod filters and StormFilters is a specialist activity. The material collected by the devices can be harmful, and needs to be handled correctly. For example, sediments may contain heavy metals and carcinogenic substances as well as harmful objects such as broken glass and syringes. It is essential that Occupational Safety and Health guidelines are followed at all times, and that the following steps are carried out to ensure safe and successful maintenance operations.

In addition to the dangers associated with the cleaning and handling of material in the filter bags, precaution needs to be taken with activities such as removing the grate as well as with managing the traffic, pedestrians and other non-worker personnel at the site. The general workplace hazards associated with working outdoors also need to be taken into account.

2.1 Personnel health and safety

All contractors and staff must comply with all current workplace health and safety legislation and take all practicable steps to:

- Comply with all applicable laws, regulations and standards
- Ensure that all employees, contractors and visitors are informed of and understand their obligations in respect of current workplace health and safety legislation
- Ensure that employees understand and accept their responsibility to practice and promote a safe and healthy work environment.

* Take proper care. Pollutants can range from organic materials such as leaves and sticks through to debris such as broken glass, syringes or other potentially harmful materials.

While cleaning and maintaining filters, all relevant precautions must be taken to prevent contact with sediment and litter. This includes wearing the following personal protective and safety equipment:

- Puncture resistant gloves
- Steel capped safety boots
- Fluorescent safety vest
- Overalls or similar skin protection
- Safety apron (if necessary)*
- Eye protection (if necessary)*.

* Higher personal safety conditions may be required when maintaining units that may contain more hazardous material, for example pits where syringes have been observed or pits located in areas associated with such activities.



2.2 Traffic control

Stormwater collection pits are typically situated either in or on roads and car parks, or adjacent to roads in a footpath or swale. Traffic control requirements across all such locations differ with most of the state and local road authorities requiring the same controls to be implemented whether the work is to be conducted on the road or on the road reserve.

As traffic requirements differ depending on road usage and the specific road configuration, separate traffic control plans should be prepared for each site. Given that maintenance is typically a quick process, the contractor should liaise with the relevant road authority to determine the specific road safety requirements for each location to ensure that on site workers can conduct the cleaning operations safely and efficiently, while complying with all laws and regulations.

State government publications such as the NSW RMS *Traffic Control at Work Sites* safety manual outline the signage requirements, placement of barricades or witches hats and the positioning of traffic control personnel that's required when working on public roads. For increased safety, IES recommends that the maintenance vehicle be used to shield the work area from oncoming traffic.

Photo 1 shows the maintenance vehicle with cones placed around and positioned to shield the work area. **Photo 2** shows the head-on view, note the vehicle is positioned to allow access to the drive, whilst still blocking the pit from on-coming traffic. The vehicle has a flashing light on the roof and the hazard lights switched on.

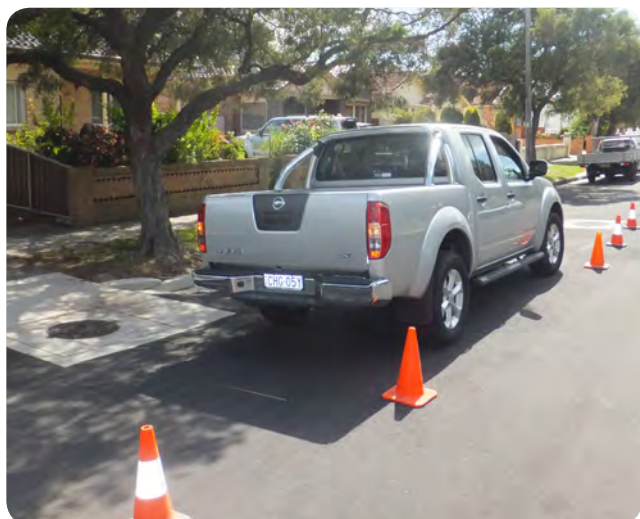


Photo 1 Vehicle positioned near pit, preventing traffic from passing close to the pit.

2.3 Confined spaces

Confined space entry procedures are not included as part of this manual. For IES employees these procedures are included as part of the IES Safety Manual. It is recommended that all contractors evaluate their own needs for confined space entry and compliance with Occupational Health and Safety regulations.

When repairs or maintenance activities cannot be conducted from the surface, and there is a need to enter and work in a confined space, only staff with current confined space training are permitted to operate in a confined space. Appropriate measures and controls must be put in place to meet confined space entry requirements. At all times the necessary safety equipment must be worn, and where gas or oxygen hazards occur, only staff trained in its use will use breathing apparatus gear. **Non-trained staff must not go into confined spaces.**

* Confined spaces pose a serious safety hazard for all personnel; however during the normal maintenance procedures there should be no reason to enter a confined space and all maintenance procedures are able to be conducted from the surface.

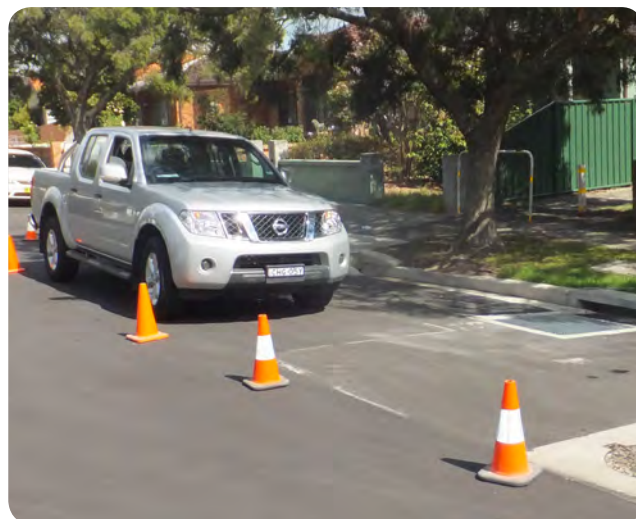


Photo 2 Head-on view, indicating the placement of the vehicle near the pit.

Operations



EnviroPod units need to be regularly inspected to determine whether they require maintenance or cleaning. This process involves several steps, and may require two or more maintenance personnel working together, as well the use of specialised equipment such as a hydraulic lifting arm or an inductor truck with a vacuum hose.

As gully pit grates are usually quite heavy, it is important that correct lifting procedures are adopted, and that the area surrounding the opened pit is shielded from access to non-work personnel.

If inspection reveals that the filter bag needs to be emptied and rejuvenated, the entire unit should also be examined to ensure that all connections and joints are sound. Any material that has accumulated in the overflow diversion channels or outlet pipes also needs to be removed, with those areas then being flushed. Where required, filter bags may need to be cleaned or repaired, and all waste material must be disposed of according to local guidelines at either an approved disposal site or transfer station.

This section outlines the procedures for cleaning the EnviroPod units. It has been written so that someone who has never previously encountered a stormwater pit or an EnviroPod unit can carry out such maintenance by simply following the outlined steps.

3.1 Maintenance and monitoring of EnviroPod filters

To ensure that each EnviroPod unit achieves optimal performance, the material collected by the filter bag should be emptied when the level of material is no more than approximately **half to two thirds** of the total bag depth or when there is evidence of material overflow. While the bag has a greater storage capacity, it is recommended that it is not left to fill completely prior to emptying, for the following reasons:

- the bags are capable of retaining a heavy mass of material (in excess of 50kg), which will make them more difficult to lift and empty
- material near the top of the bag can be re-suspended during high to extreme rainfall events
- blockage of the overflow sections can occur, when material is allowed to build up above the filter bag.

It is also recommended that additional monitoring is conducted following moderate to extreme rainfall events, especially when preceding months have had little or no rainfall. This increased frequency of monitoring is necessary as there is a greater accumulation of surface contamination during low rainfall periods, which will then enter the unit with the higher volumes of runoff generated during a major rainfall event. It is also important to ensure that the units have not been damaged due to high pipe velocities.

3.2 Stormwater pit cover removal

3.2.1 Hinged pit grates

These are the steps for opening a hinged pit grate:

- 1 Insert the lifting hooks beneath the grate.
(Position indicated in **Photo 3**)
- 2 Check hinge point is not damaged and debris is not caught in the hinge area.
- 3 Fully open pit grate, ensuring that the grate will stay in the open position without any external forces applied. Grates that do not remain open without being held should be removed or secured during cleaning or maintenance activities. **Photo 4** indicates the grate being opened and grate resting freely in the open position, respectively.

* **Please note:** Many cast iron hinges are not hinged securely (to enable the removal of the grate). This may result in the pit grate not being able to sit in an open position. Additionally the hinge pins may also be damaged or corroded, which may allow the grate to fall into the pit. Such pit grates can be removed using the method indicated below for non-hinged grates.



Photo 3 Lifting the grate



Photo 4 Fully open grate



Photo 5 Lowering grate

3.2.2 Non-hinged pit grates

To remove a non-hinged pit grate:

- 1 Place lifting hooks beneath grate, where possible in the four corners of the grate (see **Photo 6**). Concrete lids may have Gatic lifting points, a key arrangement or holes in the lid, which may require special equipment such as Gatic lifters
- 2 Position each person either side of the grate (see **Photo 7**)
- 3 Lift the grate, ensuring that good heavy lifting posture is used at all times
- 4 Place the grate on an angle on the gutter, to allow for the lifting hooks to be removed (see **Photo 8**)
- 5 For extremely heavy one-piece grates and concrete Gatic covers, insert the lifters in place and slide the lids back. Note some lids may still require two people



Photo 6 Insert hook near edge of grate



Photo 7 Position each lifter either side of the grate



Photo 8 Lift grate and move grate to one side



Photo 9 Lift grate above the support frame



Photo 10 Reinstated non hinged grate

3.3 Cleaning methods

One of the following maintenance methods should be used for servicing EnviroPod Filters:

3.3.1 Cleaning using an inductor truck

Follow these steps to safely and efficiently clean the EnviroPod using an inductor truck:

- 1 Open gully pit (See Section 3.2)
- 2 Place the inductor hose over the material collected in the filter bag and switch on the inductor
- 3 Using the inductor hose, suck out all of the sediment, organic leaf material, litter etc. collected in the filter bag
- 4 Allow the filter bag to be sucked up into the inductor hose for a few seconds to allow for the filter mesh pores to be cleaned. Care is to be taken that there are no sharp edges on the inductor hose that can damage the filter bag
- 5 If material has built up around the overflows, use the inductor hose to clear the accumulated material
- 6 Remove filter bag from the pit
- 7 Sediment retained in the gully pit grate is to be removed
- 8 Back-opening channels are to be cleared of any debris to ensure flow is not hindered. This debris can also be collected using the inductor truck
- 9 All gully pit waste is to be removed from the pit
- 10 Check the EnviroPod unit (Section 3.4)
- 11 Check filter bag (Section 3.4)
- 12 Reinstate filter bag and gully pit lids



Photo 11 Cleaning an EnviroPod using the inductor method

3.3.2 Hand maintenance

To clean the EnviroPod manually by hand, follow these steps:

- 1 Open gully pit (See Section 1)
- 2 Place the lifting hooks in the lifting loops of the filter bag (See **Photo 12**)
- 3 For extremely heavy and overfilled bags either use a hydraulic lifting arm to lift the bag, or remove excess material using a shovel or similar piece of equipment. IES prefers the use of a post hole shovel, due to the reduced strain on the back when digging and the ability of the shovel to grab material vertically
- 4 Lift the bag vertically off the supporting frame, ensuring that no undue pressure is placed on the filter bag. (See **Photo 13**)
- 5 Lift the bag clear of the stormwater pit (See **Photo 14**)
- 6 Position the bag over the truck or other collection vehicle, taking hold of the loops at the base of the bag (See **Photo 15** and **Photo 16**)
- 7 Lift and empty the filter bag by holding the bottom lifting loops only (See **Photo 17**)
- 8 Completely empty the filter bag (See **Photo 18**)
- 9 Brush the filter bag with a stiff brush to remove bound sediment from the filter pores
- 10 Check the EnviroPod unit (Section 3.4)
- 11 Check the filter bag (Section 3.5)
- 12 Reinstate filter bag, ensuring bag is installed the correct way (See **Photo 19** and **Photo 20**)
- 13 Reinstate gully pit lids (See **Photo 21** and **Photo 22**)



Photo 12 Place the lifting hooks through the bag loops



Photo 13 Lift the bag from the cage and support frame



Photo 14 Lift the bag from the stormwater pit



Photo 15 Lift the bag onto the collection vehicle



Photo 16 Grab the bottom lifting loops



Photo 17 Lifting the bottom bag loops empty the filter bag



Photo 18 Completely empty the contents of the filter bag



Photo 19 Reinstall filter bag



Photo 20 Ensure that the unit is positioned correctly, with the lifting loops on the inside



Photo 21 Correctly installed filter bag



Photo 22 Installed filter bag and sealed pit

* Please note: Under no circumstances are gully pit sediments to be backwashed into the gully pit.



Photo 23 Check seals are pushed against the pit walls



Photo 24 Check joining rivets (two piece unit shown above)

3.4 Unit inspection

After the EnviroPod filter bag has been removed, emptied and cleaned, the following should be checked to ensure that the unit has not been damaged:

- All connections and joints should be checked and broken rivets replaced (See **Photo 23**)
- The plastic pit seals should be inspected for unit movement or damage (See **Photo 24**)
- The cage should be inspected for damage or movement.

The overflow diversion channels, and the area between the EnviroPod cage and pit wall should also be inspected for any accumulated debris. Any observed debris should be removed and disposed of off-site. Accumulated material within the outlet pipe may also need to be flushed.

If spare parts are required, Stormwater360 is able to provide these at a cost to the owner of the EnviroPod unit, although these parts may also be obtained from other suppliers.

*** Please note:** If the units are not cleaned regularly, the mobilisation of material collected in the EnviroPod unit may occur. As such, cleaning of the units in accordance with this management plan is required. As this plan is based on observations and data collected during the monitoring period, ongoing adjustment of the cleaning frequency is generally required to improve the overall efficiency in the removal of collected material and prevent material overflow.

3.5 Filter bag inspection and rejuvenation

After the filter bags have been emptied and cleaned, they should be inspected to evaluate their condition. Given the nature of stormwater, the filter bag may become considerably clogged with fine sediment or damaged by various objects in stormwater as well as fauna. Sharp material such as sticks, combined with high velocity water and a large mass in the filter bag, can cause small tears in the filter material. Animals such as rats have also been known to chew through fine mesh filter bags located in gully pits near takeaway food outlets.

3.5.1 Clogged filters

Clogged filter bags can be cleaned using several different methods. If the techniques described in the general maintenance sections above do not adequately clean the filter bags, the following options should be considered:

- Using a stiff brush and a bucket of soapy water, scrub the filter bag surface.
- Remove filter bags from the pit and wash the bags using a high pressure water spray, taking care not to transfer the contamination elsewhere. Wastewater from the process should be collected and disposed of correctly.
- Remove the filter bags from the pits and the support rings and wash the bags in an industrial washing machine.

This final option typically results in the bags appearing like new, with no visible stain or pore clogging within the filter mesh.



Photo 25 Slightly clogged filter bag, indicated by the brown stain on in the centre of the bag



Photo 26 A clean used filter bag

3.5.2 Damaged filters

Damaged filter bags can often be repaired, provided the damage is small. Small tears in the fabric may occur due to several reasons, however the overall strength and structure of the nylon fabric typically prevents small tears becoming much larger. Although the bag is unlikely to tear further, care must be used when cleaning torn bags so as not to spill the collected material into the pit.

Small tears may be repaired by either sewing the tear back together with additional fabric to increase the strength of the stitching, or by sewing a patch of the filter material onto the filter bag. If large tears are present, the filter bag may need to be replaced as it is no longer able to function as intended.

3.6 Disposal of material

All gully pit wastes are to be taken off site and disposed of at a transfer station or similar approved disposal site. Stormwater sediments can contain lead, copper, zinc, mercury, hydrocarbons and PCBs, which are harmful to both humans and the receiving environment. Appropriate sampling and laboratory analysis may be required to classify the material as suitable for reuse, or disposal under appropriate local guidelines.

Emergency procedures



Spills and blockages can have an immediate impact on the performance of a stormwater management system, and can potentially result in serious damage to built infrastructure as well as the surrounding waterways and wetlands.

In these types of emergencies, it is important to act quickly to remediate the problem by removing affected sediment or clearing the cause of the blockage, so that the system can resume normal and effective functioning as soon as possible.

4.1 Spill procedures

In the event of a spill discharging into any gully pit, all sediment is to be extracted and the filter bags are to be removed and replaced with rejuvenated filter bags. Normal operation procedures apply to additional cleaning as a result of spills.

4.2 Blockages

In the unlikely event of surface flooding around a gully pit fitted with an EnviroPod the following steps should be carried out:

- 1** Check EnviroPod overflow bypass. The EnviroPod filter has been designed with an overflow mechanism built into the filter box. If surface flooding still exists, check the overflow slots underneath the rubber seal. If debris is lodged in the overflow slots it can be easily cleared by hand or a steel rod.
- 2** If overflow is clear and surface flooding still exists remove EnviroPod and check outlet pipe for blockages.
- 3** Removal of the EnviroPod may be difficult if the filter is clogged and the EnviroPod is holding water. If the filter is clogged, brush the sidewalls of the filter with a yard broom or similar. This will dislodge particles trapped at the interface allowing contained water to flow through the filter.
- 4** If the outlet pipe is blocked, it is likely that a gully sucker truck will be required to unblock it. Debris should be removed from the EnviroPod with the gully sucker truck before removal of the EnviroPod filter. If a gully sucker truck is not available and the EnviroPod needs to be removed by hand, follow the steps below:
 - a** Remove excess debris by hand or brush the side of the filter.
 - b** Lift and place filter ring through the filter box and into cage.
 - c** Remove Filter box.
 - d** Lift cage containing filter bag and ring out of the pit.
 - e** Unblock outlet pipe.

The Stormwater Management StormFilter®

For almost two decades the Stormwater Management StormFilter® has helped meet the most stringent stormwater quality requirements.

The system has been continually tested and refined, to ensure it achieves maximum reliability and performance.

As a best management practice (BMP) system, it removes the most challenging target pollutants – including fine solids, soluble heavy metals, oils and total nutrients (including soluble) – by using a variety of media to achieve site-specific pollutant removal objectives.

StormFilter® overview



1.1 Description

StormFilter is a passive, flow-through stormwater filtration system consisting of vaults that house rechargeable cartridges filled with a variety of filter media, and is installed in-line with storm drains. The StormFilter works by passing stormwater through media-filled cartridges, which trap particulates and adsorb materials such as dissolved metals and hydrocarbons. After being filtered through the media, the treated stormwater flows into a collection pipe or discharges into an open channel drainage way. StormFilter is offered in three different configurations: cast-in-place, precast and linear. The precast and linear models utilise pre-manufactured vaults. The cast-in-place units are customised for larger flows and may be either covered or uncovered underground units.

1.2 Operation

1.2.1 Purpose

The StormFilter is a passive stormwater filtration system designed to improve the quality of stormwater runoff from the urban environment before it enters receiving waterways.

Through independent third party studies, it has been demonstrated that the StormFilter is highly effective for treatment of first flush flows, and fast-paced flows, during the latter part of a storm. In general, StormFilter's efficiency is highest when pollutant concentrations are highest. The primary target pollutants for removal are: sediments (TSS), soluble metals, soluble phosphorus, nitrates, and oil and grease.

1.2.2 Sizing

The StormFilter is typically sized to meet design water quality objectives, which are subject to legislation regulated by local government authorities and other relevant environmental bodies. MUSIC modelling software is used to determine pollutant loads from a site, influenced by a number of factors such as site area, imperviousness and land use. Pollutant load reduction capabilities, based on third party testing, allows the number of StormFilter cartridges required to achieve the relevant objectives to be established. Cartridges are designed to treat a peak flow between 0.7 and 1.6 litres/second, depending on the cartridge size used. For example, 10 standard sized cartridges (460mm) are able to treat 11 L/s, as each filter can treat 1.1 L/s.

Because of the highly porous nature of the granular filter media, the flow through a newly installed cartridge is restricted to 1 L/s (average 460mm), using a restrictor disc, to ensure adequate pollutant-media contact time.



