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34-54 CLAYTON ROAD, CLAYTON

SUSTAINABILITY MANAGEMENT PLAN – MASTERPLAN

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DOCUMENT PROPERTIES

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DESCRIPTION: Sustainability Management Plan

PROJECT NAME: 34-54 Clayton Road, Clayton

PROJECT NUMBER: 20205

DOCUMENT AMENDMENTS

REVISION	DETAILS	AUTHOR/S	DATE	ISSUED BY
01	Draft issue for review	DC	11/05/2020	DC
02	Draft issue for final review	DC	30/07/2020	DC
03	Final issue for Town Planning	DC	14/08/2020	DC
04	Minor updates	DC	23/03/2021	DC

CONTENTS

1 INTRODUCTION

This Sustainability Management Plan (SMP) has been prepared to assist the design, construction and operation of the proposed commercial masterplan development at 34-54 Clayton Road, Clayton, to achieve a range of best-practice sustainable development objectives.

WRAP Engineering have assessed the proposed plans and provided input to the design team.

This SMP captures initiatives necessary to ensure that the development meets the sustainability requirements of the City of Monash, in particular the ESD requirements of the following Planning Clauses:

- 22.13 "Environmentally Sustainable Development Policy"

1.1 SITE DESCRIPTION

The site at 34-54 Clayton Road, Clayton has an area of approximately 37,032 m^2 and is located approximately 17 km south-east of the Melbourne CBD.

The site is currently occupied by a number of one- and two-storey industrial and commercial buildings which will be demolished prior to construction of the proposed development.

Figure 1: Aerial view of the site at 34-54 Clayton Road, Clayton, showing the approximate site boundary. (Source: Nearmap, Mark-up: WRAP Engineering)

1.2 DEVELOPMENT SUMMARY

The proposed masterplan development will consist of the following:

- Basement: Car parking and building services
- Ground level and above: 8 No. individual buildings, with proposed space uses including commercial office, hotel, retail, food and childcare, along with back-of-house and end-of-trip facilities and complementary services.

1.3 COUNCIL PLANNING REQUIREMENTS

The City of Monash expects new developments to be designed, built and maintained at a level that reflects best practice sustainable development outcomes. The ESD response will need to ensure that the design meets sustainability targets in the areas of energy reduction, water use reduction and water sensitive urban design, indoor environment quality, materials selection, transportation, waste management and urban ecology.

The council's Planning Scheme also encourages the use of relevant ESD tools to assess the proposed development. For this masterplan project, the following tools will be used (where appropriate) to guide the masterplan design:

- Green Star – a holistic sustainability assessment tool; and
- MUSIC – a stormwater assessment tool.

This SMP incorporates initiatives to ensure that the council's ESD requirements are satisfied by addressing the Green Star categories, demonstrating that council's objectives will be achieved, and using relevant and appropriate ESD assessment tools. Where the specific initiatives relate to the future design and development of the individual buildings, this will be clearly identified.

1.4 REFERENCE DOCUMENTATION

This SMP should be read in conjunction with the other relevant documentation included within the development's town planning submission to council. These documents may include the following:

- Architectural documentation
- Landscape documentation
- Waste management plan
- Traffic engineer's report, transport plan, green travel plan or similar

2 ESD ASSESSMENT

The following sections outline the ESD assessment which has been completed for the project. The assessment is presented within the Green Star categories, and for each item following information is provided:

1. A short description of the ESD initiative and/or the project's design response;
2. The nominated party responsible for implementation of the initiative;
3. The stage or part of the project to which it applies; and
4. The stage of the project at which implementation could be demonstrated.

Within this assessment, the level of detail that has been provided is generally in proportion to what is appropriate or practicable at this early stage of masterplan design, as well as the items which specifically apply to the common area or public realm of the site. This is described or explained within each item, with future commitments in relation to the future works (individual buildings/lots) included as appropriate.

2.1 CONSTRUCTION AND BUILDING MANAGEMENT

2.1.1 OBJECTIVES:

- *To encourage a holistic and integrated design and construction process and ongoing high performance.*
- *To ensure waste avoidance, reuse and recycling during the operation stages of development.*

2.1.2 DEVELOPMENT RESPONSE

ESD INITIATIVE	RESPONSIBILITY	APPLICATION	PROJECT STAGE
Green Star Professional Masterplan: WRAP Engineering are engaged for the masterplan project to provide advice, support and information related to Green Star and sustainable design. Future Buildings/Lots: GSAP to be engaged for each project to provide advice, support and information related to Green Star and sustainable design.	Developer	Masterplan & Individual Buildings	Initiation
Environmental Targets Future Buildings/Lots: The building owner will set environmental targets for water and energy, and monitor the performance of the building against those targets.	Developer	Individual Buildings only	Operation
Services & Maintainability Review Future Buildings/Lots: The project team will complete a services & maintainability review prior to construction.	Developer	Individual Buildings only	Contract Documentation
Building Systems Commissioning Future Buildings/Lots: Comprehensive building systems commissioning will be completed in accordance with best practice standards.	Contractor	Individual Buildings only	Construction
Building Tuning Future Buildings/Lots: The building owner will implement a building tuning process for at least the first 12 months after occupation.	Developer	Individual Buildings only	Occupation

ESD INITIATIVE	RESPONSIBILITY	APPLICATION	PROJECT STAGE
Building Information Future Buildings/Lots: Prior to occupancy, a package of building information will be developed and handed over to the building manager. This will include as-built drawings, operations and maintenance manuals, and supplier and warranty details.	Contractor	Individual Buildings only	Construction
Building User Guide Future Buildings/Lots: Prior to occupancy, a Building User Guide (BUG) will be developed for use by the residents. The BUG will use non-technical language help facilitate more sustainable behaviour by building occupants and more efficient use of the building systems.	Developer	Individual Buildings only	Construction
End-of-Life Waste Performance Future Buildings/Lots: The building owner will commit to reduce demolition waste at the end of life of interior fit-outs and base-building areas.	Developer	Individual Buildings only	Operation
Energy Metering – Electricity and Gas Future Buildings/Lots: All dwellings will be provided with individual authority meters, and all major base-building systems will be individually sub-metered to allow for effective building tuning.	Services Engineer	Individual Buildings only	Contract Documentation
Water Metering Future Buildings/Lots: All dwellings will be provided with individual authority meters, and all major base-building systems will be individually sub-metered to allow for effective building tuning.	Services Engineer	Individual Buildings only	Contract Documentation
Monitoring Systems Future Buildings/Lots: A monitoring system will be implemented to automatically capture and process the data produced by the energy and water meters.	Services Engineer	Individual Buildings only	Contract Documentation

ESD INITIATIVE	RESPONSIBILITY	APPLICATION	PROJECT STAGE
Construction Environmental Management Masterplan & Future Buildings/Lots: The contractor(s) will prepare and implement a Best Practice project-specific EMP at the start of construction. The EMP will be developed in accordance with the NSW Environmental Management Systems Guidelines or equivalent.	Contractor	Masterplan & Individual Buildings	Construction
Contractor Environmental Management Masterplan & Future Buildings/Lots: The contractor(s) engaged for the construction will hold ISO14001 certification.	Contractor	Masterplan & Individual Buildings	Construction
Contractor Staff Support Masterplan & Future Buildings/Lots: The contractor(s) will promote positive mental and physical health outcomes of site activities and culture of site workers, and enhance site workers' knowledge on sustainable practices through education programs.	Contractor	Masterplan & Individual Buildings	Construction
Operational Waste Masterplan: Dedicated storage areas will be provided for the separation and collection of recyclable waste, located in a convenient location. Provisions will be made for the inclusion of both waste and recycling receptacles within the development to help encourage occupants to separate their waste at the earliest point of disposal. Future Buildings/Lots: Individual building / lot design will include storage areas for the separation and collection of recyclable waste, located in a convenient location, and in accordance with the site-wide waste management plan.	Architect	Masterplan & Individual Buildings	Contract Documentation

2.2 INDOOR ENVIRONMENT QUALITY & HEALTH AND WELLBEING

2.2.1 OBJECTIVES

- *To achieve a healthy indoor environment quality for the wellbeing of building occupants.*
- *To provide a naturally comfortable indoor environment will lower the need for building services, such as artificial lighting, mechanical ventilation and cooling and heating devices.*

2.2.2 DEVELOPMENT RESPONSE

ESD INITIATIVE	RESPONSIBILITY	APPLICATION	PROJECT STAGE
Ventilation System Future Buildings/Lots: The mechanical ventilation systems will be designed to mitigate the entry of outdoor pollutants, provide easy access for maintenance, and will be cleaned prior to occupation.	Services Engineer Contractor	Individual Buildings only	Construction
Effective Ventilation Future Buildings/Lots: The mechanical ventilation systems will be designed to control CO_2 to 800 PPM.	Services Engineer	Individual Buildings only	Contract Documentation
Acoustic Comfort Future Buildings/Lots: Noise levels, reverberation and cross-talk will be maintained to relevant best-practice levels.	Acoustics	Individual Buildings only	Contract Documentation
Artificial Lighting Future Buildings/Lots: The lighting design throughout the development will ensure that the minimum illuminance levels and uniformity are in accordance with the requirements of AS1680.	Services Engineer	Individual Buildings only	Contract Documentation
Daylight Future Buildings/Lots: A Green Star daylight assessment will be completed for each project. The preliminary assessment will show that the project is on track to achieve high levels of daylight (DF > 2%) to at least 40% of the nominated areas.	Architect	Individual Buildings only	Contract Documentation

ESD INITIATIVE	RESPONSIBILITY	APPLICATION	PROJECT STAGE
External Views Future Buildings/Lots: A Green Star views assessment will be completed for each project. The preliminary assessment will show that the project is on track to achieve high quality views to at least 60% of the nominated areas.	Architect	Individual Buildings only	Design Development
Volatile Organic Compounds Future Buildings/Lots: All paints, adhesives and sealants and carpets will not exceed the limits outlined in Appendix A.	Architect Services Engineer	Individual Buildings only	Contract Documentation
Formaldehyde Future Buildings/Lots: All engineered wood products will have 'low' formaldehyde emissions, certified as E0 or better, or will not exceed the limits outlined in Appendix A.	Architect	Individual Buildings only	Contract Documentation
Thermal Comfort Future Buildings/Lots: The developments will include low-e double glazing throughout, and they will achieve a PMV of +/- 1 for 95% of the nominated area and 98% of the year.	Architect ESD Consultant	Individual Buildings only	Contract Documentation
Public Outdoor Gym Masterplan: The public realm landscaping will include an outdoor gym area, allowing all occupants and visitors to the site to undertake physical exercise.	Architect Landscape	Masterplan	Contract Documentation

2.3 ENERGY EFFICIENCY

2.3.1 OBJECTIVES:

- *To ensure the efficient use of energy.*
- *To reduce total operating greenhouse emissions.*
- *To reduce energy peak demand.*
- *To reduce associated energy costs.*

2.3.2 DEVELOPMENT RESPONSE

ESD INITIATIVE	RESPONSIBILITY	APPLICATION	PROJECT STAGE
Heating and Cooling Systems Future Buildings/Lots: The projects will implement an energy efficient central plant HVAC system, which will utilise best practice design and construction in accordance with NCC Section J 2019, including: - Heat recovery; - Demand (CO_2) control ventilation; and - Energy efficient pumps and fans.	Services Engineer	Individual Buildings only	Contract Documentation
Domestic Hot Water Future Buildings/Lots: The projects will implement an energy efficient central domestic hot water system, utilising either high-efficiency gas boilers or electric heat pumps.	Services Engineer	Individual Buildings only	Contract Documentation
Solar PV Future Buildings/Lots: The projects will implement a solar PV array to partially offset the base-building energy usage. The PV panels will be located on the roof of each building and any other available surfaces. The PV arrays will be sized to be as large as possible, depending on available roof area and coordination with building services equipment.	Architect Services Engineer	Individual Buildings only	Contract Documentation

ESD INITIATIVE	RESPONSIBILITY	APPLICATION	PROJECT STAGE
Artificial Lighting Future Buildings/Lots: - The lighting design throughout the developments will be at least 20% more energy efficient than the BCA 2016 requirements. - External and common area lighting systems will use daylight and occupancy sensors to control lighting energy usage.	Services Engineer	Individual Buildings only	Contract Documentation
Car Park Ventilation Masterplan & Future Buildings/Lots: The project(s) will achieve energy reductions in the car park ventilation system through the use of carbon monoxide sensors and demand control. Car parks will be naturally ventilated where possible, using the slope of the site to create natural ventilation openings.	Services Engineer	Masterplan & Individual Buildings	Contract Documentation