Photo 27 Filter cartridge

1.2.3 Basic function

The StormFilter is designed to siphon stormwater runoff through a filter cartridge containing media. The variety of media available can be designed to act as a mechanical filter to remove sediments, as an ion exchanger to remove dissolved heavy metals, and as an absorber to remove oils and greases.

1.2.4 Priming system function

The treated stormwater collects in the centre tube of the cartridge, which is equipped with a self-priming siphon system. (Figure 1 illustrates this system.) The key component of the system is the plastic float, consisting of a ball located at the base leading up to a larger portion, which provides increased buoyancy. Initially the ball rests in a seat, effectively closing off the port to the drainage manifold.

As a result, the filter fills the centre drainage tube until the water level has risen high enough to purge the air from the filter cartridges and displaces the float. At a water depth of 22 inches the float pulls loose and allows the filtered water to drain out through the manifold. This effectively “primes” a siphon within the drainage tube and greatly increases the potential across the filter. The priming system increases StormFilter’s ability to be loaded with sediment. A related feature is the cartridge “hood”. This hood maintains the siphon effect by preventing air from being drawn into the cartridge until the external water level drops below the bottom of the hood.

Cartridges are connected to the manifold with a plastic connector. These can be either quarter turn connectors or in the older systems, threaded connectors.

StormFilter is also equipped with flow spreaders that trap floating debris and surface films, even during overflow conditions. Depending on individual site characteristics, some systems are equipped with high and/or low flow bypasses. High flow bypasses are installed when the calculated peak storm event generates a flow that overcomes the overflow capacity of the system. This is especially important for precast systems. Low flow bypasses are sometimes installed to bypass continuous inflows caused by ground water seepage, which usually do not require treatment. All StormFilter units are designed with an overflow. The overflow operates when the inflow rate is greater than the infiltration capacity of the filter media.

1.2.5 Maintenance overview

The primary purpose of the StormFilter is to filter out and prevent pollutants from entering our waterways. Like any effective filtration system, these pollutants must be removed periodically to restore the StormFilter to its full efficiency and effectiveness. Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. To assist the owner with maintenance issues, Stormwater360 provides detailed Operation and Maintenance Guidelines with each unit.

Stormwater360 can provide maintenance services completely, or in part. Available services include tracking of installed systems, advising the system’s owner of maintenance needs, and notification of the regulatory agency once the system has been maintained.

Maintenance is usually performed in the dryer periods to rejuvenate the filter media and prepare the system for the next rainy period. Maintenance activities can also be required in the event of a chemical spill or excessive sediment loading due to site erosion or extreme storms. It is good practice to inspect the system after severe storm events.

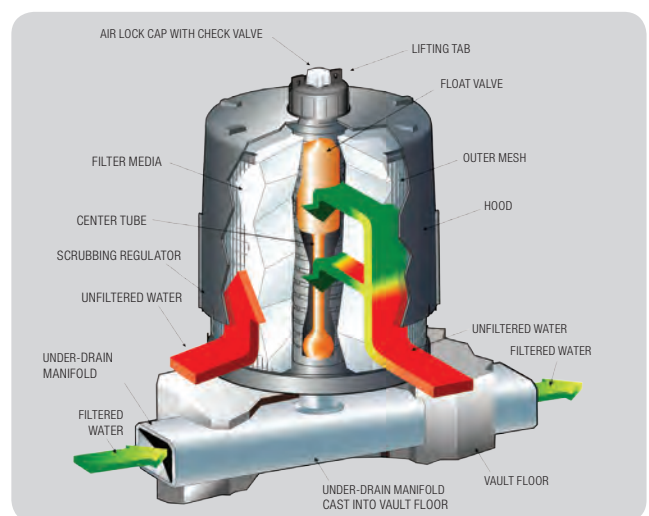


Figure 1 Filter cartridge

StormFilter[®] maintenance and performance expectations



To ensure the optimal and ongoing performance of the StormFilter, the system requires systematic inspection, cleaning and maintenance. This maintenance regime falls into two categories – ongoing minor inspection and maintenance, and major cleaning and maintenance. The maintenance frequency is largely determined by the conditions of each site, and the amount of sedimentation in the stormwater runoff that flows through the system. Unexpected events such as chemical spills, erosion or extreme storm activity require immediate inspection of the system, together with removal of debris or contaminated sediment, and where appropriate, replacement of the media cartridges.

While some maintenance activities can be completed by hand, others require specialised equipment such as an inductor truck with a vacuum hose. In all cases, it is important that maintenance staff are properly trained in the functioning of the StormFilter system and have a good knowledge of the correct procedures for disposing contaminated sediment as well as the methods for removing and installing StormFilter media cartridges.

At all times, appropriate safety equipment must be used, and Occupational Health And Safety (OH&S) guidelines adhered to.

2.1 Types of maintenance

Presently, procedures have been developed for two levels of maintenance:

- Inspection and/or minor maintenance
- Major maintenance.

Inspection/minor maintenance activities are combined since the minor maintenance does not require special equipment and typically little or no materials are in need of disposal.

Inspection/minor maintenance typically involves opening the flow restricting valves (to pre-set levels) and cleaning up vegetation and debris. Major maintenance typically includes cartridge recharging. Major maintenance may involve disposal of materials that require consideration of regulatory guidelines. Depending on the particular unit configuration and equipment used, major maintenance may require an understanding of OSHA rules. **Table 1** summarises the primary activities associated with StormFilter maintenance.

Table 1: StormFilter

Facility component requiring maintenance	Maintenance activity	When maintenance activity is required	Expected facility performance after maintaining
StormFilter cartridges and containment structure	Litter and debris removal	Floatable objects or other litter is present in the filter. Remove to avoid hindrance of filtration and eliminate unsightly debris and litter.	Permanent removal from storm system.
StormFilter cartridges and containment structure	Cartridge replacement and sediment removal	Media has been contaminated by high levels of pollutants, such as after a spill.	New media is able to effectively treat stormwater.
Drainage system piping	Flushing with water	Drainage system is obstructed by debris or sediment.	Outflow is not restricted.

2.2 Maintenance activities

2.2.1 Maintenance activity timing

Two scheduled inspections/maintenance activities should take place during the year. During the minor maintenance activities (routine inspection, debris removal), the type of major maintenance required is determined and, if required for disposal, samples of the sediments and media are obtained.

The next scheduled date is to perform major maintenance activities (replacement of the filter cartridges and associated sediment removal). In addition to the scheduled activities, it is important to check the condition of the filter after major storms to check for damage caused by high flows and to check for high sediment accumulation, which may be caused by localised erosion in the drainage area. It may be necessary to adjust maintenance activity scheduling depending on the actual operating conditions encountered by the system.

2.2.2 Maintenance activity frequency

The primary factor controlling timing of maintenance for the StormFilter is sedimentation. A properly functioning system will remove solids from water by trapping these particulates within the porous structure of the media. The flow through the system will naturally decrease as more and more solids are trapped. Eventually the flow through a system will be low enough to require replacement of the cartridges. Sediment should be removed from upstream trapping devices on an as-needed basis to prevent material from being re-suspended and discharged to the system.

Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction should be inspected and maintained more often than those in fully established areas. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after large storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual filter.

2.3 Maintenance crew requirements

Table 2 lists the anticipated crew requirements for maintenance operations. Removal of water and sediments during major maintenance activities can be accomplished using either a pump and water truck or a vacuum truck. All

applicable occupational health and safety (OH&S) and disposal regulations should be followed. A general description of the maintenance activities follows.

Table 2 Anticipated Crew Requirements

	Inspection/Minor Maintenance	Major Maintenance: Sediment Removal	Major Maintenance: Cartridge Replacement
Labourer	1		1
Skilled Worker	1	1	1
Vacuum/Water Truck Operator		1	0/1
Total	2*	2*	2/3*
Special Requirements	Knowledge of Proper StormFilter Function	Knowledge of Disposal Requirements	Knowledge of Cartridge Removal and Installation Procedures

* May require OH&S trained person if/when vault entry occurs.

2.4 Maintenance methods

2.4.1 Minor maintenance/inspection (twice a year)

Minor maintenance typically will involve the steps below, however if it appears that a spill of some type has occurred, the local hazard control agency and Stormwater360 should be notified immediately.

Steps for Minor Maintenance/Inspection

- 1 Maintenance to be performed by a skilled worker familiar with StormFilter units.
- 2 If applicable, set up safety equipment to protect pedestrians from fall hazards presented by open access covers. Also set up appropriate safety equipment for work near roadways.
- 3 Inspect the external condition of the unit and take notes concerning defects/problems.
- 4 Open the access covers to the vault and allow the system to air out for 5-10 minutes.
- 5 **Without entering the vault**, inspect the inside of the unit, including components.
- 6 Take notes about the external and internal condition. This includes inspecting pit penetrations, walls, lids, ladders and grates etc.
- 7 Give particular attention to recording the level of sediment build-up on the floor of the vault and on top of the internal components. If flow is occurring, note the level of water and estimate the flow rate per drainage pipe. Record all observations.
- 8 Remove large loose debris and litter using a pole with a grapple or net on the end.
- 9 Close and fasten the access cover, and remove safety equipment.
- 10 Finally, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loadings of other materials to the system.

* In the case of a spill, workers should abort maintenance activities until the proper guidance has been obtained.

2.4.2 Major maintenance inspection (once a year)

The primary goal of the major maintenance inspection is to assess the condition of the cartridges relative to the level of sediment loading. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, large amounts of sediments should be present and very little flow will be discharging from the drainage pipes. It is likely that the cartridges need to be replaced. Major maintenance inspection will typically involve the steps below. However, if it appears that a spill of some type has occurred, the local hazard control agency and Stormwater360 should be notified immediately. **In the case of a spill, the worker should abort maintenance activities until the proper guidance has been obtained.**

Steps for Pre-Major Maintenance Inspection

- 1 Maintenance to be performed by a skilled worker familiar with StormFilter units.
- 2 If applicable, set up safety equipment to protect pedestrians from fall hazards presented by open doors. Also, set up appropriate safety equipment for work near roadways.
- 3 Inspect the external condition of the unit and take notes concerning defects/problems.
- 4 Open the access covers to the vault and allow the vault to air out for 5-10 minutes.
- 5 Without entering the vault, give the inside of the unit, including components, a general condition inspection.
- 6 Take notes about the external and internal condition.
- 7 Give particular attention to recording the level of sediment build-up on the floor of the vault, and on top of the internal components.
- 8 Remove large loose debris and litter using a pole with a grapple or net on the end.
- 9 If the visit is during a storm, make the flow observations discussed above.
- 10 Close and fasten the access cover, and remove safety equipment.
- 11 Make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
- 12 Review the condition reports from the previous minor and major maintenance visits and schedule for cartridge replacement if needed.