2.4 TRANSPORT

2.4.1 OBJECTIVES:

- *To minimise car dependency.*
- *To ensure that the built environment is designed to promote the use of public transport, walking and cycling.*

2.4.2 DEVELOPMENT RESPONSE

ESD INITIATIVE	RESPONSIBILITY	APPLICATION	PROJECT STAGE
Electric Vehicle Charging Masterplan: The masterplan electrical infrastructure will be provisioned with sufficient capacity to allow for on-site electric-vehicle charging. Future Buildings/Lots: The developments will support the use of electric vehicles by ensuring that the secure car parks are "electric-vehicle ready", with adequate electrical infrastructure to support future installation of charging systems.	Services Engineer	Masterplan & Individual Buildings	Contract Documentation
Active Transport Facilities Masterplan: The public realm areas will be provided with visitor bike parking facilities at a rate of one per 20 peak visitors to the precinct. Visitor bike hoops are currently shown on the masterplan ground level drawing. Future Buildings/Lots: The development(s) will include the following facilities to support active transport: - Secure bicycle parking spaces in each building for use by regular occupants/staff, at a rate of one per 13 regular occupants; and - Change facilities, including showers and lockers provided in accordance with the current Green Star criteria.	Architect	Masterplan & Individual Buildings	Contract Documentation
Walking Access to Amenities The site location currently achieves a Walk Score of 68 out of 100, however once the development is completed it will significantly improve the walkability of the local neighbourhood through the various amenities that are proposed on the site, e.g. gymnasium, café, restaurant, childcare, etc.	n/a		

2.5 WATER EFFICIENCY

2.5.1 OBJECTIVES:

- *To ensure the efficient use of water.*
- *To reduce total operating potable water use.*
- *To encourage the collection and reuse of stormwater.*
- *To encourage the appropriate use of alternative water sources (e.g. grey water).*
- *To minimise associated water costs.*

2.5.2 DEVELOPMENT RESPONSE

ESD INITIATIVE	RESPONSIBILITY	APPLICATION	PROJECT STAGE
Water Fixtures and Fittings Future Buildings/Lots: The following minimum Water Efficiency Labelling Scheme (WELS) star ratings will be specified: - Toilets: 4 Star; - Urinals: 5 Star; - Taps (bathroom and kitchen): 5 Star; and - Showerheads: 3 Star (≤7.5 L/min).	Architect	Individual Buildings only	Contract Documentation
Rainwater Collection and Reuse Future Buildings/Lots: Rainwater tanks will be installed for each project as required to meet relevant water efficiency and WSUD requirements. Harvested rainwater will be utilised for toilet flushing and landscape irrigation. The current masterplan drawings includes an allocation of at least 175 kL rainwater tanks located below the B2 slab, and there is space for more if required to achieve the future projects' water efficiency and WSUD targets.	Architect Services Engineer	Individual Buildings only	Contract Documentation
Waterless HVAC Future Buildings/Lots: All HVAC systems will use air-cooled heat rejection systems.	Services Engineer	Individual Buildings only	Contract Documentation

ESD INITIATIVE	RESPONSIBILITY	APPLICATION	PROJECT STAGE
Landscape Irrigation Masterplan & Future Buildings/Lots: Landscaping irrigation water will be supplied from the rainwater collection systems and will use generally use water-efficient drip irrigation where appropriate.	Services Engineer Landscape	Masterplan & Individual Buildings	Contract Documentation
Fire System Test Water Masterplan & Future Buildings/Lots: The fire water test system(s) will not expel water for testing, or the fire systems will include temporary storage for 80% of the routine fire protection system test water and maintenance drain-downs for reuse on site.	Services Engineer	Masterplan & Individual Buildings	Contract Documentation

2.6 BUILDING MATERIALS

2.6.1 OBJECTIVES:

- *To minimise the environmental impacts materials used by encouraging the use of materials with a favourable lifecycle assessment; and*
- *To ensure waste avoidance, reuse and recycling during the construction stages of development.*

2.6.2 DEVELOPMENT RESPONSE

ESD INITIATIVE	RESPONSIBILITY	APPLICATION	PROJECT STAGE
Concrete Masterplan & Future Buildings/Lots: - At least 50% of concrete mix water will be reclaimed.	Contractor	Masterplan & Individual Buildings	Construction
Steel Masterplan & Future Buildings/Lots: - At least 95% of all structural steel used in the project will be sourced from a Responsible Steel Maker; and - At least 60% of reinforcing steel used in the project will be produced using energy-reducing processed in its manufacture.	Contractor	Masterplan & Individual Buildings	Construction
Timber Masterplan & Future Buildings/Lots: At least 95% of timber used in the project will be reused or will be from FSC or PEFC certified forests.	Contractor	Masterplan & Individual Buildings	Construction
PVC Masterplan & Future Buildings/Lots: At least 90% of PVC used in the project will be GBCA approved Best Practice PVC.	Contractor	Masterplan & Individual Buildings	Construction
Construction Waste Management Masterplan & Future Buildings/Lots: The contractor will prepare a construction waste management plan for the project and will divert at least 90% of all demolition and construction waste from landfill.	Contractor	Masterplan & Individual Buildings	Construction

2.7 URBAN ECOLOGY

2.7.1 OBJECTIVES:

- *To protect and enhance biodiversity.*
- *To provide sustainable landscaping.*
- *To protect and manage all remnant indigenous plant communities.*
- *To encourage the planting of indigenous vegetation.*
- *To minimise the urban heat island effect.*
- *To remediate contaminated and hazardous sites and existing buildings.*

2.7.2 DEVELOPMENT RESPONSE

ESD INITIATIVE	RESPONSIBILITY	APPLICATION	PROJECT STAGE
Ecological Value Masterplan: The ecological value of the site will be enhanced by including native plant species within the landscape design.	Landscape	Masterplan only	Contract Documentation
Contamination and Hazardous Materials Masterplan: The project will assess the existing site for contamination and any existing buildings will be assessed for asbestos, lead and PCB's. Any contamination or hazardous materials will be safely remediated and cleared in accordance with relevant standards.	Contractor	Masterplan only	Construction
Urban Heat Island Effect Masterplan: The public realm will include significant areas of soft landscaping and tree canopy cover to mitigate the heat island effect. Future Buildings/Lots: The project(s) will minimise the urban heat island effect through the implementation of high-SRI roofing materials (> 81).	Architect Landscape	Masterplan & Individual Buildings	Contract Documentation

ESD INITIATIVE	RESPONSIBILITY	APPLICATION	PROJECT STAGE
Community Garden Masterplan: The public realm landscaping will include a productive community garden and related facilities. This will allow occupants of the site to grow their own produce.	Landscape	Masterplan	Contract Documentation

2.8 EMISSIONS & STORMWATER MANAGEMENT

2.8.1 OBJECTIVES:

- *To reduce the impact of stormwater run-off.*
- *To improve the water quality of stormwater run-off.*
- *To achieve best practice stormwater quality outcomes.*
- *To incorporate water sensitive urban design principles.*
- *To reduce impacts to wildlife due to light pollution.*
- *To reduce risk of harmful microbes in HVAC systems.*
- *To reduce ozone layer depletion.*

2.8.2 DEVELOPMENT RESPONSE

ESD INITIATIVE	RESPONSIBILITY	APPLICATION	PROJECT STAGE
Stormwater Discharge Masterplan: Post-development peak discharge will not exceed the pre-development peak discharge rate.	Civil Engineer	Masterplan only	Contract Documentation
Stormwater Pollution Reduction Masterplan: A preliminary whole-site WSUD assessment has been completed and a treatment system has been designed to provide WSUD treatment in accordance with the best practice guidelines. A space has been allocated on the plans to accommodate this system if it is required in the future. Refer to Appendix B for details.	Architect Services Engineer Civil Engineer	Masterplan only	Contract Documentation
Light Pollution Masterplan & Future Buildings/Lots: The lighting design will minimise light pollution to neighbours and the night sky through compliance with AS4282 and ensuring that no external light fittings have an upward light output ratio greater than 5%.	Services Engineer	Masterplan & Individual Buildings	Contract Documentation
Microbial Control Future Buildings/Lots: All HVAC systems will use air-cooled heat rejection systems.	Services Engineer	Individual Buildings only	Contract Documentation

ESD INITIATIVE	RESPONSIBILITY	APPLICATION	PROJECT STAGE
Insulation Future Buildings/Lots: All insulants will have zero ozone depletion potential (ODP).	Contractor	Individual Buildings only	Construction
Refrigerants Future Buildings/Lots: All HVAC refrigerants used in the development will be selected to have an Ozone Depletion Potential (ODP) of zero.	Services Engineer	Individual Buildings only	Contract Documentation

APPENDIX A – VOC & FORMALDEHYDE LIMITS

VOC LIMITS – PAINTS, ADHESIVES & SEALANTS

PRODUCT CATEGORY	MAX. TVOC (g/L OF READY TO USE PRODUCT)
General purpose adhesives and sealants	50
Interior wall and ceiling paint, all sheen levels	16
Trim, varnishes and wood stains	75
Primers, sealers and prep coats	65
One and two pack performance coatings for floors	140
Acoustic sealants, architectural sealant, waterproofing membranes and sealant, fire retardant sealants and adhesives	250
Structural glazing adhesive, wood flooring and laminate adhesives and sealants	100

VOC LIMITS – CARPETS

COMPLIANCE OPTIONS	COMPLIANCE CRITERIA
A – PRODUCT CERTIFICATION	The product is certified under a recognised Product Certification Scheme (listed on the GBCA website http://new.gbca.org.au/product-certification-schemes/) or other recognised standards. The certificate must be current at the time of project registration or submission and list the relevant product name and model.
B – LABORATORY TESTING	ASTM D5116: - Total VOC limit: 0.5mg/m^2 per hour, & - 4-PC limit: 0.05mg/m^2 per hour ISO 16000 / EN 13419: - TVOC at three days: 0.5mg/m^2 per hour ISO 10580 / ISO/TC 219 (Document N238): - TVOC at 24 hours: 0.5mg/m^2 per hour

FORMALDEHYDE LIMITS

TEST PROTOCOL	EMISSION LIMIT/ UNIT OF MEASUREMENT
AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood	≤1mg/ L
AS/NZS 1859.1:2004 - Particle Board, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤1.5 mg/L
AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤1mg/ L
AS/NZS 4357.4 - Laminated Veneer Lumber (LVL)	≤1mg/ L
Japanese Agricultural Standard MAFF Notification No.701 Appendix Clause 3 (11) - LVL	≤1mg/ L
JIS A 5908:2003- Particle Board and Plywood, with use of testing procedure JIS A 1460	≤1mg/ L
JIS A 5905:2003 - MDF, with use of testing procedure JIS A 1460	≤1mg/ L
JIS A1901 (not applicable to Plywood, applicable to high pressure laminates and compact laminates)	≤0.1 mg/m²hr
ASTM D5116 (applicable to high pressure laminates and compact laminates)	≤0.1 mg/m²hr
ISO 16000 part 9, 10 and 11 (also known as EN 13419), applicable to high pressure laminates and compact laminates	≤0.1 mg/m²hr (at 3 days)
ASTM D6007	≤0.12mg/m³
ASTM E1333	≤0.12mg/m³
EN 717-1 (also known as DIN EN 717-1)	≤0.12mg/m³
EN 717-2 (also known as DIN EN 717-2)	≤3.5mg/m²hr

APPENDIX B – STORMWATER ASSESSMENT

OVERVIEW

Under clause 22.13 of the City of Monash Planning Scheme, the proposed development is required to demonstrate, as part of its town planning application, its ability to meet the following water quality performance objectives:

- To reduce the impact of stormwater run-off.
- To improve the water quality of stormwater run-off.
- To achieve best practice stormwater quality outcomes.
- To incorporate the use of water sensitive urban design, including stormwater re-use.

General considerations and potential maintenance activities for the proposed WSUD response have been outlined in this report. The final detailing of the systems will be agreed with the civil and hydraulic design consultants for each of the individual buildings or lots. General measures to be considered by the building contractor to minimise stormwater pollution during construction have also been included.

MASTERPLAN ALLOWANCES

At the masterplan stage, spatial allowance has been made for at least 175 kL of underground rainwater storage to be installed beneath the basement. As the rainwater tanks are beneath the lower basement slab, this can be easily increased if required, subject to detailed design and water balance calculations.

Rainwater capture and reuse for toilet flushing will likely form the primary WSUD treatment method for each building or lot as they are developed.

A secondary spatial allowance has been made for an end of line stormwater treatment system, which would have capacity to treat all of the ground plane impermeable surfaces to mee the best practice standards. Refer to the attached report for full details.

INDIVIDUAL DEVELOPMENT RESPONSIBILITY

Final responsibility to demonstrate that the WSUD requirements have been achieved will fall to the design team for each building or lot at the time of their respective town planning submission(s). It is anticipated that the WSUD strategy for the development(s) will likely involve use of a rainwater tank for toilet flushing, and possibly supplemented with one or more of the following initiatives, pending detailed design coordination:

- Raingarden(s)
- Stormwater treatment systems
- Buffer strips & swales

RAINWATER TANK DESIGN & INSTALLATION CONSIDERATIONS

Rainwater tanks provide flow retention capacity and storage for reuse. They reduce stormwater run-off, decrease the demand of potable water and allow particle settlement within the tank, thus treating rainwater. General considerations for rainwater tank systems design and potential maintenance activities include:

- Incorporating a first flush device to the rainwater collection system. First flush devices divert the initial most polluted portion of water runoff.
- Automated switches to divert water supply from the tank to mains need to be incorporated.
- Connection to toilets ensure water tanks are run down on a daily basis, leaving spare capacity for new rainwater collection.

STORMWATER RUNOFF TREATMENT DURING THE CONSTRUCTION STAGE

Stormwater management in the construction stage will be required to minimise the likelihood of contaminating stormwater discharge from the site and reducing the velocity of the flows generated from the development as it is being constructed.

Stormwater management will form a part of the contractor's EMP, and it will need to specifically address the following objectives:

1. Prevent discharge of contaminated stormwater;
2. Prevent impact on offsite surface or groundwater due to construction works; and
3. Slow down stormwater flows during heavy rainfall.

The EMP should consider the following specific items in relation to stormwater management:

- Storage of materials, chemicals and construction waste must be well clear of site drainage lines or other infrastructure;
- Immediate clean-up of chemical spills;
- Soil and dust containment;
- Regular cleaning of roadways and other impervious surfaces;
- Install sediment or silt traps around stormwater drain points;
- Prevent stormwater from adjacent properties entering the site;
- Capping/bunding of piles of contaminated materials or soil;
- Inspect and clean all sediment filters and traps after heavy rains; and
- Regularly evaluate site stormwater management systems for effectiveness.

More information is available from Melbourne Water booklet "*Keeping Our Stormwater Clean – A Builder's Guide*".

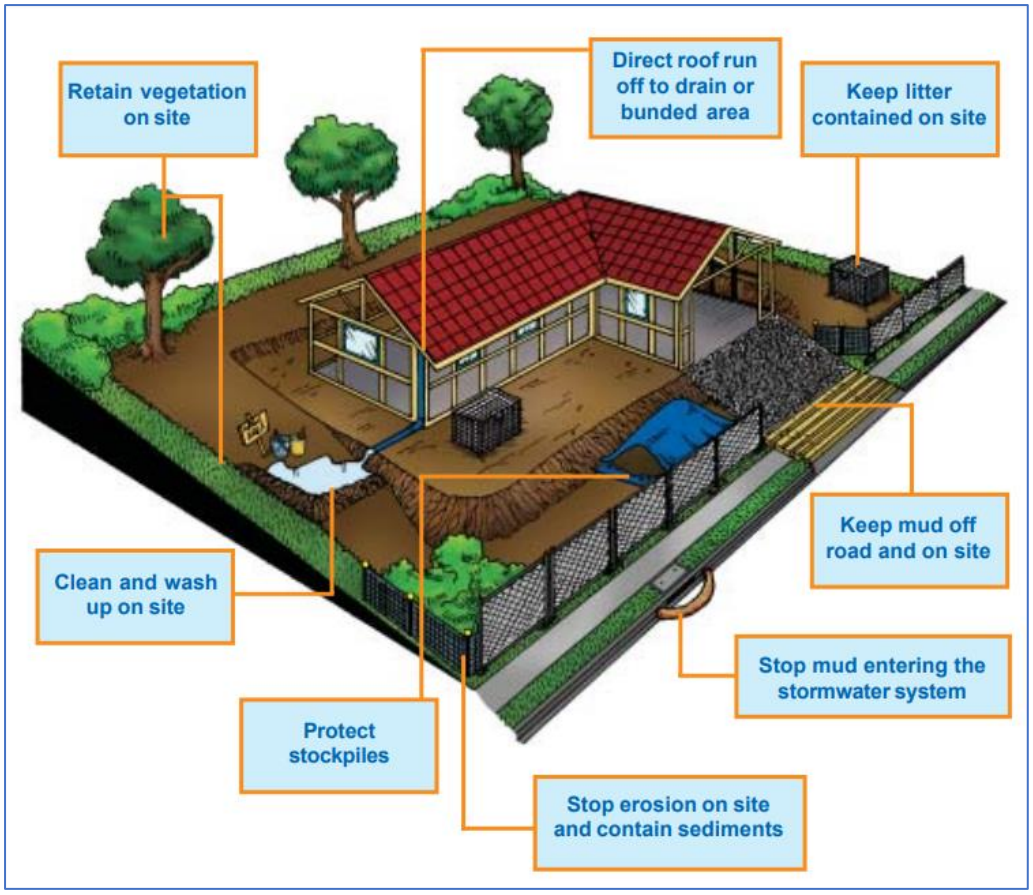


Figure 2: Site stormwater management considerations. Source: Melbourne Water – Keeping Our Stormwater Clean: A Builder's Guide

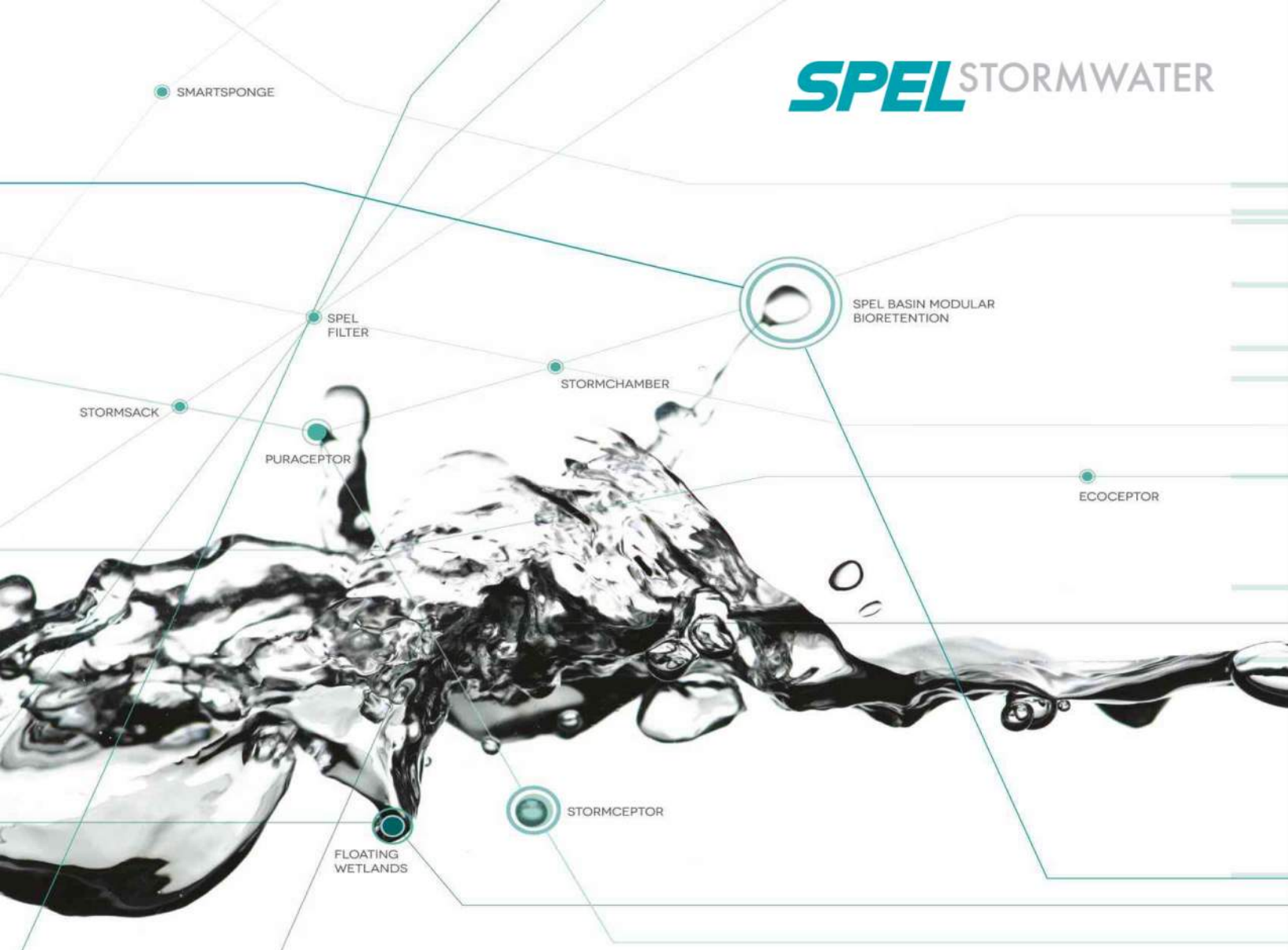
STORMWATER MAINTENANCE PROGRAMME

The proposed rainwater harvesting system will be maintained in accordance with the manufacturer's requirements. The building owner, body corporate or facility manager will be responsible for undertaking the routine maintenance and ensuring that the system is operating as designed.

The following specific maintenance activities will be required as a minimum:

- Roof and other rainfall collection areas are to be inspected regularly, at minimum every 6 months, to ensure they are kept free of pollutants, leaves and other debris;
- First flush devices should be cleaned at least every 6 months; and
- Routine maintenance as specified by the manufacturers for the hardware; pumps, tanks and filters.

Sludge layers and biofilms can be formed in the tank's walls. If water colour and smell become an issue, professional tank cleaners should be engaged.



Stormwater Management Plan for 32A-62 Clayton Road, Clayton VIC

Date: July 28, 2020

Client: WRAP Engineering Pty Ltd

Issue: R1

Victoria Office
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Position:	Environmental Division Manager
Signed:	
Date:	28 July 2020

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1	SUBMISSION	28 July 2020	

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Confidentiality

Section 1

1 Confidentiality

1.1 Conferee

This entire document has been presented to WRAP Engineering Pty Ltd as **commercial-in-confidence** on the basis that it should not be disclosed in any part or whole to any third party without written consent from SPEL Total Stormwater.
This document contains:

- **Intellectual Property** – Material and design that are commercially sensitive intellectual property
- **Pricing Schedule** - Information from SPEL Total Stormwater and details about commercially sensitive pricing

1.2 Request for Information

Please direct all enquiries regarding this submission to:

Kurt Jensen | Senior Technical Consultant
SPEL Total Stormwater
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Executive Summary

Section 2

2 Executive Summary

SPEL Total Stormwater has been commissioned by WRAP Engineering Pty Ltd to prepare a Conceptual Stormwater Management Plan (CSMP) for the proposed precinct development located at 32A-62 Clayton Road, Clayton VIC.

The stormwater quality modelling was undertaken using the MUSIC version 6.3 software. The modelling results (see **Table 2.1**) indicate the 85%, 80%, 30% and 30% reduction targets for Gross Pollutants (GP), Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN) respectively can be achieved.

Table 2.1: Treatment Train Effectiveness

Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction Achieved (%)	Reduction Target (%)
Flow (ML/yr)	22.9	18.7	**18.1**	0
Total Suspended Solids	6290	1150	**81.7**	80
Total Phosphorus	11.1	7.58	**31.6**	30
Total Nitrogen	53.2	30.5	**42.7**	30
Gross Pollutants	888	20.2	**97.7**	85

Stormwater management for the site is achieved using the following devices:

- One (1) x Stormceptor (OL.4360.C1.2C)
- One (1) x SPEL Hydrosystem (HS.400/2)
- Eight (8) x 25kL Rainwater Tank (Others)

Overview

Section 3

3 Overview

3.1 Company Background

SPEL Total Stormwater is a market leader in the environmental compliance sector since 1991. During that time, we have established many satisfied customers who return to SPEL Total Stormwater when they require new and more advanced technological solutions and services. SPEL Total Stormwater devotes a great deal of time, effort and financial investment to maintain our position as a market leader in a rapidly developing field. We employ the latest industry knowledge and advancements, providing our customers with the most progressive stormwater improvement technology.

SPEL Total Stormwater develops long term partnerships with our clients and providing on-going technical support which include a comprehensive scheduled service and maintenance program. We take pride in delivering quality workmanship and customer satisfaction that has created a market reputation, taking SPEL Total Stormwater to where it is today. In order maintain this vision and standard, we are heavily committed to Australian manufacturing and site water quality testing programs to control and maintain consistent quality.