2.4.3 Major maintenance: sediment removal and cartridge replacement (and emergency)

Major maintenance/filter cartridge replacement typically involves the steps below. However, if it appears that a spill of some type has occurred, the local hazard control agency and Stormwater360 should be notified immediately. **In the case of a spill, the worker should abort maintenance activities until the proper guidance has been obtained.**

Depending on the configuration of the particular system, a worker may be required to enter the vault to perform some tasks. If vault entry is required, OH&S rules for general confined space entry must be strictly adhered to. Filter cartridge replacement should occur during dry weather and it may be necessary to plug the filter inlet pipe if base flows exist. Standing water present in the vault should be regarded as polluted and contained during this operation by temporarily capping the manifold connectors.

*** Please note:** Confined space entry may be required on StormFilter systems. In this case, please ensure that appropriate Confined Space entry training and subsequent certification has been undertaken and is valid, and work procedures are strictly adhered to. If you are unsure, do not enter the vault and contact Stormwater360 immediately.

Steps For Cartridge Replacement Maintenance

- 1 Depending on the particular unit, one or two utility workers and a hauling truck operator will deliver the replacement cartridges to the site. Information concerning how to obtain the replacement cartridges is available from Stormwater360.
- 2 If applicable, set up safety equipment to protect pedestrians from fall hazards presented by open doors. Also, set up appropriate safety equipment for work near roadways.
- 3 Inspect the external condition of the unit and take notes concerning defects/problems.
- 4 Open the doors to the vault and allow the system to air out for 5-10 minutes.
- 5 Without entering the vault, give the inside of the unit, including components, a general condition inspection.
- 6 Make notes about the external and internal condition.
- 7 Give particular attention to recording the level of sediment build-up on the floor of the vault and on top of the internal components.
- 8 Ensuring safe working procedures are met, off load the replacement cartridges (16-39kgs each) and set aside.
- 9 Remove the top cap (threaded), upper seal and float from the cartridge. Repeat procedure for every cartridge within StormFilter vault. Place items in a large plastic container to be lifted from the vault.
- 10 Using a cordless drill and 8mm hex head, remove the three screws located around the top perimeter of the cartridge hood. Place screws in the large plastic container and, once full or completed, remove plastic container from vault.
- 11 Move the vacuum truck near the StormFilter vault on the down-wind side. Be sure that the truck is not too close to the vault so that fumes will not enter the vault. Make sure that the last 500mm of the nozzle is approximately 100-125mm in outside diameter.
- 12 Feed vacuum nozzle into cartridge bay and start vacuum truck. Remove cartridge hood and place nozzle directly onto filter media. Completely remove media from each cartridge and repeat process for every cartridge in vault.
- 13 Once completed disconnect cartridges from vault floor and place hood back on cartridges
- 14 Using the appropriate lifting cap, attach the cable and remove the cartridge (up to 10kgs. each) from the vault. It is strictly prohibited to have personnel standing under suspended cartridges. Care must also be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner unless Stormwater360 is performing maintenance activities and damage is not related to discharges to the system.
- 15 Set the used cartridge aside or load onto the hauling truck.
- 16 Repeat steps 14 to 15 until all cartridges have been removed.
- 17 Remove deposited sediment from the floor of the vault. This can be accomplished by using the vacuum truck
- 18 Once the sediments are removed, it is necessary to assess the condition of the vault, particularly the manifold and the connectors. These are short sections of 2-inch schedule 50 PVC, or threaded schedule 80 PVC that should protrude above the floor of the vault. If required, apply a light coating of FDA approved silicon grease to the outside of the exposed portion of the connectors. This ensures a watertight connection between the cartridge and the drainage pipe. Replace any damaged connectors.
- 19 Using the boom, crane, or tripod, lower and install the new cartridges (typically 30kg for standard 460 cartridges). Once again, take care not to damage connectors.
- 20 Close and fasten the access cover, and remove safety equipment.
- 21 Make notes about the local drainage area relative to ongoing construction, erosion problems, or high loadings of other materials to the system.
- 22 Finally, dispose of the residual materials in accordance with applicable regulations. Make arrangements to return the used cartridges to Stormwater360.

2.4.4 Related maintenance activities (performed on an as-needed basis)

StormFilter units are often just one of many components in a more comprehensive stormwater drainage and treatment system. The entire system may include catch basins, detention vaults, sedimentation vaults and manholes, detention/retention ponds, swales, artificial wetlands, and other miscellaneous components. In order for maintenance of the StormFilter to be successful, it is imperative that all other

components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities. In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil and grease loading, and discharges of inappropriate materials.

2.5 Typical equipment required for maintenance activities

Typical equipment required for conducting maintenance is shown in Table 3. Some of the materials listed are suggestions rather than requirements. It should be noted that there is more than one way to accomplish some tasks. Owners

with available labour and equipment resources may desire to use alternative methods. However, it is advisable that guidance from Stormwater360 be obtained prior to using alternative techniques.

Table 3 Maintenance Equipment Requirements

Maintenance equipment required		
Minor maintenance	Pre-major maintenance inspection	Major maintenance cartridge replacement
- Safety equipment*: First aid, cones, barricades, flagging, flares, tape, vests, hard hats - Work clothes: Rubber boots, overalls, and gloves - Door bolt, wrench, proprietary lifters (e.g. Gatic) and miscellaneous Tools - Tape measure - Flashlight - Grapple or net pole - Record keeping forms - Litter/debris container	- Safety equipment*: First aid, cones, barricades, flagging, flares, tape, vests, hard hats - Work clothes: Rubber boots, overalls, and gloves - Door bolt, wrench, proprietary lifters (e.g. Gatic) and miscellaneous Tools - Tape measure - Flashlight - Grapple or net pole - Record keeping forms - Litter/debris container	- Safety equipment*: First aid, cones, barricades, flagging, flares, tape, vests, hard hats - Work clothes: Rubber boots, overalls, and gloves - Door bolt, wrench, Pentasocket and miscellaneous Tools - Tape measure - Flashlight - Grapple or net pole - Record keeping forms - Vacuum truck - Replacement cartridges - Cartridge hauling truck - Crane, tripod and hoist, or other lifting device (150kg minimum capacity) - Shovels - Extra 50mm PVC cartridge connectors - Spare flow restrictor discs - Litter/debris container - Vault inlet pipe plug - Dolly - PVC Pipe cutter - Ladder - Cartridge installation and removal sling

*Confined space equipment may be required for vault entry. This equipment must be used by personnel with the appropriate OH&S training. This equipment typically includes: Atmospheric testing devices, atmospheric purging and ventilating devices, and entry, exit, and rescue assisting devices.

2.6 Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in a manner that will not allow the material to affect surface or ground water. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily travelled roads. Sediments and water must be disposed of in accordance with all applicable waste disposal regulations.

It is not appropriate to discharge these materials back to the stormwater drainage system. Part of arranging for maintenance to occur should include coordination of disposal of solids (landfill coordination) and liquids (municipal vacuum truck decant facility, local wastewater treatment plant, on-site treatment and discharge). Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals. Stormwater360 will determine disposal methods or reuse of the media contained in the cartridges. If the material has been contaminated with any unusual substance, the cost of special handling and disposal will be the responsibility of the owner.



SFEP StormFilter & EnviroPod Maintenance Data Sheet



Date:	Location:	GPS COORD:
System size:	Type: ☐ Cast-in-place ☐ Precast ☐ Linear	
Number of Cartridges:	Type of Cartridge: ☐ 460mm ☐ 690mm ☐ 310mm	
Filter Media: ☐ ZPG ☐ Perlite		
Type of EnviroPods:		Number of EnviroPods:
Personnel:		

STORMFILTER SYSTEM OBSERVATIONS

Last service:	
Sediment Depth on Vault Floor:	
Structural Damage:	
Cartridges submerged: ☐ Yes ☐ No	How deep:
Comments:	

ENVIROPOD SYSTEM OBSERVATIONS

Last service:
Amount of Sediment in Basket:
Structural Damage:
Comments:

DRAINAGE AREA REPORT

Excessive Oil and Grease Loading	☐ Yes ☐ No	Source:
Sediment Accumulation on Pavement	☐ Yes ☐ No	Source:
Erosion of Landscaped Areas	☐ Yes ☐ No	Source:
Comments:		

STORMFILTER CARTRIDGE MAINTENANCE ACTIVITIES

Remove Litter and Debris	☐ Yes ☐ No	Details:
Sediment Removed from Vault Floor	☐ Yes ☐ No	Details:
Quantity of Sediment Removed (estimate?):		
Replace Cartridges	☐ Yes ☐ No	Details:
Minor Structural Repairs	☐ Yes ☐ No	Details:
Residuals (debris, sediment) Disposal Methods:		
Notes/Problems:		

ENVIROPOD MAINTENANCE ACTIVITIES

Number of Bags Replaced:	Clogged EnviroPods/Bags: ☐ Yes ☐ No
Comments:	

SFEP Treatment Train Inspection Data Sheet



It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, large amounts of sediments should be present, very little flow will be discharging from the drainage pipes, and it is likely that the cartridges need to be replaced during major maintenance.

Date:	Location:	GPS COORD:
System size:	Type: ☐ Cast-in-place ☐ Precast ☐ Linear	
Number of Cartridges:	Type of Cartridge: ☐ 460mm ☐ 690mm ☐ 310mm	
Filter Media: ☐ ZPG ☐ Perlite		
Type of EnviroPods:		Number of EnviroPods:
Personnel Attending Inspection:		

STORMFILTER SYSTEM OBSERVATIONS

Last service:	
Sediment Depth on Vault Floor:	
Structural Damage:	
Cartridges submerged: ☐ Yes ☐ No	How deep:
Comments:	

ENVIROPOD SYSTEM OBSERVATIONS

Last service:	
Amount of Sediment in Basket:	
Structural Damage:	
Comments:	

DRAINAGE AREA REPORT

Excessive Oil and Grease Loading	☐ Yes ☐ No	Source:
Sediment Accumulation on Pavement	☐ Yes ☐ No	Source:
Erosion of Landscaped Areas	☐ Yes ☐ No	Source:
Comments:		

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Stormwater Management StormFilter is a licensed trademark of Stormwater360 Australia.