SPEL Total Stormwater is committed to the health and safety of its people and protecting the environment in which they work. We understand the challenges associated with a project of this nature and the physical environment involved. Our safety, environmental and quality standards apply to all our people, products and services, providing certainty that the client's safety, environmental and quality requirements are adhered to.

3.2 Introduction

This report has been prepared by SPEL Total Stormwater to accompany and be considered part of a Development Application (DA) for a proposed precinct development located at 32A-62 Clayton Road, Clayton VIC. The site is located within the catchment of the Monash City Council.

3.3 Site Locality

The subject site is bounded by Clayton Road to the west. Situated in Monash City Council the site has a total area of 4.7558ha (see **Figure 3.1**).

Figure 3.1 Site Location

3.4 Site Layout

The proposed development is presented on **Figure 3.2**.

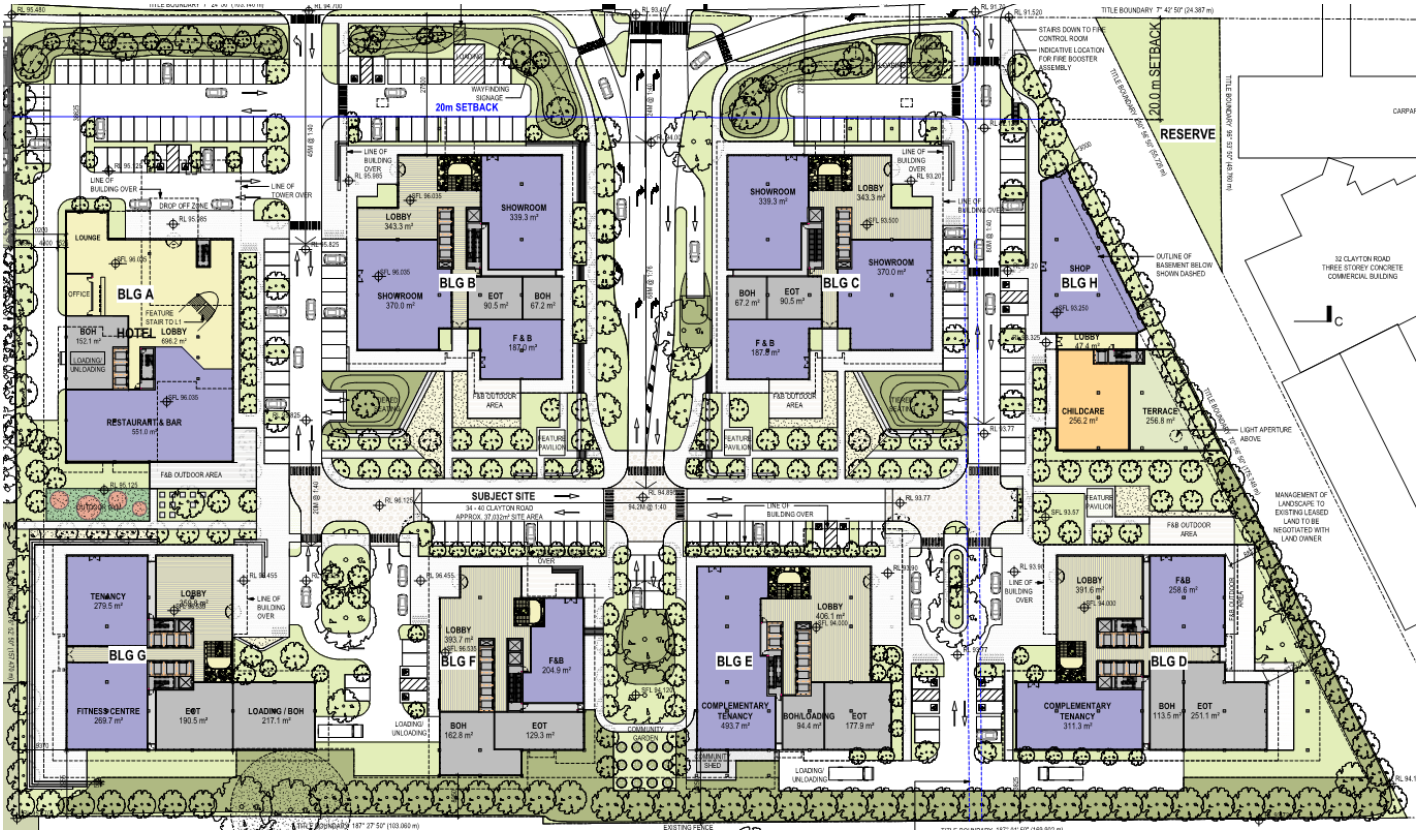


Figure 3.2 Proposed Site Layout

Quality Management – Operational Controls

Section 4

4 Quality Management – Operational Controls

4.1 Water Quality Objectives

Melbourne Water (2018) requires treatment of stormwater so that annual pollutant loads achieve targets set out in the Greenstar Column A Environmental Management Guidelines (BPEMG). These are:

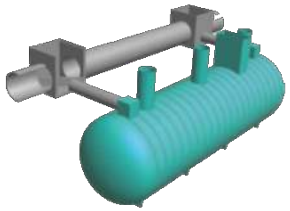
- 80% reduction in Total Suspended Solids (TSS) from typical urban loads;
- 30% reduction in Total Nitrogen (TN) from typical urban loads;
- 30% reduction in Total Phosphorus (TP) from typical urban loads; and
- 85% reduction in Gross Pollutants (GP) from typical urban loads.

4.2 Treatment Train

Based on the site characteristics and the range of available Stormwater Quality Improvement Devices (SQIDs), this study has developed an overall concept that will satisfy the requirements of downstream environmental protection. **Figure 4.1** shows a schematic representation of the proposed treatment train elements.

Road/Paved Areas
Size: 24,717.3m²
Imperviousness: 100%

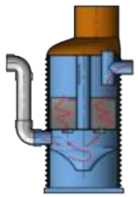
Landscaping Areas
Size: 6,181.5m²
Imperviousness: 20%



SPEL Stormceptor
OL.4360.C1.2C

8 x 25kL Rainwater Tank

Total Roof Areas
Size: 6,659.2m²
Imperviousness: 100%



SPEL Hydrosystem (HS.400/2)

Legal Point of Discharge

Figure 4.1 Treatment Train Schematic

4.2.1 SPEL Stormceptor

The SPEL Stormceptor Class 1 is an integrated oil-spill capture and light liquid treatment separator that provides an environmentally sustainable and certified solution for the treatment and capture of hydrocarbons in surface water runoff from high risk sites such as retail fuel forecourts for stormwater discharge (see **Appendix 1**). The Stormceptor treatment system surpasses the traditional sewer system for water quality and hydrocarbons capture with the independently tested and proven design complying with the stormwater discharge quality requirements of;

- Department of Environment Climate Change Water of NSW (DECCW) for stormwater quality;
- OEH NSW stipulates that hydrocarbons are to be of `no visible trace` complying with ANZECC 2000 Guidelines;
- Department of Environment and Resource Management (DERM) Queensland;
- Environmental Protection Agency (EPA) of South Australia, Northern Territory, Tasmania & Victoria
- Australian and New Zealand Environment Conservation Council;
- Guidelines for recreational water quality and aesthetics (Chapter 5) “Surface films, Oil and petrochemicals should not be noticeable as a visible film on the water nor should they be detectable by odour”;
- Australian Airport (Federal) Environmental Protection Act;
- Department of Water, Western Australia

Current guidelines stipulate that hydrocarbon content in stormwater or any receiving waters is to be of “no visible trace or sheen of oil or grease on released waters”. Environmental Authorities worldwide regard a minimum of 10 ppm as being the benchmark for no visible trace or sheen. The treatment efficiency in SPEL Stormceptor Class 1 is:

- >99.9% hydrocarbons reduction
- >97% sediment reduction. Median particle size distribution 70µm
- >30% Phosphorus reduction

4.2.1.1 General Information for Class 1 Stormceptor

Class 1 was introduced by the UK Environment Agency (UKEA), with guidelines tailored specifically for the treatment and capture of hydrocarbons from service station forecourts. Class 1 stipulates a discharge water quality of less than 5ppm from a tested inflow concentration of 5,000ppm (hydrocarbons content). The UKEA has adopted the European Standard BS EN 858.1 Separator systems for light liquids (oil/petrol/diesel). (known hence in this document as The Standard) for the design, use, selection, installation, operation and maintenance of prefabricated separators. Separators have to satisfy essential requirements mandated by the Standard`s clauses including independent testing to the test methodology of Clause 8.3., in order to be certified as a Class 1 separator.

SPEL Class 1 separators have been independently tested by HR Wallingford Research Laboratory UK and the University of South Australia Hydraulics Research Centre to The Standard with a discharge water quality of : `no visible trace` and less than 5ppm from an inflow concentration of 5,000ppm under test flow conditions. Relevant certificates and the Standard are in **Appendix 2**.

Australian Compliance

The Standard and Class 1 system exceeds all Australian regulatory requirements pertaining to hydrocarbons with the exception of South Australia, who have themselves recently adopted the Class 1 Standard and treatment system for forecourt hydrocarbons management.

Treatment and Capture Efficacy

Hydrocarbons separation dynamics act no differently anywhere in the world. The density of oils and fuel is lighter than water and will always rise, however the Class 1 system requires an efficacy in the quality of separation that depends upon the right conditions in which to achieve no visible trace in the water column. This includes suitable retention time (as specified by BS EN 858 & Stokes law), low velocity water flow, and enhanced by a coalescing filter action.

Proven Record in Australia

Class 1 is not solely a design theory but has indeed a proven record in the UK, one of the world`s most industrialized and urban environments, and for the past 21 years in Australia. **Table 4.3** lists the SPEL Stormceptor application in Australian projects. The comprehensive list is in **Appendix 3**.

Table 4.3 List of Similar Stormceptor Installation in Australia

Council	Project	Model Number	APPLICATION
Newcastle	Sandvik Heatherbrae NSW	S.300/80.C1.2C.A.450.RCP	5 Off Line Stormceptors treating industrial site. Treatment train includes a swale
Camden	M2 Milk Smeaton Grange NSW	OL.300.080.30.C1.2C.SP	Off Line Stormceptor for TSS reduction prior to bioretention
Federal Aviation	18 Canberra Ave ACT	S.200/70.C1.2C.A.225	2 Stormceptors for stormwater treatment of airport carparks
Geraldton Council	ARG – Narngulu WA	S.100/25.C1.2C.A.225	
Geraldton Council	ARG – Narngulu WA	S.100/25.C1.3C.PS.SP	
Adelaide City Council	BP – Reynella SA	S.200/40.C1.2C.A.300	Large service station carpark treatment before stormfilters
AKS Industries	BP Dandenong VIC	S.300/220.C1.2C.A.375	Large service station carpark treatment before stormfilters
Canberra	ECLIPSE APPARTMENTS ACT	S.300/160.C1.2C.A.450	Offline Stormceptor as part of treatment train for apartment development
Canberra	ULLADULLA HIGH SCHOOL NSW	S.900/406060	Stormceptor for school grounds run off
Lake Macquarie City Council	CALTEX SWANSEA NSW	S.300/100.C1.2C.A.300	Large service station carpark treatment before stormfilters
Geelong City Council	MACKILLOP ST DENTAL SURGERY	S.100/25.C1.2C.A.150	TSS removal prior to stormfilters
SIMS METAL	ST MARYS NSW	S.400/600.C1.2C.G.525	Industrial site runoff
City of Unley	CENTENNIAL PARK SA	S.300/130.C1.2C.A.300	
Tasmania	Netco TAS	S.100/15.C1.2C.A.100	
City of Greater Geelong	Eastern Park – VIC	S.300/160.C1.2C.A.450	Pre-treatment prior to a Constructed Wetland
Federal Aviation	QANTAS JET BASE – SYDNEY	S.300/220.C1.2C.A.300	Stormceptors for stormwater treatment of airport carparks
Federal Aviation	QANTAS JET BASE – SYDNEY	S.300/100.C1.2C.A.300	Stormceptors for stormwater treatment of airport carparks
Belconnen Community Council	BELCONNEN ACT	S.200/40.C1.2C.A.300	
Knox City Council	BATTERHAM PARK VIC	S.300/80.T.C1.3C.PS.SP	TSS removal prior to wetland for urban subdivision
Maroondah City Council	MAROONDAH HWY UNITS VIC	S.300/130.C1.2C.A.300	Treatment of carparks and grounds in conjunction with swale
Whyalla City Council	Quest Apartments Whyalla – SA	S.100/15.C1.2C.A.100	Treatment of carparks and grounds in conjunction with swale
Port Hedland Council	PORT HEDLAND REFUELING FACILITY	S.400/1100.C1.2C.A.375	
Brisbane City Council	TJH – BRISBANE AIRPORT LINK – QLD	S.400/850/20.C1.3C.SP.C.600	8 Stormceptors to compress the size of bioretention basins and provide hydrocarbon treatment from road

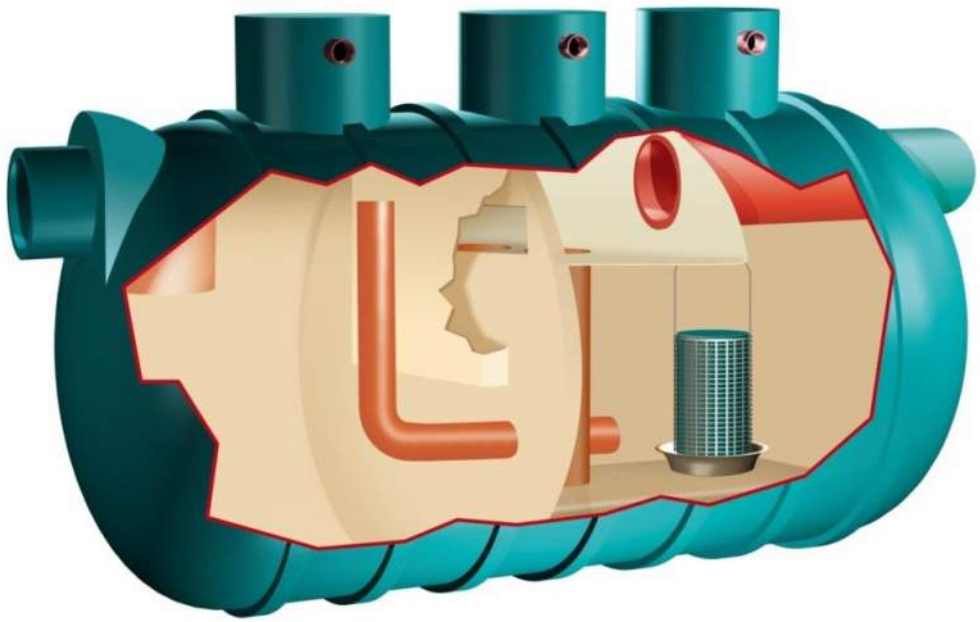


Figure 4.2: The schematic of SPEL Stormceptor Class 1™

Independent Standard and Validation

The Standard and the independent validation that applies to the SPEL Class 1™ separators provides the council and the authority the appropriate latitude to assess the product and the catchment design unencumbered by commercial partiality. Please refer to the test data in **Appendix 4**.

Current Guidelines and Practices Pollute the Environment

Existing ` traditional` guidelines are, and have proved to be, totally unsatisfactory in protecting the environment from hydrocarbon pollution, both for egress to receiving waters and soil absorption. Sewer systems cannot receive stormwater meaning there is a significant portion of the forecourt catchment that egresses to stormwater or to soil (on sites where there is no stormwater). The majority of service stations within the council`s and the territories precinct are marked by these defects and consequently are non-compliant.

4.2.1.2 Components and Hydraulics of Class 1 Stormceptor

The Stormceptor Class 1 is a gravity-type, passive, full retention flow process that treats all flows through two chambers. Low velocity laminar flow provides quiescent conditions in the separator enabling the light liquid content of the water to separate and rise to the surface due to the difference in density of the oil and water. Contaminated water cannot flow directly across the surface before effective separation has taken place. Treatment process involves the `cleaner` water passing from the primary chamber by underflow into the secondary chamber and finally through a coalescing filter mounted in the secondary chamber to `collect` smaller droplets of hydrocarbons and encourage larger droplets to form enabling better removal by gravity to the collecting area in the sealed secondary chamber.

The SPEL Stormceptor Class 1 is sized to treat and capture all flows. There is no bypass facility, meaning all pollutants are captured and retained between maintenance cycles.

Coalescing filter

The coalescer is a high- reticulated and high-contact surface filter with a minimum life span of eight years. It is mounted into the secondary chamber, providing a coalescing process for the separation of smaller oil droplets. Incorporated in the secondary chamber prevents the coalescer from being blocked in the event of major spillages and large amounts of accumulated hydrocarbon or heavy silt content in the surface water. It can be simply lifted out for cleaning during routine maintenance.

Fire Trap

SPEL Stormceptor Class 1 tanks contain an immersed inlet dip pipe to extinguish flames and prevent inflammable vapours from passing through to the drainage system. It is also prevents mosquito breeding.

No Scouring: Suitable for Flood & Tidal Conditions

The horizontal configuration, internally sealed treatment chambers and its coalescing function ensures no risk of scouring including when the separator is submerged in flood or tidal events.

4.2.1.3 Performance Analysis

SPEL Class 1™ devices have undergone rigorous and comprehensive testing for total suspended solids, total phosphorus and hydrocarbons. The reduction values listed within are from flow tests conducted by the University of South Australia (UniSA) Hydraulics Research Laboratory.

Total Petroleum Hydrocarbons (TPH)

Tests were performed at the UniSA Hydraulics Research facility and at HR Wallingford UK with the device in flow mode, with the following results. Test methodology was done to European Standard BS EN 85.1 Section 8.3. **Table 4.4** shows that discharge water quality reduction remains constant at <0.1ppm of TPH translating to `no visible trace` from a constant inflow concentration of 5,000ppm

Table 4.4 Reduction of Total Petroleum Hydrocarbons

Hydrocarbon Fraction	EQL*	Inflow Concentration (Total 5699.0)	Outlet Samples TPH Fraction Concentrations					Calculated Mean Concentration
			1	2	3	4	5	
C6-C9	0.02	0.15	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C10-C14	0.04	125.43	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
C15-C28	0.10	5570.62	<0.1	0.162	<0.1	<0.1	<0.1	< 0.032
C29-C36	0.1	3.42	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
* Sensitivity: Estimated Quantitation Limit Results expressed in mg/l								

Results show `no detection` of hydrocarbons of all carbon fractions with the exception of Sample 2 C15-C28 with 1 sample showing` Inflow concentration of >5,000ppm.

Caution: Claims made of 98% Hydrocarbon Reduction

Data expressed by competitors in terms of percentages are erroneous. Claims expressed in percentage form are unreliable and misleading. A 98% reduction of TPH off catchments with vehicular activity would result in discharge loads ranging from 20ppm to 100ppm. This exceeds the concentration of TPH `visibility` which is approximately 10ppm rendering such devices as non-compliant.

Total Suspended Solids: Particle Size Distribution (PSD)

In depth investigation of particle size capture performance was developed for the first time at the UNISA hydraulic research facilities for assessment for typical stormwater TSS characteristics. The make-up of particulate size was weighted fine fraction <125um which makes up 90% of the load reflecting MUSIC load characteristics. The test was conducted at the UNISA research facility with the device in flow mode. This is stressed as the most accurate method in determining reduction as opposed to accumulative loads analysis.

In summary the reduction of Total Suspended Solids and the relevant particle size distribution (PSD) is as follow:

- >97% >75um (Refer Annexure for validation)
- >55% <75um. (Refer Annexure for validation)

TSS UNISA Test Methodology

The sediment added to the inlet of the SPEL Stormceptor Class 1™ consisted of 10 kg of dry material. Half of this material (by weight) was a sand material sourced from a brick sand quarrying operation in Noarlunga, SA which was pre-sieved to remove particles finer than 600 µm. The second half (by weight) was a commercially sourced silica product (Unimin Silica 60G). The particle size distribution (PSD) of the sediment produced was determined to 75 µm by sieving in accordance with AS 1289.3.6.1 – 2009 prior to adding the material to the concentrated pollutant mixture. The PSD of material less than 75 µm was determined using laser diffraction.

At the completion of the test the suspended solids retained by Chamber 1 and Chamber 2 of the SPEL unit were collected. The collected sediment was harvested by draining all water from the tank at the completion of the test through a geofabric filter to manually collect retained sediment. Retained sediment was then dried in the oven at 105°C and sieved to 75 µm in accordance with AS 1289.3.6.1 – 2009. The sediment fraction which was not collected was assumed to pass through the tank in normal running conditions.

Although the loss of retained sediment during the retained sediment collection method is considered possible, it was considered appropriate because this method represents a conservative approach to determining the total mass of retained sediment as losses are considered to pass through the SPEL Stormceptor Class 1™. Furthermore, as sediment that is lost through the cloth filter is most likely to be in the smaller particle size range, this added a further degree of conservatism as it leads to an under-estimation of the amount of retained low diameter particles.

TSS Results

Overall, 10 kg of sediment was added to the SPEL Class 1™ unit, and 8.486 kg of sediment was retained. Analysis of the PSD of sediment indicated that the retained sediment was predominantly larger particle sizes. The SPEL Stormceptor Class 1™ removed more than 95% of sediment larger than 75 µm, and more than half the particles less than 75 µm. These results are based on repeated tests of approximately 100 to 200 g of retained material, and for this reason the retained percentages are approximate – the percentage reduction for particles greater than 125 µm, for example, was consistently greater than 95%, with minor fluctuations between 95 and 100%. These results are illustrated in **figure 4.3**.

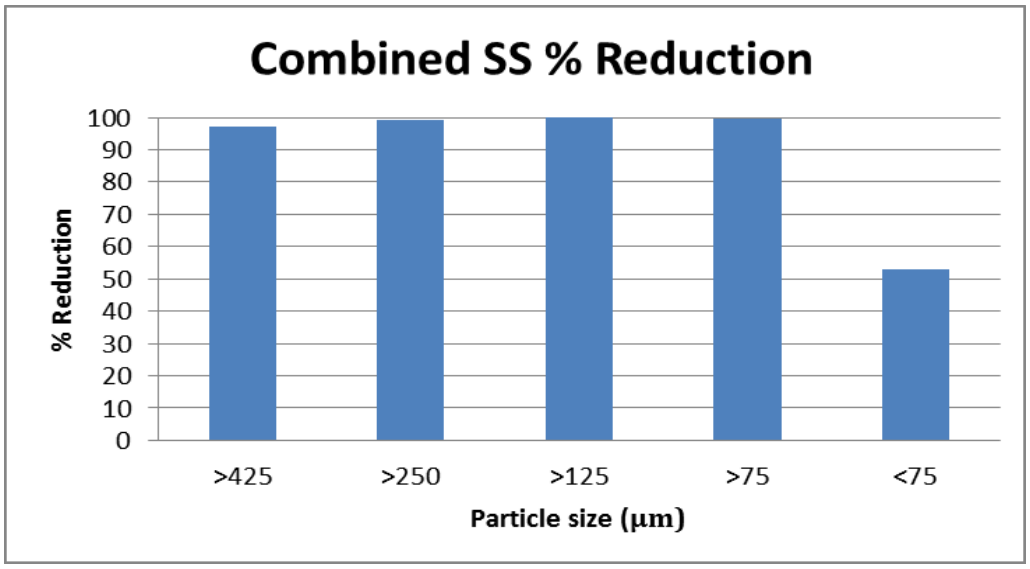


Figure 4.3: Percentage of Sediment Retained by the SPEL Stormceptor Based on Particle Size

The PSD of sediment which was placed into the pollutant mixture and that which was retained within the SPEL unit (retained) is shown in **Figure 4.4**. The data was determined by laser diffraction. **Figure 4.5** compares the inlet PSD of sediment used in this test with the assumed PSD of sediment in the MUSIC model. The comparison indicates that there was generally a broader PSD Distribution than that assumed by the MUSIC software.