Stormwater360 supplies and maintains
a complete range of filtration,
hydrodynamic separation, screening and
oil/water separation technologies.

Call 1300 354 722

www.stormwater360.com.au



APPENDIX 3

Stormwater 360 - Maintenance Agreement and Facilities Management

Maintenance Agreement



Maintenance Agreement

Tax Invoice

Agreement No:

NATIONAL MAINTENANCE SOLUTIONS PTY LTD ABN: 42 156 044 834 (**we or us or our**) agrees to provide to the customer named in the Schedule below (**you**) the services described in the Schedule below (the **Maintenance Services**) in relation to the equipment described in the Schedule below (the **Equipment**) and, where applicable, any Additional Services (as later defined) and you agree to accept the provision of the Maintenance Services and, where applicable, the Additional Services (collectively the **Services**) on the terms and conditions set out in this document (including any Special Conditions set out in this document). This document will not bind us until it is signed by our authorised officer, at which time a contract for the provision of Services in relation to the Equipment (this **Agreement**) will arise without the need for us to give any further notice.

Schedule

FACILITIES MANAGEMENT PLAN			
Facilities Management Plan applies:		Yes	No
Facilities Management Plan No:		Date of Facilities Management Plan:	

CUSTOMER	
Name:	
Trading as:	ACN/ABN:
Address:	
Telephone number:	Facsimile number:
Contact person:	Email address:

EQUIPMENT		
Model	Description	Serial No(s) (if applicable)

EQUIPMENT LOCATION	

MAINTENANCE SERVICES				
Maintenance Services cover the cleaning and maintenance of the Equipment and the removal from the Equipment of Stormwater Waste (up to the Maximum Pollutant Load per Cartridge referred to below), on and subject to the Terms and Conditions set out in this document. Stormwater Waste means pollutants and concentrations generated in typical stormwater run-off defined as the pollutants (gross pollutants suspended solids, metals, nutrients and hydrocarbons only) that exist within stormwater run-off that are generated from fully developed and stabilised (once building and construction work ceases) residential, commercial and light industrial (non-manufacturing) catchments and exhibit “typical” pollutant concentrations only as prescribed in “Managing Urban Stormwater: Harvesting and Reuse” published by the Department of Environment and Conservation NSW, 2006.				
Estimated Maintenance Frequency:	Cartridge Type:		690mm	460mm
Maximum Pollutant Load per Cartridge (in kgs):				