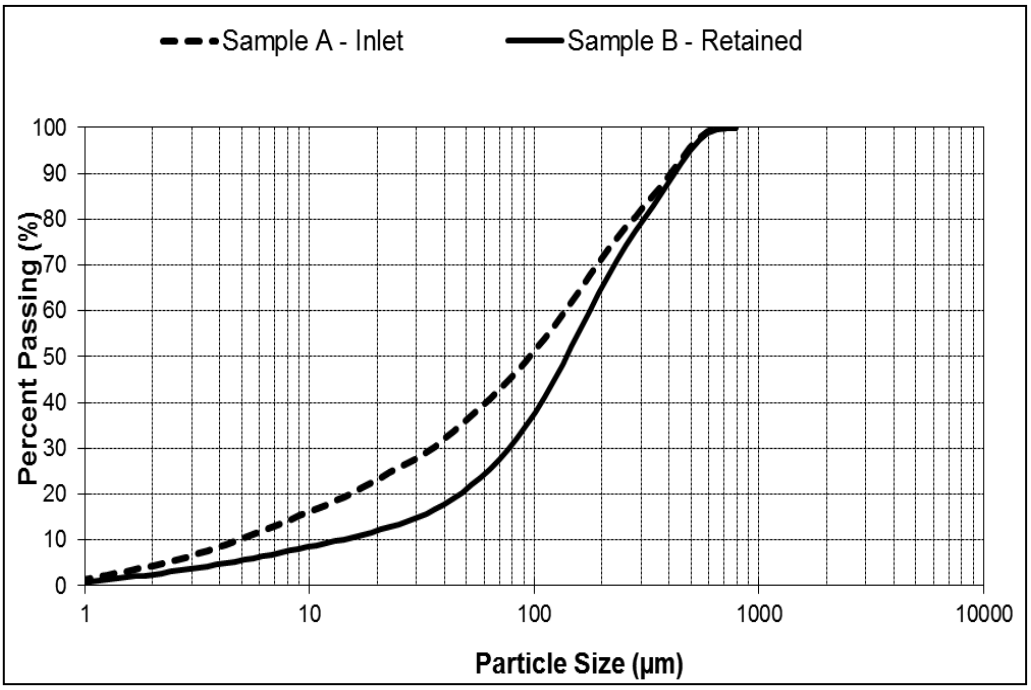


Figure 4.4: PSD of sediment at the inlet and retained by the SPEL Stormceptor (by laser diffraction)

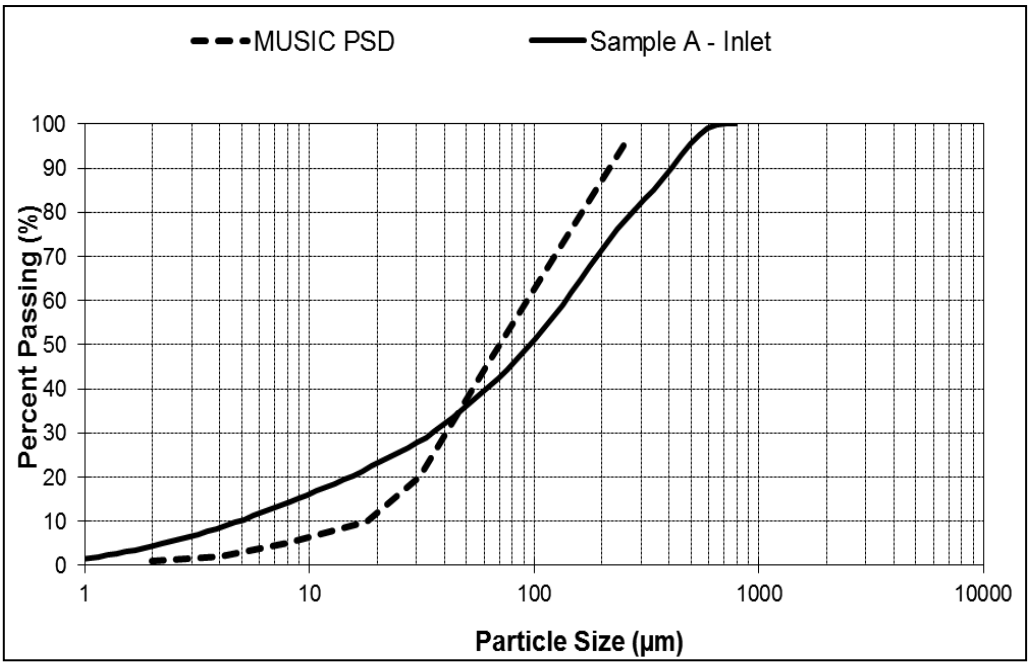


Figure 4.5: PSD of sediment at the inlet of the SPEL Stormceptor compared to that assumed in the MUSIC model (by laser diffraction)

TSS Summary of Findings

The results indicate that there is a consistent reduction in the sediment concentrations. Sieve testing of sediment at the inlet and retained by the SPEL Stormceptor Class 1™ indicated that most particles retained were in the larger particle size range. Removal of sediment was determined based on particle size as follows:

- For particles greater than 425 µm, over 96% of particles were retained
- For particles between 425 µm and 250 µm, over 98% of particles were retained
- For particles between 250 µm and 125 µm, over 99% of particles were retained
- For particles between 125 µm and 75 µm, over 99% of particles were retained
- For particles less than 75 µm, over 52% of particles were retained

Total Phosphorus

Tests were performed in flow mode at the UNISA Research facility and in-situ capture tests of units treating a commercial/mixed subdivision with removal particulate-bound.

Reduction of Total Phosphorus (TP)

In the meantime eight site tests were performed in western Sydney. Five tests were dismissed due to vagaries; either whilst sampling was being conducted or catchment activities that distorted the inflow concentration levels. The catchment is a mixed commercial/industrial subdivision with a typical suburban streetscape. The TSS inflow concentration is >500mg/l (upper Fletcher et al (2004)) .This is due to the catchment being flat with a gradient of <0.5% and the presence of gravel streets, excavated allotments and some construction activity within the catchment at the time of testing period. The data reveals a consistent reduction of >95% of TSS.

Site tests of cadmium, chromium, lead, aluminium and zinc (particulate) show removal rates >90 %. The comprehensive validation report is available in **Appendix 4**.

Gross Pollutants

SPEL Class 1™ retains 100% of gross pollutants >5mm size in treatable flow conditions.

4.2.1.4 Tank Structure-Certification & Maintenance for Class 1 Stormceptor

SPEL Stormceptor Class 1 units are glass reinforced plastic vessels made by the technical advanced chop hoop filament winding process (patented) producing circumferential and longitudinal strength complying with BS4994 FRP Pressure Vessel code and AS 2634FRP Chemical Equipment to ensure the construction meets the necessary strength and stability requirements. The tank is designed to accept ground conditions with low stiffness down to 4.8Mpa, water tables are set to ground level as standard with a minimum depth of cover, based on a standard soil density.

Maintenance Operation

Maintenance is performed at a minimum of every six months or if the probe alarm is activated, by eduction method (suction).

Coalescing Filter Media

The coalescer is a high- reticulated and high-contact surface filter with a minimum life span of eight years. It is mounted into the secondary chamber, providing a coalescing process for the separation of smaller oil droplets. Incorporated in the secondary chamber prevents the coalescer from being blocked by large amounts of heavy sediment that are separated in the primary chamber. It can be simply lifted out for cleaning during routine maintenance.

Sediment:

Sediment is removed by a vacuum loading truck from the base of the primary chamber. The cylindrical shape ensures sediment collects at the base of the chamber. Floatables: Gross pollutants and litter are removed by the same process described above.

Operation & Maintenance Manual:

The Maintenance Programme will be kept on the premises at all times, with a ledger recording all maintenance and inspection activities. This will provide a useful and efficient record for Council Inspection officers to facilitate random verification.

4.2.2 SPEL Hydrosystem – General Information

The SPEL Hydrosystem is a tertiary stromwater treatment filtration device targeting known pollutants of concern including Total Suspended Solids (TSS); Nutrients (TP & TN); Gross Pollutants; as well as Heavy Metals (i.e. Cu, Zn, Pb). This specialist stormwater filtration system is installed within conventional concrete manholes, polyethylene and fibreglass shafts. The pre-fabricated and pre-assembled SPEL Hydrosystem is quickly and safely installed using onsite diggers (see Figure 4.3 below). This system is designed for an array of applications with treatment flow rates ranging from 2.5l/s up to 144l/s. The Hydrosystem is designed in an off-line configuration and operates at full treatment flow with a hydraulic fall of 250mm across the system.

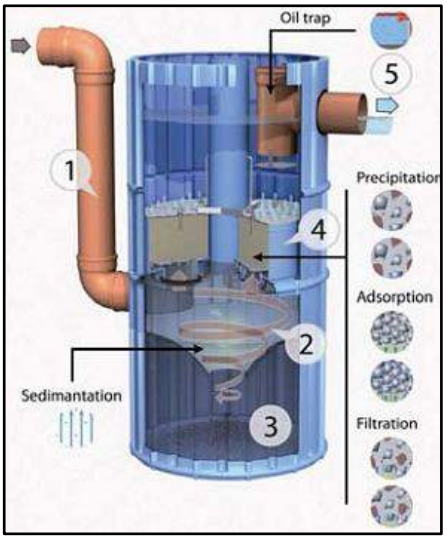
Figure 4.3: SPEL Hydrosystem (SHS.1000) installation using onsite digger

4.2.2.1 International Validation and Testing

SPEL Hydrosystem have been lab and field tested by several Universities and Institutes across Germany. The German Institute for Structural Engineering (DIBt) granted a general technical approval (Z-84.2-4)1 passing all test conditions under heavy trafficable conditions. Field test data has been obtained across Germany including Bremer Straße in Hamburg-Harburg2 reinforcing the above approval.

Function Principles:

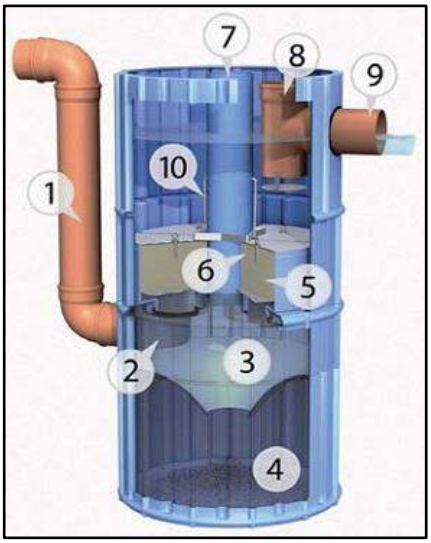
1. The rainwater from the connected area is fed into the basal section of the filter housing. The angled inlet generates a radial flow pattern.
2. The hydrodynamic separator converts turbulent waters into a radial laminar flow pattern, generating particle sedimentation, particularly of the sand fraction.
3. This takes place over an inlet to the lower section of the filter shaft. The sediment is retained in a silt trap chamber below the separator. The silt trap needs to be emptied out at intervals.
4. In the central section of the filter housing is the actual filter,
5. Filter Element: Metal. The filter element filters out the fine materials in an up-flow process and dissolved materials are precipitated and adsorbed. The filter can be backwashed. When exhausted the filter is easily exchanged.
6. The filter element is easily pulled up via shaft openings.
7. Above the filter element is the clean water. It passes via a blockade of light substances and then flows over the outlet into a soak away.



Schematic of SPEL Hydrosystem Process

Product Components:

1. Rainwater Inlet (DN 200).
2. Angled Inlet.
3. Separator Chamber.
4. Silt Trap.
5. Filter Elements (4 No.).
6. Removal Device for Filter Element.
7. Overflow.
8. Blockade of light substances and suction pipe
9. Outlet to storage or to waste.
10. Locking buoyancy control system



Schematic of SPEL Hydrosystem Components

4.3 Maintenance Procedure

The SPEL treatment train specified above is an engineered stormwater treatment solution for the reduction in TSS, nutrients, gross pollutants and hydrocarbons. The Stormwater Quality Improvement Devises (SQIDs) identified in the stormwater treatment solution will required on-going maintenance for a prescribed period as specified by their respective council/authority. A draft of the proposed treatment train maintenance contract can be seen in **Appendix 2**.

Quality Analysis - MUSIC

Section 5

5 Quality Analysis – MUSIC

Water quality modelling has been undertaken of the post-development (mitigated) scenario using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software to demonstrate the load based reduction targets are achieved. A stormwater treatment train has been developed and modelled to determine the effectiveness of the proposed system in achieving the relevant water quality objectives.

5.1 Rainfall and Evapotranspiration Parameters

Table 5.1 summarized the meteorological and rainfall-runoff data used in the MUSIC model.

Table 5.1 Meteorological and Rainfall Runoff Data

Parameter	Value
Rainfall station	086314 – Koo Wee Rup
Time step	6 minute
Modelling period	January 1971 – December 1980
Mean annual rainfall (mm)	769 mm
Evapotranspiration	1008 mm

5.2 Catchment Parameters

Based on the proposed land uses within the development, the subject site has been modelled as an urban source node. The rainfall-runoff parameters and pollutant generation parameters are based on parameters recommended by Melbourne Water (2018) (**Tables 5.2** and **5.3**).

Table 5.2 Rainfall Runoff Parameters

Parameter	All Nodes
Rainfall threshold (mm)	1.0
Soil storage capacity (mm)	120
Initial storage (% capacity)	25
Field capacity (mm)	50
Infiltration capacity coefficient a	200
Infiltration capacity exponent b	1
Initial depth (mm)	10
Daily recharge rate (%)	25
Daily base flow rate (%)	5
Daily deep seepage rate (%)	0

Table 5.3: Pollutant Export Parameters for Urban Sites

Catchment ID		Total Suspended Solids [log (mm/L)]		Total Phosphorous [log (mm/L)]		Total Nitrogen [log (mm/L)]	
		Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Landscape	Storm Flow Concentration	1.9	0.333	-0.7	0.242	0.243	0.182
	Base Flow Concentration	0.96	0.401	-0.731	0.36	-0.566	0.363
Hardstand	Storm Flow Concentration	2.431	0.333	-0.301	0.242	0.342	0.205
	Base Flow Concentration	0	0	0	0	0	0
Roof	Storm Flow Concentration	1.301	0.333	-0.886	0.242	0.301	0.205
	Base Flow Concentration	0	0	0	0	0	0

5.3 Treatment Node Parameters

The following sections describe the modelling parameters applied to MUSIC for each of the treatment nodes included as part of the water quality assessment.

5.3.1 SPEL Stormceptor Parameters

A generic treatment node in MUSIC has been used to simulate the treatment efficiency of the Stormceptor based on third party field testing results. The SPEL Stormceptor treatment node parameters are summarised in **Table 5.4**.

Table 5.4 SPEL Stormceptor Treatment Node Parameters

Catchment ID	SPEL Stormceptor
Are the proposed pollutant reduction efficiencies independently verified using a method suited to local conditions?	Y
Does the data provided include performance results under dry weather flows (to account for potential pollutant leeching?)	Y
It the assumed high-glow bypass rate consistent with manufacturer specifications?	Y
High Flow by-pass (m^3/s)	0.060
Low Flow	0.000
TSS Input (mg/L) Output (mg/L)	1000 170
TN Input (mg/L) Output (mg/L)	100 77
TP Input (mg/L) Output (mg/L)	100 89
Gross Pollutants Input (mg/L) Output (mg/L)	15 0

5.3.2 SPEL Hydrosystem Parameters

A generic node has been utilized in MUSIC, for the purpose of simulating treatment efficacy of SPEL Hydrosystem and the transform function in the node has been modified based on SPEL Total Stormwater's 2nd and 3rd Party field testing product data. These test results and papers are available upon request from SPEL Total Stormwater. The SPEL Hydrosystem parameters utilised within MUSIC are summarised in **Table 5.5**.

Table 5.5: SPEL Hydrosystem Parameters

Catchment ID	SPEL Hydrosystem
Are the proposed pollutant reduction efficiencies independently verified using a method suited to local conditions?	Y
Does the data provided include performance results under dry weather flows (to account for potential pollutant leeching?)	Y
It the assumed high-glow bypass rate consistent with manufacturer specifications?	Y
High Flow by-pass (m^3/s) (for each separate system)	0.005
Low Flow	0.000
TSS Input (mg/L) Output (mg/L)	1000 150
TN Input (mg/L) Output (mg/L)	100 57
TP Input (mg/L) Output (mg/L)	100 34
Gross Pollutants Input (mg/L) Output (mg/L)	15 0

5.4 MUSIC Results

Results of the MUSIC modelling for the treatment train effectiveness are summarised in **Table 5.6**. The results indicate the 80%, 30%, 30% and 85% reduction target for TSS, TP, TN and gross pollutants respectively are achieved. A screen capture of the MUSIC modelling results is included as **Figure 5.2**.

Table 7.6: Treatment Train Effectiveness

Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction Achieved (%)	Reduction Target (%)
Flow (ML/yr)	22.9	18.7	**18.1**	0
Total Suspended Solids	6290	1150	**81.7**	80
Total Phosphorus	11.1	7.58	**31.6**	30
Total Nitrogen	53.2	30.5	**42.7**	30
Gross Pollutants	888	20.2	**97.7**	85

Figure 5.2: Treatment Train Effectiveness & Layout

WRAP note: MUSIC mark-up shown above is schematic only. WSUD filters to be located in this area. Refer to architectural plans for confirmation.

Summary and Recommendation

Section 6

6 Summary and Recommendation

Based on the water quality assessment using the MUSIC software, it is found that the pollutant reduction targets can be achieved by adopting the SQIDs specified in **Table 6.1**.

Table 6.1: Recommended Stormwater Quality Improvement Devices

Stormwater Quality Improvement Device	**Quantity**
SPEL Stormceptor OL.4360.C1.2C	1
SPEL Hydrosystem (SHS.400/2)	1

The recommended SQIDs are designed to capture stormwater at the downstream end of the drainage network and treat the runoff prior to discharging into the local waterway. The pollutant reduction targets achieved (as modelled in MUSIC) are summarised in **Table 6.2**.

Table 6.2: MUSIC modelling results

Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction Achieved (%)	Reduction Target (%)
Flow (ML/yr)	22.9	18.7	**18.1**	0
Total Suspended Solids	6290	1150	**81.7**	80
Total Phosphorus	11.1	7.58	**31.6**	30
Total Nitrogen	53.2	30.5	**42.7**	30
Gross Pollutants	888	20.2	**97.7**	85

References

Section 7

7 References

Melbourne Water (2018). *MUSIC Guidelines – Input Parameters and modelling approaches for MUSIC users in Melbourne Water's service area 2018*

List of Appendices

Appendix 1 – SPEL SQID Product Guides

SPEL Stormceptors

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SPEL ENVIRONMENTAL
INTEGRATED WATER SOLUTIONS

SPEL STORMCEPTOR CLASS 1

Stormwater Treatment & Hydrocarbon Capture

SPEL Stormceptor Class 1* is a horizontally configured two chamber stormwater quality improvement device (SQID) equipped with a gravity enhancing coalescer unit.

The advanced design facilitates a retention period that provides quiescent conditions within the secondary chamber, efficiently promoting the separation of total suspended solids (TSS), light liquids and pollutants.

SPEL treatment devices can accommodate a complete range of flow rates with corresponding pipe size and types.

*Stormceptor Class 2 model with no coalescer is available for medium to low-risk applications.

APPLICATIONS

- Car Parks & Shopping Centres
- Council Depots
- Industrial Estates
- Heavy Vehicle Maintenance & Storage Areas
- Transport Depots & Loading Bays
- Tunnels
- Highways & Transport Corridors
- Recycling Yards
- Airport Aprons & Tarmacs

SPEL STORMCEPTOR OL CLASS 1

Offline Stormwater Treatment & Hydrocarbon Capture

SPEL Stormceptor Class 1* is a horizontally configured two chamber stormwater quality improvement device (SQID) equipped with a gravity enhancing coalescer unit.

The design, facilitated by a retention period of approximately 6 minutes generates quiescent conditions within the secondary chamber, efficiently promoting the separation of total suspended solids (TSS), light liquids and pollutants.

Treatable flow rates range from 0.1LPS to 400+LPS (max. flow rate more than 4,000 LPS) and can fit pipe sizes from 100mm to greater than 1500mm.

*Stormceptor Class 2 model with no coalescer is available for medium to low-risk applications.

APPLICATIONS

- Car Parks & Shopping Centres
- Council Depots
- Industrial Estates
- Heavy Vehicle Maintenance & Storage Areas
- Transport Depots & Loading Bays
- Tunnels
- Highways & Transport Corridors
- Recycling Yards
- Airport Aprons & Tarmacs

Independently tested for reducing the average annual loads:

- ✓ 97% total suspended solids (TSS)
- ✓ 100% > 3mm gross pollutant solids (GP)
- ✓ 99.9% light liquids (TPH) (certified discharge quality of 5PPM or less, European standard BSEN 858 .1 2006)
- ✓ Nutrient reduction

SPEL Stormceptor

The SPEL Stormceptor Class 1 is an integrated oil-spill capture and light liquid treatment separator that provides an environmentally sustainable and certified solution for the treatment and capture of hydrocarbons in surface water runoff from high risk sites such as retail fuel forecourts for stormwater discharge. The Stormceptor treatment system surpasses the traditional sewer system for water quality and hydrocarbons capture with the independently tested and proven design complying with the stormwater discharge quality requirements of;

- Department of Environment Climate Change Water of NSW (DECCW) for stormwater quality;
- OEH NSW stipulates that hydrocarbons are to be of `no visible trace` complying with ANZECC 2000 Guidelines;
- Department of Environment and Resource Management (DERM) Queensland;
- Environmental Protection Agency (EPA) of South Australia, Northern Territory, Tasmania & Victoria
- Australian and New Zealand Environment Conservation Council;
- Guidelines for recreational water quality and aesthetics (Chapter 5) “Surface films, Oil and petrochemicals should not be noticeable as a visible film on the water nor should they be detectable by odour”;
- Australian Airport (Federal) Environmental Protection Act;
- Department of Water, Western Australia

Current guidelines stipulate that hydrocarbon content in stormwater or any receiving waters is to be of “no visible trace or sheen of oil or grease on released waters”. Environmental Authorities worldwide regard a minimum of 10 ppm as being the benchmark for no visible trace or sheen. The treatment efficiency in SPEL Stormceptor Class 1 is:

- >99.9% hydrocarbons reduction
- >97% sediment reduction. Median particle size distribution 70µm
- >30% Phosphorus reduction

General Information for Class 1 Stormceptor

Class 1 was introduced by the UK Environment Agency (UKEA), with guidelines tailored specifically for the treatment and capture of hydrocarbons from service station forecourts. Class 1 stipulates a discharge water quality of less than 5ppm from a tested inflow concentration of 5,000ppm (hydrocarbons content). The UKEA has adopted the European Standard BS EN 858.1 Separator systems for light liquids (oil/petrol/diesel), (known hence in this document as The Standard) for the design, use, selection, installation, operation and maintenance of prefabricated separators. Separators have to satisfy essential requirements mandated by the Standard`s clauses including independent testing to the test methodology of Clause 8.3., in order to be certified as a Class 1 separator.

SPEL Class 1 separators have been independently tested by HR Wallingford Research Laboratory UK and the University of South Australia Hydraulics Research Centre to The Standard with a discharge water quality of : `no visible trace` and less than 5ppm from an inflow concentration of 5,000ppm under test flow conditions. Relevant certificates and the Standard are in **Appendix 1**.

Australian Compliance

The Standard and Class 1 system exceeds all Australian regulatory requirements pertaining to hydrocarbons with the exception of South Australia, who have themselves recently adopted the Class 1 Standard and treatment system for forecourt hydrocarbons management.

Treatment and Capture Efficacy

Hydrocarbons separation dynamics act no differently anywhere in the world. The density of oils and fuel is lighter than water and will always rise, however the Class 1 system requires an efficacy in the quality of separation that depends upon the right conditions in which to achieve no visible trace in the water column. This includes suitable retention time (as specified by BS EN 858 & Stokes law), low velocity water flow, and enhanced by a coalescing filter action.

Proven Record in Australia

Class 1 is not solely a design theory but has indeed a proven record in the UK, one of the world`s most industrialized and urban environments, and for the past 21 years in Australia. **Table 4.3** lists the SPEL Stormceptor application in Australian projects.

Table 1: List of Similar Stormceptor Installation in Australia

Council	Project	Model Number	APPLICATION
Newcastle	Sandvik Heatherbrae NSW	S.300/80.C1.2C.A.450.RCP	5 Off Line Stormceptors treating industrial site. Treatment train includes a swale
Camden	M2 Milk Smeaton Grange NSW	OL.300.080.30.C1.2C.SP	Off Line Stormceptor for TSS reduction prior to bioretention
Federal Aviation	18 Canberra Ave ACT	S.200/70.C1.2C.A.225	2 Stormceptors for stormwater treatment of airport carparks
Geraldton Council	ARG – Narngulu WA	S.100/25.C1.2C.A.225	
Geraldton Council	ARG – Narngulu WA	S.100/25.C1.3C.PS.SP	
Adelaide City Council	BP – Reynella SA	S.200/40.C1.2C.A.300	Large service station carpark treatment before stormfilters
AKS Industries	BP Dandenong VIC	S.300/220.C1.2C.A.375	Large service station carpark treatment before stormfilters
Canberra	ECLIPSE APPARTMENTS ACT	S.300/160.C1.2C.A.450	Offline Stormceptor as part of treatment train for apartment development
Canberra	ULLADULLA HIGH SCHOOL NSW	S.900/406060	Stormceptor for school grounds run off
Lake Macquarie City Council	CALTEX SWANSEA NSW	S.300/100.C1.2C.A.300	Large service station carpark treatment before stormfilters
Geelong City Council	MACKILLOP ST DENTAL SURGERY	S.100/25.C1.2C.A.150	TSS removal prior to stormfilters
SIMS METAL	ST MARYS NSW	S.400/600.C1.2C.G.525	Industrial site runoff
City of Unley	CENTENNIAL PARK SA	S.300/130.C1.2C.A.300	
Tasmania	Netco TAS	S.100/15.C1.2C.A.100	
SIMS Metal	St Marys NSW	S.320/603737	Industrial site runoff
SIMS Metal	St Marys NSW	S.750/605252	Industrial site runoff
SIMS Metal	St Marys NSW	S.850/605252	Industrial site runoff
SIMS Metal	St Marys NSW	S.400/500.C1.2C.G.525	Industrial site runoff
SIMS Metal	St Marys NSW	S.300/220.C1.2C.A.375	Industrial site runoff
AKS Industries	Eastern Park – VIC	S.300/160.C1.2C.A.450	
Federal Aviation	QANTAS JET BASE – SYDNEY	S.300/220.C1.2C.A.300	Stormceptors for stormwater treatment of airport carparks
Federal Aviation	QANTAS JET BASE – SYDNEY	S.300/100.C1.2C.A.300	Stormceptors for stormwater treatment of airport carparks
Belconnen Community Council	BELCONNEN ACT	S.200/40.C1.2C.A.300	
Knox City Council	BATTERHAM PARK VIC	S.300/80.T.C1.3C.PS.SP	TSS removal prior to wetland for urban subdivision
Maroondah City Council	MAROONDAH HWY UNITS VIC	S.300/130.C1.2C.A.300	Treatment of carparks and grounds in conjunction with swale