MAINTENANCE SPECIFICATIONS	

Services Agreement Terms and Conditions

- Definitions and Interpretation** In this Agreement, unless the context otherwise requires: **Billing Period, Commencement Date, Equipment, Equipment Location, Facilities Management Plan, Maintenance Specifications, Maintenance Services, Maintenance Services Charge, Services, Stormwater Waste and Term** are as defined or referred to in the Schedule; **ACL** means The Australian Consumer Law as set out in Schedule 2 of the Competition and Consumer Act 2010 (Cth); **Additional Services** has the meaning provided in clause 3(2); **Additional Services Charges** has the meaning provided in clause 4(4); **Annual Recurrence Interval (ARI)** has the meaning provided by the Bureau of Meteorology's Australian Water Information Dictionary; **Business Day** means any day on which banks are open for business in Australia, other than a Saturday or Sunday; **GST** means goods and services tax levied under A New Tax System (Goods and Services Tax) Act 1999 (Cth) and related legislation; **Hazardous Waste** means any waste material classified as "Hazardous Waste" or otherwise identified as having specific handling and disposal requirements by the Department of Sustainability, Environment, Water, Population and Communities [Schedule] means the Schedule to this Agreement; words importing the singular include the plural and vice versa; headings shall be ignored in construing this Agreement; if any party is comprised of more than one person, those persons' obligations are joint and several; references to a party include references to that party's legal personal representatives, successors and permitted assigns; references to persons include references to corporations and other bodies and entities; references to statutes include all statutes amending, consolidating or replacing such statutes; and a reference to "\$" or "dollars" is a reference to the lawful currency of the Commonwealth of Australia.
- Term** This Agreement commences on or with effect from the Commencement Date and, subject to clause 13, shall continue for the Term.
- Provision of Services** (1) We will provide the Maintenance Services at the Equipment Location at the times specified in clause 7. For the avoidance of doubt, Maintenance Services does not include any cleaning or maintenance of, removal from or other services in relation to the Equipment for or in respect of any Hazardous Waste, aggregates, concrete, debris, plastic, shingle, sediment or other waste contained on or within runoff derived from a 1 in 5 year Annual Recurrence Interval (ARI) or flood event, construction run-off or any other waste material other than Stormwater Waste. (2) We may, and you authorise us to, provide services in relation to the Equipment which are outside of and/or in addition to the Maintenance Services (**Additional Services**) (provided that where the cost of any Additional Services exceeds the Authorised Additional Services Amount specified in the Schedule, we will obtain your consent prior to undertaking those services). Such Additional Services may include, without limitation: (a) the cleaning or maintenance of the Equipment that does not fall under the scope of Maintenance Services (including, without limitation, the removal from the Equipment of any Stormwater Waste which is in excess of the Maximum Pollutant Load per Cartridge specified in the Schedule); (b) any additional time expended by us (including reasonable waiting time for any of our personnel at the Equipment Location) in performing the Maintenance Services as a result of any failure by you to comply with your obligations under clause 9 or any operation of the Equipment under abnormal conditions (including mains fluctuations or any contamination of the Equipment); (c) any additional time or costs expended by us arising from any delays or difficulties in accessing the Equipment Location or the Equipment (or any part of it) which are outside of our control; (d) the supply and installation of consumables specific to the Equipment, other than in accordance with the Maintenance Specifications or other than where such consumables can be supplied and installed as part of the Maintenance Services without significant additional expense or increase in the time required to perform the Maintenance Services; (e) the supply of any consumables used by us to perform the Maintenance Services, in particular, any substances used to clean and maintain the Equipment; (f) clearing any gas accumulated in the Equipment that cannot be cleared by natural means (for example, ventilation); (g) the cleaning, maintenance, removal, handling, uplifting, treatment or disposal of any Hazardous Waste or any other waste material other than Stormwater Waste; (h) undertaking any remedial work in respect of the Equipment in accordance with clause 8(3); (i) undertaking any instruction or training in respect of your safety procedures and other requirements for accessing the Equipment Location; (j) pedestrian or traffic control; (k) removing pit covers using hydraulic or other similar means.
- Charges** (1) If a Facilities Management Plan is referred to in the Schedule, then the charges for the Maintenance Services are included in the Rental Payments payable under the Facilities Management Plan. (2) If a Facilities Management Plan is not referred to in the Schedule, you must pay the Maintenance Services Charges at the times referred to in the Schedule. (3) If a Facilities Management Plan is not referred to in the Schedule, on each anniversary of the Commencement Date, we may increase the Maintenance Services Charges prevailing at the relevant time by the greater of: (a) any increases in the Index over the preceding 12 months; and (b) an amount (determined by us) of not more than the Specified Percentage Increase set out in the Schedule. "Index" means the Consumer Price Index (All Groups weighted average of eight capital cities) published by the Australian Bureau of Statistics (or an equivalent index, in the event that such index is discontinued or suspended). A certificate by us as to any increase in charges will be conclusive and binding on you. (4) Whether or not a Facilities Management Plan is referred to in the Schedule, we will invoice you separately at rates from time to time prevailing for the provision of any Additional Services (**Additional Services Charges**), which must be paid by you within 14 days of the date of each such invoice. Where current rates are specified in the Schedule, these will be subject to change in accordance with any changes in prevailing rates. (5) You must reimburse us on demand for the amount of any GST payable on any supply made by us under or in connection with this Agreement. (6) You must pay interest on any amount due but unpaid under this Agreement at 2% calculated from the due date for payment until the date on which the amount is paid. Such interest shall be calculated daily and is payable on demand. (7) You must pay all payments under this Agreement by way of direct debit or in such other manner as we may from time to time direct in writing. (8) All payments by you must be paid on demand or as provided for in the Schedule in funds that are immediately available to us. If a date for payment: (a) is not a Business Day, payment must be made on the preceding Business Day; or (b) falls on a day not contained in a month, the payment must be made on the last day of that month.
- Hazardous Waste** (1) You must promptly inform us of any spill or activity on or proximate to the Equipment Location or catchment which may result in Hazardous Waste entering the Equipment. (2) We will not be liable for removing, uplifting, treating or disposing of any Hazardous Waste unless specifically agreed between you and us, in which case such services will be provided by us as Additional Services pursuant to clause 3(2). You must provide an appropriate facility at the Equipment Location to enable us to store any Hazardous Waste and pay or reimburse us all costs and expenses incurred by us in handling any Hazardous Waste. (3) You acknowledge that we may be convicted or otherwise held liable under statute or regulation as a result of your actions, inaccuracies or omissions in the description of the Hazardous Waste and its collection, deposit or retention. You agree to indemnify us and keep us indemnified against all losses, liabilities, fines, costs, expenses and damages in respect of any prosecution, claim, action or conviction against us arising from or in connection with any such action, inaccuracy or omission by you.
- Maintenance Personnel** (1) We will perform the Services using appropriately trained and qualified personnel. (2) We may subcontract the provision of any of the Services to a third party, provided that we will remain primarily liable to you for the provision of such Services.
- Maintenance Times** (1) We will perform the Maintenance Services on the Equipment at the Estimated Maintenance Frequency specified in the Schedule and in accordance with the Maintenance Specifications. (2) The Maintenance Services and any Additional Services will be performed at a time agreed upon between you and us. If either party is unable to comply with the agreed time for the Services as a result of unforeseen events outside that party's control, it will notify the other party as soon as reasonably practicable, and you and us will agree another suitable time. (3) We will perform the Services between 9.00am and 5.00pm on Business Days agreed between you and us. If you require the Services to be performed outside these hours, an after-hours surcharge may be charged by us at our prevailing standard rates.
- Certification Services** (1) Where "Certification Services" is selected in the Schedule, we will at the Estimated Certification Frequency specified in the Schedule: (a) inspect the Equipment to ascertain whether it complies with our operations and maintenance procedures and requirements (the **Requirements**); (2) where the Equipment complies with the Requirements, issue a certificate to you confirming this (**Compliance Certificate**); and (3) where the Equipment does not comply with the Requirements, advise you and work with you to complete any remedial work required to enable a Compliance Certificate to be issued, provided that the cost of such remedial work will be borne by you and any services provided by us will be charged as Additional Services, unless they fall within the scope of the Maintenance Services.
- Consumables** If a Facilities Management Plan is referred to in the Schedule, we will replace any consumables supplied with the Equipment (including, without limitation, enviropod bags and broken filter cartridges) requiring replacement due to reasonable wear and tear or normal operating conditions (**Authorised Conditions**). For the avoidance of doubt, we will not be responsible for the replacement of any such consumables where the requirement for replacement arises other than due to Authorised Conditions, including, without limitation, a flood event or deliberate damage caused to the consumables.
- Co-operation** (1) You must: (a) operate the Equipment at all times in accordance with the Facilities Management Plan (if applicable) and any specifications for the Equipment; and (b) comply with our reasonable instructions and directions in respect of the maintenance and operation of the Equipment. (2) You must grant access to the Equipment Location and make the Equipment available to our personnel and subcontractors to allow the Services to be provided. (3) You must notify us of any special safety regulations or other requirements for accessing the Equipment Location that must be observed by us during the performance of the Services and you must, prior to the commencement of any such Services, explain such requirements to our personnel and provide such additional training in respect of such requirements as may be reasonably necessary to ensure that our personnel can provide the Services safely and effectively. If any such instruction or training results in a significant increase in the time required to perform the Services, we may charge Additional Services Charges in respect of such increase. (4) Where we attend the Equipment Location to perform any Services, you must inform our personnel of any problems or other variations from the normal operation of the Equipment and will provide such other information as our personnel may reasonably require in relation to the operation of the Equipment. (5) You must not, at any time without our prior written consent: (a) modify, repair or maintain the Equipment or permit any third party to do so; or (b) use any accessories or consumables as part of the operation of the Equipment other than in accordance with the specifications for the Equipment.
- Acknowledgements** (1) You acknowledge and agree that: (a) to the full extent permitted by the ACL and other applicable laws, all express and implied terms, conditions, representations, warranties and guarantees are excluded and we do not give any guarantee, representation, warranty or assurance as to the care and skill, fitness for purpose or time for supply in relation to the provision of the Services. Nothing in this Agreement, however, will exclude, restrict or modify any rights or remedies which you may have for failure to comply with a guarantee under the ACL or any other applicable law; (b) to the full extent permitted by the ACL and other applicable laws, we are not liable for any indirect, consequential or economic loss or damage (including, without limitation, loss of profit) arising under or in connection with this Agreement; and (c) in any event, to the full extent permitted by the ACL and other applicable laws, our liability under or in relation to this Agreement or the provision of the Services (to the extent that the ACL does not apply) or for failure to comply with a guarantee under the ACL (subject to section 64A(3) of the ACL) (to the extent that the ACL applies), is limited to, at our option, one or more of the following: (i) in the case of goods supplied, to one or more of the following (as we may determine): replacing the goods or supplying equivalent goods, repairing the goods, paying the cost of replacing the goods or of acquiring equivalent goods, or paying the cost of having the goods repaired; (ii) in the case of services supplied, to one or more of the following (as we may determine): supplying the services again or paying the cost of having the services supplied again. (2) You acknowledge that the Services and any replacement parts or consumables supplied in connection with the Services will be supplied to you for business purposes. (3) You must: (a) immediately notify us where you become aware of any problem with or damage to the Equipment; and (b) take all reasonable steps to mitigate the effect of any problem or damage. (4) Where appropriate, reconditioned parts may be used instead of new spare parts. We will own any parts removed from the Equipment.
- Insurance** You must, at your own cost, effect and keep current throughout the Term with a reputable and solvent insurer: (a) insurance for such amount of cover as is reasonably required by us against any loss, damage or injury of any kind whatever and however caused to any person or property arising out of the Equipment or its use, under a policy covering all such risks, including claims by third parties; and (b) insurance against any other loss, damage, injury or risk which we may reasonably require from time to time.
- Termination** (1) We may terminate this Agreement if: (a) you breach any provision of this Agreement and fail to rectify that breach within ten (10) Business Days of written notice from us; or (b) you enter into, or any steps are taken to have you enter into, liquidation, provisional liquidation, receivership, receivership and management, administration, bankruptcy or any arrangement, reconstruction or composition with your creditors or any of them, or a controller is appointed with respect to any of your assets, you become unable to pay your debts to any person as they become due or you otherwise become insolvent; or (c) if a Facilities Management Plan is referred to in the Schedule, the Facilities Management Plan is terminated. (2) Termination of this Agreement is without prejudice to any remedies available to us and any rights or obligations of the parties that accrued prior to the time of termination.
- Representations and Warranties** (1) You represent and warrant to us that: (a) you have full authority and all necessary consents to enter into and perform your obligations under this Agreement; and (b) the execution and performance by you of this Agreement will not result in a breach of, or constitute a default under, any instrument to which you are a party or by which you are bound or violate any laws. (2) If you enter into this Agreement as a trustee of a trust (the Trust), then, you represent and warrants to us that: (a) you enter into this Agreement for a proper purpose of the trust; (b) you have power and authority under the Trust to enter into this Agreement; and (c) you have the right to be indemnified fully out of the trust property before the Trust's beneficiaries for all liabilities you incur under this Agreement.
- General** (1) We will not be responsible for any delay or failure to perform our obligations under this Agreement to the extent that such delay or failure is due to any cause beyond our reasonable control. (2) You must not assign, transfer or otherwise deal with any of your rights under this Agreement without our prior written consent. We may assign, transfer or subcontract any of our rights and obligations under this Agreement without your consent. (3) No waiver of any breach of this Agreement will be effective unless such waiver is in writing and signed by the party against whom such waiver is claimed. No waiver of any breach will be deemed to be a waiver of any other or subsequent breach. (4) You irrevocably authorise us to set off without notice any money held by us on any account of yours against any money owing by you to us or any of our related bodies corporate. You must not exercise any right of set-off on any account. (5) This Agreement will be governed by and construed in accordance with the laws of New South Wales. (6) If any provision of this Agreement is found to be invalid or unenforceable in any jurisdiction, it will have no force or effect in that jurisdiction and will be severed from this Agreement in that jurisdiction without affecting the remaining provisions and without affecting the operation of this Agreement in any other jurisdiction. (7) You authorise us to insert the Commencement Date in the Schedule once the date of delivery of the Equipment is known (if a Facilities Management Plan is not referred to in the Schedule) and to complete and amend any other blank, incomplete or inaccurate particular appearing in the Schedule and to otherwise complete all necessary formalities to render this Plan complete and enforceable. (8) Any notice to or by a party to this Agreement: (a) must be in writing addressed to the other party or parties to this Agreement; (b) may be delivered in person, by pre-paid post or by facsimile transmission; and (c) is regarded as given by the sender and received by the addressee: (i) if by delivery in person, when delivered to the addressee; (ii) if by pre-paid post, on the third day after posting; and (iii) if by facsimile transmission, when transmitted to the addressee (provided that a report from the sending machine confirms successful transmission).

OTHER	
Certification Services	Estimated Certification Frequency:
Authorised Additional Services Amount: \$	

TERM	
	If a Facilities Management Plan is referred to in this Schedule: the Term is the "Term" referred to in the Facilities Management Plan and the Commencement Date is the "Commencement Date" referred to in the Facilities Management Plan.
	If a Facilities Management Plan is not referred to in this Schedule:
	Commencement Date - the date of delivery of the Equipment:
	Term: months from the Commencement Date

SERVICE CHARGES	
	If a Facilities Management Plan is referred to in this Schedule: the charges for the Maintenance Services are included in the Rental Payments payable under the Facilities Management Plan. Any Additional Services will be charged at our prevailing rates and invoiced separately.
Billing Periods:	Monthly Quarterly Half-Yearly Yearly
Maintenance Services Charge:	\$ plus \$ GST = \$ per billing period
Maintenance Services Charges are due and payable in advance on the _____ day of each Billing Period throughout the Term and are subject to adjustment in accordance with the terms and conditions set out in this document. Any Additional Services will be charged at our prevailing rates and invoiced separately.	
Specified Percentage Increase (for Maintenance Services Charges): _____ %	
Current rate for removal of Stormwater Waste in excess of Maximum Pollutant Load per Cartridge: \$ _____ per tonne	

SPECIAL CONDITIONS	

SIGNATURE OF CUSTOMER	
You acknowledge and confirm that: (1) you have read and understood and agree to be bound by the Terms and Conditions set out in this document; and (2) all information provided by you is true and correct.	
Executed by you/for and on your behalf:	
Executed by you:	Executed on your behalf:
Signed: X	Signed: X
Name:	Name:
Title/Position:	Title/Position:
Signed: X	Witness Signature: X
Name:	Name of Witness:
Title/Position:	Address of Witness

SIGNATURE OF	
Entity Name:	
Authorised Officer: X	Date:

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Affordable. Effective. Environmental





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“

We are dedicated to investment in on-going research and development, and through undergoing rigorous independent scientific research and testing, our products have proven their efficiency and performance in the field.

Stormwater360

Specialists in managing, treating and storing stormwater.

Stormwater360 is a leader in developing innovative and efficient site-specific solutions that manage the impact of stormwater runoff on the built environment, and prevent contaminants in the runoff from entering aquatic ecosystems.

Whether the primary focus of your site is flood mitigation, water quality or stormwater harvesting, we have the expertise and products to develop the right water sensitive urban design (WSUD) solution to achieve your runoff objectives.

Just as importantly, with stormwater regulations and water quality standards becoming increasingly complex and onerous, our best management practice filtration, screening and treatment systems meet the most stringent regulatory requirements.



Ecologically sustainable stormwater management

Regardless of compliance measures, astute developers and investors recognise that there is an increasing demand from business, consumers and the community for projects that incorporate high environmental sustainability standards and are fiscally responsible.

This is even more critical in urbanised areas, where stormwater water run-off contaminated by pollution, heavy metals, total nutrients, hydrocarbons and sediment, can affect the health of groundwater as well as the ecology of streams, ponds, lakes and harbours. In such regions, the environmental stormwater management solutions developed by Stormwater360 are not simply a 'nice-to-have', but define an aspirational benchmark for all organisations that recognise their corporate and social responsibilities.

By viewing stormwater as an asset and a resource, and then managing it in an ecologically sustainable manner, we are helping to conserve one of the planet's most precious resources – a resource that's inextricably linked to our ability to sustain future populations. Similarly, by maintaining the health of the world's oceans and waterways, we are preventing the disruption of the food chain's biodiversity and ensuring that tomorrow's children can enjoy simple pleasures such as swimming in clean seas.

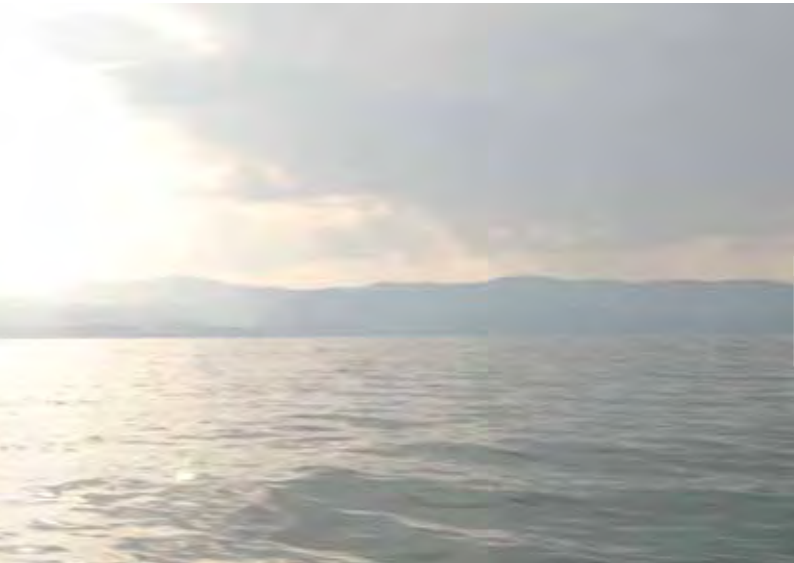
The Stormwater360 Facilities Management Plan

Managing the cost as well as the solution

It is clear that across Australia, government bodies are increasing their regulatory involvement in stormwater management and implementing stringent best practice guidelines. Even where regulations have not yet been mandated, there is a strong economic argument for implementing BPM stormwater management systems at the development stage, rather than meeting the higher costs associated with a future retrofit.

To assist developers better manage the costs associated with compliance, Stormwater360 has developed a Facilities Management Plan for installation of the StormFilter™ / EnviroPod™ (SFEP) Treatment Train. This plan enables you to amortise the cost of your stormwater management system over a fixed period, so you can achieve your water quality objectives without incurring upfront capital costs.

The Facilities Management Plan also incorporates an on-going maintenance agreement, providing you with budgeting certainty for the functional operation of your stormwater system for the life of the agreement. In addition, as inefficient maintenance is often the reason for system failure, such as flooding or the inadvertent release of pollutants into waterways, this comprehensive maintenance service also helps minimise the risk of future inconvenience and disruption to site users (such as tenants), as well as mitigate the risk of penalties for regulatory breaches.



“

By viewing stormwater as an asset and a resource, and then managing it in an ecologically sustainable manner, we are helping to conserve one of the planet's most precious resources.

A comprehensive stormwater management package

In total, the Stormwater360 SFEP Treatment Train Facilities Management Plan provides you with:

- Supply of all StormFilter units required by your site
- Supply of EnviroPod gully pit baskets
- 12 monthly service of StormFilter units
- 3-6 month service of EnviroPods
- Disposal of contaminants
- Yearly compliance certificate
- Warranty on all parts.

The benefits of the Facilities Management Plan are extensive and include:

- No capital cost
- Enhanced cash flow and greater budgeting certainty
- 100% tax deductibility (as an operating expense and off balance sheet)
- No additional unexpected costs relating to maintenance
- Clarity of actual costs when attributing outgoings for multiple dwelling developments
- Flexible payment and contract terms
- Guaranteed compliance with legislated water quality objectives

- Guaranteed maintenance
- No replacement or reinstatement costs
- A warranty on all parts, including EnviroPod bags and StormFilter cartridges, for the term of the agreement
- A single point of contact for design, supply and maintenance.

From every perspective, the Stormwater360 Facilities Management Plan provides a smart and sustainable way to achieve your stormwater treatment objectives.

An integrated end-to-end solution

From design through to supply, manufacture and maintenance

As a dedicated stormwater management specialist, Stormwater360 offers a complete turnkey solution that includes all the resources required to take any project from the conceptual design through to construction. Plus, with either a Maintenance Agreement, or as part of our Facilities Management Plan, we ensure that your stormwater devices and systems continue to provide optimal performance throughout their entire lifecycle.



The importance and value of on-going maintenance

Wherever possible, Stormwater360 selects easy-to-access treatment systems that have been designed for minimal maintenance. However, regular cleaning and device maintenance are nevertheless necessary to remove pollutants and ensure the proper performance of your stormwater management system.

Regular maintenance schedules minimise system failure and prevent unnecessary damage (and the associated costs) to other infrastructure or drainage assets. It also ensures compliance with corporate environmental policy guidelines.

Maintenance is also vital to minimising the development impact on the surrounding environment.

A comprehensive project planning and design service

The Stormwater360 solution includes a design and planning service, whereby our engineering division works with developers, contractors and jurisdictional authorities to select a runoff solution that will meet the climate and geographic challenges of the site, as well as any relevant regulatory requirements. Whatever methodology is chosen, we will provide you with everything to get the project started. This includes MUSIC (Model for Urban Stormwater Improvement Conceptualisation) modelling, CAD drawings and product specifications together with maintenance schedules and associated cost schedules.

Once the system has been agreed on, we work together with our precast production partner to manage every aspect of the manufacturing process.

Our end-to-end solution includes full maintenance of your stormwater treatment devices, such as the removal of sediment and the rejuvenation of filters. In addition to ensuring the full functionality of your system, we provide detailed reports that verify your ongoing compliance with local authority regulations.



To find out more about Stormwater360's stormwater management systems, or for details about the Facilities Management Plan, speak to your Stormwater360 consultant or call us on 1300 354 722.

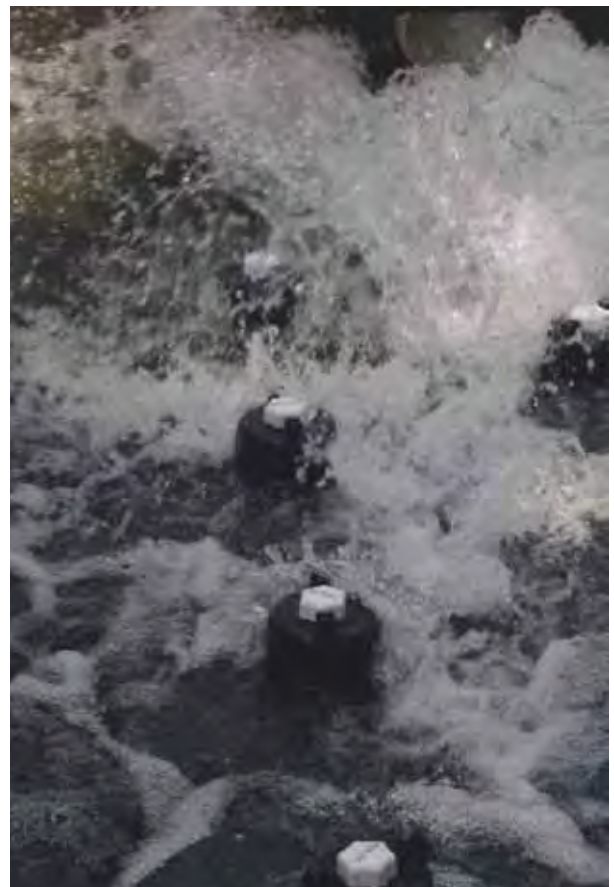
Best management practice systems

Innovative solutions proven through extensive in-field testing

The Stormwater360 line of stormwater treatment solutions comprises the most innovative and effective products available. We are dedicated to investment in on-going research and development, and through undergoing rigorous independent scientific research and testing, our products have proven their efficiency and performance in the field. Many have achieved hundreds of standalone Best Management Practice (BMP) approvals from regulatory agencies around the world.

The Stormwater360 StormFilter™ / EnviroPod™ (SFEP) Treatment Train is the only proprietary treatment train in Australia with published independent third party field verification of performance. While stormwater is dynamic, and no two sites or storms are the same, when the StormFilter™ (a siphon actuated cartridge filtration system) is combined in a treatment train with the EnviroPod™ gully pit basket, its performance has been evaluated as achieving reductions of up to 85% TSS (total suspended solids), 70% TP (total phosphorous) and 45% TN (total nitrogen).

Across our extensive range, each product we supply and install meets Australia's most stringent standards and has been verified for its effectiveness in real world – not just laboratory – situations.





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APPENDIX 4

FloodWise Report

THIS REPORT IS FOR BUILDING AND DEVELOPMENT PURPOSES ONLY

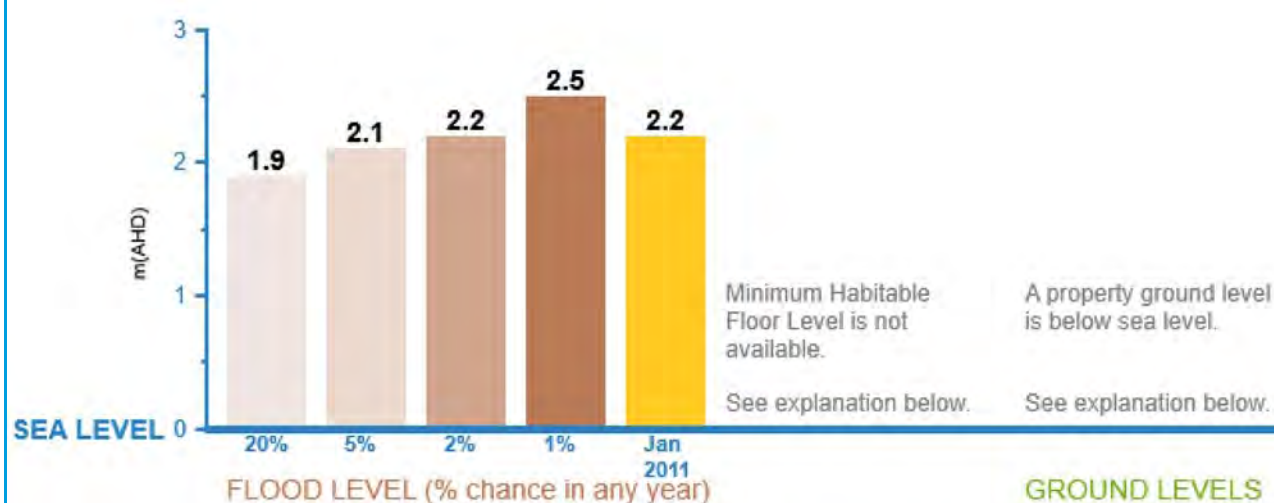
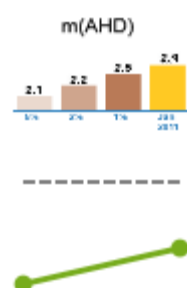
The FloodWise Property Report provides property or lot-based flood information for building and development requirements. This report provides information on estimated flood levels, habitable floor level requirements and more technical information on the four sources of flooding: river, creek / waterway, storm tide and overland flow. Refer to the Useful Definitions section for a glossary of terms.

To find out more about how the contents of this report may affect building or development on this property, please visit www.brisbane.qld.gov.au/planning-building. For more general information about understanding your flood risk and how to prepare your property, family or business for potential flooding visit www.brisbane.qld.gov.au/beprepared

PROPERTY DETAILS:

Address: 305 MACARTHUR AVE, HAMILTON QLD 4007

Lot Details: L.115 SP.205130

FLOOD LEVEL INFORMATION**EXPLANATION**

m(AHD) - Metres Australia Height Datum. The level of 0.0m AHD is approximately mean sea level.

Flood Levels - The Flood level bar chart above shows the possible flooding level and percentage chance of that level being reached or exceeded in any year. If an orange bar shows, it is the calculated January 2011 flood level at this address or lot.

Minimum Habitable Floor Level - Applies to residential development only. Please refer to Council's planning scheme to learn how this may affect you. If a property is in an overland flow path, or a large allotment, a minimum habitable floor level cannot be provided. Refer flood and planning development flags below.

Ground Levels - The green line above shows this property's approximate lowest and highest ground levels based on latest available information (2009 airborne laser survey) to Council. If you are building, please confirm with a surveyor.

For further information and definitions please refer to the Useful Definitions page

FLOOD AND PLANNING DEVELOPMENT FLAGS

DEVELOPMENT
FLAG(S)

This property is affected by one or more flood or property development overlay or flags. These are: **LARGE ALLOTMENT**

Please review the technical summary over page for more detail.

TECHNICAL SUMMARY

This section of the FloodWise Property Report contains more detailed flood information for this property so surveyors, builders, certifiers, architects and engineers can plan and build in accordance with Council's planning scheme. For more information about building and development in Brisbane please visit www.brisbane.qld.gov.au/planning-building or talk to a Development Assessment Planning Information Officer via Council's Contact Centre on (07) 3403 8888.

PROPERTY DETAILS:

Address: 305 MACARTHUR AVE, HAMILTON QLD 4007
 Lot Details: L.115 SP.205130

PROPERTY INFORMATION (Summary)

The following table provides a summary of flood information for this property. More detailed flood level information is provided in the following sections of this report.

PROPERTY SUMMARY	LEVEL (mAHD)
Minimum Ground Level	-0.6
Maximum Ground Level	5.3
Min Habitable Floor Level	Contact Council
Defined Flood Level (DFL)	2.5
Defined Flood Level Source	STORM TIDE
Source of Highest Flooding	STORM TIDE
Flooding may also occur from	RIVER

ESTIMATED PEAK FLOODING LEVELS

The table below displays the peak estimated flood levels by probability for this property. Estimated flood level data should be used in conjunction with applicable planning scheme requirements - Refer to Flood Planning Development Information.

Note that the overland flow flooding level maybe higher than the levels below from other sources.

DESCRIPTION	LEVEL (mAHD)	SOURCE
20% AEP	1.9	STORM TIDE
5% AEP	2.1	STORM TIDE
2% AEP	2.2	STORM TIDE
1% AEP	2.5	STORM TIDE
January 2011	2.2	RIVER
DFL	2.5	STORM TIDE

FLOOD PLANNING DEVELOPMENT INFORMATION

This section of the FloodWise Property Report contains information about Council's planning scheme overlays. Overlays identify areas within the planning scheme that reflect distinct themes that may include constrained land and/or areas sensitive to the effects of development.

FLOOD OVERLAY CODE

The Flood overlay code of Council's planning scheme uses the following information to provide guidelines when developing properties. The table below summarises the Flood Planning Areas (FPAs) that apply to this property. Development guidelines for the FPAs are explained in Council's planning scheme, which is available from www.brisbane.qld.gov.au/planning-building.

RIVER	FLOOD PLANNING AREAS (FPA) CREEK/WATERWAY	OVERLAND FLOW
FPA1		Not Applicable
FPA3		
FPA4		
FPA5		

COASTAL HAZARD OVERLAY CODE

The coastal hazard overlay code of Council's planning scheme uses the following information to provide guidelines when conducting new development. The table below summarises the coastal hazard categories that apply to this property. Development guidelines for the following coastal hazard overlay sub-categories are explained in the planning scheme, which is available from www.brisbane.qld.gov.au/planning-building.

COASTAL HAZARD OVERLAY SUB-CATEGORIES
High Storm Tide Inundation Area
Medium Storm Tide Inundation Area
Erosion Prone – Coastal Erosion
Erosion Prone Area - permanent inundation by 2100
Coastal Management District

NOTE: Where land is identified within one or more flood planning area on the Flood Overlay, or is identified within a Storm Tide Inundation area on the Coastal Hazard Overlay, the assessment criteria that provide the highest level of protection from any source of flooding applies.

PROPERTY DEVELOPMENT FLAGS

Large Allotment - This property is a Large Allotment of over 1000 square metres. Flood levels may vary significantly across allotments of this size. Further investigations may be warranted in determining the variation in flood levels and the minimum habitable floor level across the site. For more information or advice, it is recommended you engage a Registered Professional Engineer of Queensland.

Useful Definitions

Australian Height Datum (AHD) - The reference level for defining ground levels in Australia. The level of 0.0m AHD is approximately mean sea level.

Annual Exceedance Probability (AEP) – The probability of a flood event of a given size occurring in any one year, usually expressed as a percentage annual chance.

Defined Flood Level (DFL) - The DFL for Brisbane River flooding is a level of 3.7m AHD at the Brisbane City Gauge based on a flow of 6,800 m³/s.

Maximum and Minimum Ground Level – Highest and lowest ground levels on the property based on available ground level information. A Registered Surveyor can confirm exact ground levels.

Minimum Habitable Floor Level – The minimum level in metres AHD at which habitable areas of development (generally including bedrooms, living rooms, kitchen, study, family and rumpus rooms) must be constructed.

Council's Planning Scheme - The City Plan (planning scheme) has been prepared in accordance with the Sustainable Planning Act as a framework for managing development in a way that advances the purpose of the Act. In seeking to achieve this purpose, the planning scheme sets out the Council's intention for future development in the planning scheme area, over the next 20 years.

Residential Flood Level (RFL) – Residential flood level (RFL) for Brisbane River flooding equates to the flood level applicable to the extent of January 2011 floods as depicted by mapping on the Queensland Reconstruction Authority website or the Council's defined flood level (DFL) for the Brisbane River, whichever is higher.

Brisbane City Council's Online Flood Tools

Council provides a number of online flood tools:

- to guide planning and development
- to help residents and businesses understand their flood risk and prepare for flooding.

Planning and Development Online Flood Tools

Council's online flood tools for planning and development purposes include:

- FloodWise Property Report
- Flood Overlay Code

For more information on Council's planning scheme and online flood tools for planning and development:

- phone 07 3403 8888 to talk to a Development Assessment Customer Liaison Officer
- visit www.brisbane.qld.gov.au/planning-building
- visit a Regional Business Centre.

Helping residents and businesses be prepared for flooding

Council has a range of free tools and information to help residents and businesses understand potential flood risks and how to be prepared. This includes:

- Flood Awareness Maps
- Flooding in Brisbane – A Guide for Residents
- Flooding in Brisbane – A Guide for Business
- Early Warning Alert Service. Visit www.brisbane.qld.gov.au/earlywarning to register for email, home phone or SMS severe weather alert updates.

Note: The Flood Awareness Maps show four levels of flood risk from high risk (flooding is very likely to occur) through to very low risk (very rare and extreme flood events). Flooding in the low and very low risk areas has no planning and development requirements and is therefore not reflected in the FloodWise Property Report.

For more information on Council's online flood tools for residents and business:

- Visit www.brisbane.qld.gov.au/beprepared
- Phone (07) 3403 8888.

Disclaimer

1. Defined Flood Levels and Residential Flood Levels, and the Minimum Habitable Floor Levels are determined from the best available information to Council at the date of issue. These flood levels, for a particular property, may change if more detailed information becomes available or changes are made in the method of calculating flood levels.
2. Council makes no warranty or representation regarding the accuracy or completeness of a FloodWise Property report. Council disclaims any responsibility or liability in relation to the use or reliance by any person on a FloodWise Property Report.



Planning to build or renovate?

For information, guidelines, tools and resources to help you track, plan or apply for your development visit www.brisbane.qld.gov.au/planning-building

You can also find the Brisbane City Plan 2014 and Neighbourhood Plans as well as other information and training videos to help with your building and development plans.