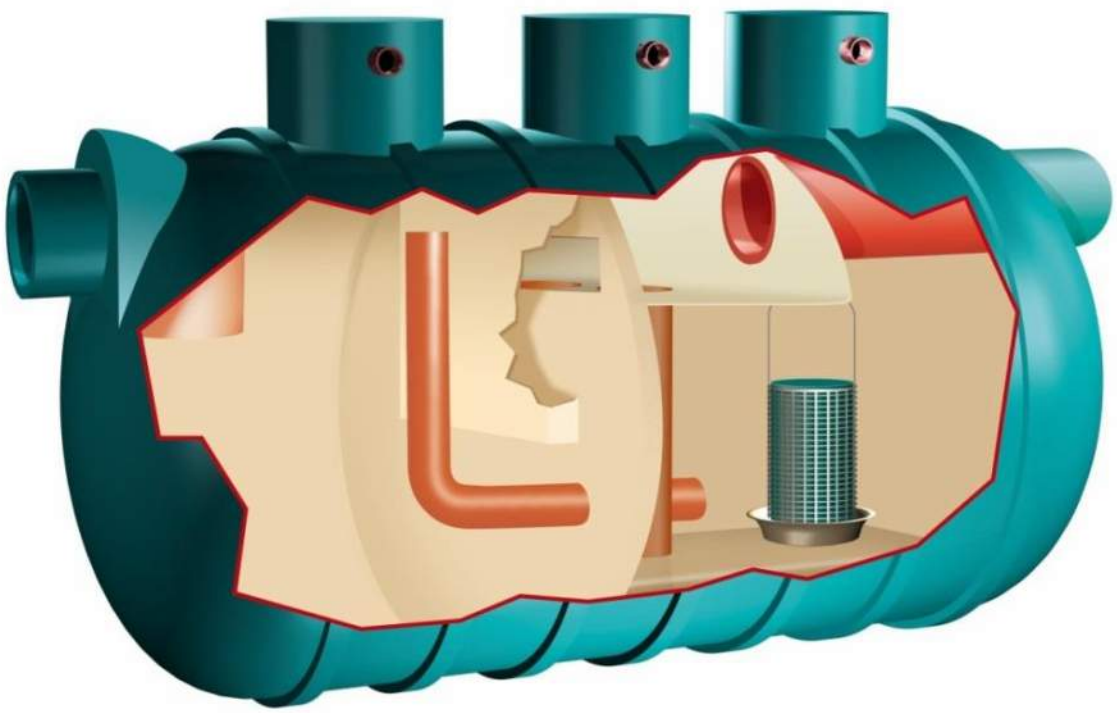

Figure 1: The schematic of SPEL Stormceptor Class 1™

Independent Standard and Validation

The Standard and the independent validation that applies to the SPEL Class 1™ separators provides the council and the authority the appropriate latitude to assess the product and the catchment design unencumbered by commercial partiality.

Current Guidelines and Practices Pollute the Environment

Existing ` traditional` guidelines are, and have proved to be, totally unsatisfactory in protecting the environment from hydrocarbon pollution, both for egress to receiving waters and soil absorption. Sewer systems cannot receive stormwater meaning there is a significant portion of the forecourt catchment that egresses to stormwater or to soil (on sites where there is no stormwater). The majority of service stations within the council`s and the territories precinct are marked by these defects and consequently are non-compliant.

Components and Hydraulics of Class 1 Stormceptor

The Stormceptor Class 1 is a gravity-type, passive, full retention flow process that treats all flows through two chambers. Low velocity laminar flow provides quiescent conditions in the separator enabling the light liquid content of the water to separate and rise to the surface due to the difference in density of the oil and water. Contaminated water cannot flow directly across the surface before effective separation has taken place. Treatment process involves the `cleaner` water passing from the primary chamber by underflow into the secondary chamber and finally through a coalescing filter mounted in the secondary chamber to `collect` smaller droplets of hydrocarbons and encourage larger droplets to form enabling better removal by gravity to the collecting area in the sealed secondary chamber.

The SPEL Stormceptor Class 1 is sized to treat and capture all flows. There is no bypass facility, meaning all pollutants are captured and retained between maintenance cycles.

Coalescing filter

The 20 coalescer is a high- reticulated and high-contact surface filter with a minimum life span of eight years. It is mounted into the secondary chamber, providing a coalescing process for the separation of smaller oil droplets. Incorporated in the secondary chamber prevents the 20 coalescer from being blocked in the event of major spillages and large amounts of accumulated hydrocarbon or heavy silt content in the surface water. It can be simply lifted out for cleaning during routine maintenance.

Fire Trap

SPEL Stormceptor Class 1 tanks contain an immersed inlet dip pipe to extinguish flames and prevent inflammable vapours from passing through to the drainage system. It is also prevents mosquito breeding.

No Scouring: Suitable for Flood & Tidal Conditions

The horizontal configuration, internally sealed treatment chambers and its coalescing function ensures no risk of scouring including when the separator is submerged in flood or tidal events.

Performance Analysis

SPEL Class 1™ devices have undergone rigorous and comprehensive testing for total suspended solids, total phosphorus and hydrocarbons. The reduction values listed within are from flow tests conducted by the University of South Australia (UniSA) Hydraulics Research Laboratory.

Total Petroleum Hydrocarbons (TPH)

Tests were performed at the UniSA Hydraulics Research facility and at HR Wallingford UK with the device in flow mode, with the following results. Test methodology was done to European Standard BS EN 858.1 Section 8.3. **Table 4.4** shows that discharge water quality reduction remains constant at <0.1ppm of TPH translating to `no visible trace` from a constant inflow concentration of 5,000ppm.

Table 2 Reduction of Total Petroleum Hydrocarbons

Hydrocarbon Fraction	EQL*	Inflow Concentration (Total 5699.0)	Outlet Samples TPH Fraction Concentrations					Calculated Mean Concentration
			1	2	3	4	5	
C6-C9	0.02	0.15	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C10-C14	0.04	125.43	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
C15-C28	0.10	5570.62	<0.1	0.162	<0.1	<0.1	<0.1	< 0.032
C29-C36	0.1	3.42	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
* Sensitivity: Estimated Quantitation Limit Results expressed in mg/l								

Results show `no detection` of hydrocarbons of all carbon fractions with the exception of Sample 2 C15-C28 with 1 sample showing` Inflow concentration of >5,000ppm.

Caution: Claims made of 98% Hydrocarbon Reduction

Data expressed by competitors in terms of percentages are erroneous. Claims expressed in percentage form are unreliable and misleading. A 98% reduction of TPH off catchments with vehicular activity would result in discharge loads ranging from 20ppm to 100ppm. This exceeds the concentration of TPH `visibility` which is approximately 10ppm rendering such devices as non-compliant.

Total Suspended Solids: Particle Size Distribution (PSD)

In depth investigation of particle size capture performance was developed for the first time at the UNISA hydraulic research facilities for assessment for typical stormwater TSS characteristics. The make-up of particulate size was weighted fine fraction <125um which makes up 90% of the load reflecting MUSIC load characteristics. The test was conducted at the UNISA research facility with the device in flow mode. This is stressed as the most accurate method in determining reduction as opposed to accumulative loads analysis.

In summary the reduction of Total Suspended Solids and the relevant particle size distribution (PSD) is as follow:

- >97% >75um (Refer Annexure for validation)
- >55% <75um. (Refer Annexure for validation)

TSS UNISA Test Methodology

The sediment added to the inlet of the SPEL Stormceptor Class 1™ consisted of 10 kg of dry material. Half of this material (by weight) was a sand material sourced from a brick sand quarrying operation in Noarlunga, SA which was pre-sieved to remove particles finer than 600 µm. The second half (by weight) was a commercially sourced silica product (Unimin Silica 60G). The particle size distribution (PSD) of the sediment produced was determined to 75 µm by sieving in accordance with AS 1289.3.6.1 – 2009 prior to adding the material to the concentrated pollutant mixture. The PSD of material less than 75 µm was determined using laser diffraction.

At the completion of the test the suspended solids retained by Chamber 1 and Chamber 2 of the SPEL unit were collected. The collected sediment was harvested by draining all water from the tank at the completion of the test through a geofabric filter to manually collect retained sediment. Retained sediment was then dried in the oven at 105°C and sieved to 75 µm in accordance with AS 1289.3.6.1 – 2009. The sediment fraction which was not collected was assumed to pass through the tank in normal running conditions.

Although the loss of retained sediment during the retained sediment collection method is considered possible, it was considered appropriate because this method represents a conservative approach to determining the total mass of retained sediment as losses are considered to pass through the SPEL Stormceptor Class 1™. Furthermore, as sediment that is lost through the cloth filter is most likely to be in the smaller particle size range, this added a further degree of conservatism as it leads to an under-estimation of the amount of retained low diameter particles.

TSS Results

Overall, 10 kg of sediment was added to the SPEL Class 1™ unit, and 8.486 kg of sediment was retained. Analysis of the PSD of sediment indicated that the retained sediment was predominantly larger particle sizes. The SPEL Stormceptor Class 1™ removed more than 95% of sediment larger than 75 µm, and more than half the particles less than 75 µm. These results are based on repeated tests of approximately 100 to 200 g of retained material, and for this reason the retained percentages are approximate – the percentage reduction for particles greater than 125 µm, for example, was consistently greater than 95%, with minor fluctuations between 95 and 100%. These results are illustrated in **figure 4.3**.

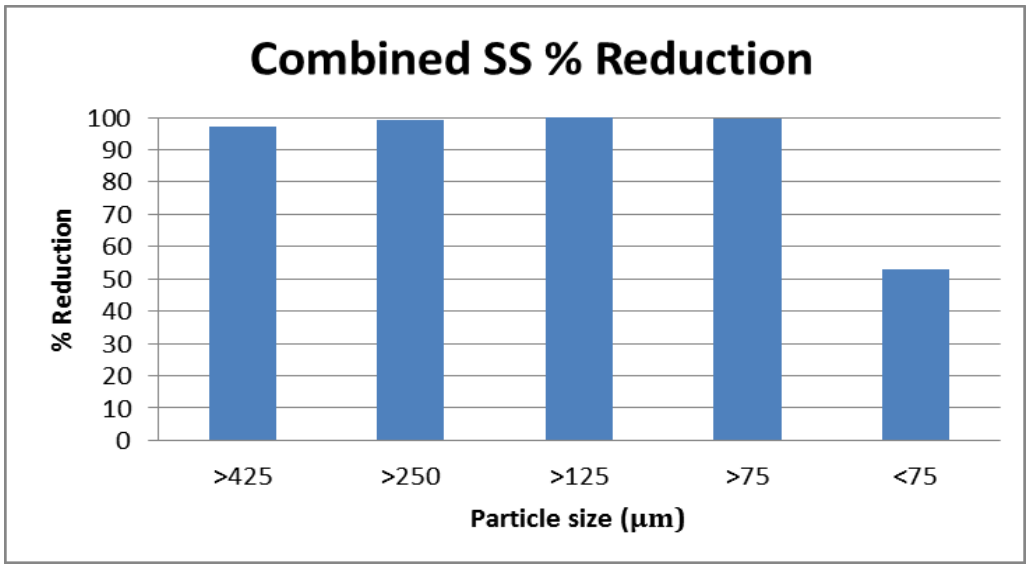

Figure 2: Percentage of Sediment Retained by the SPEL Stormceptor Based on Particle Size

The PSD of sediment which was placed into the pollutant mixture and that which was retained within the SPEL unit (retained) is shown in **Figure 4.4**. The data was determined by laser diffraction. **Figure 4.5** compares the inlet PSD of sediment used in this test with the assumed PSD of sediment in the MUSIC model. The comparison indicates that there was generally a broader PSD Distribution than that assumed by the MUSIC software.

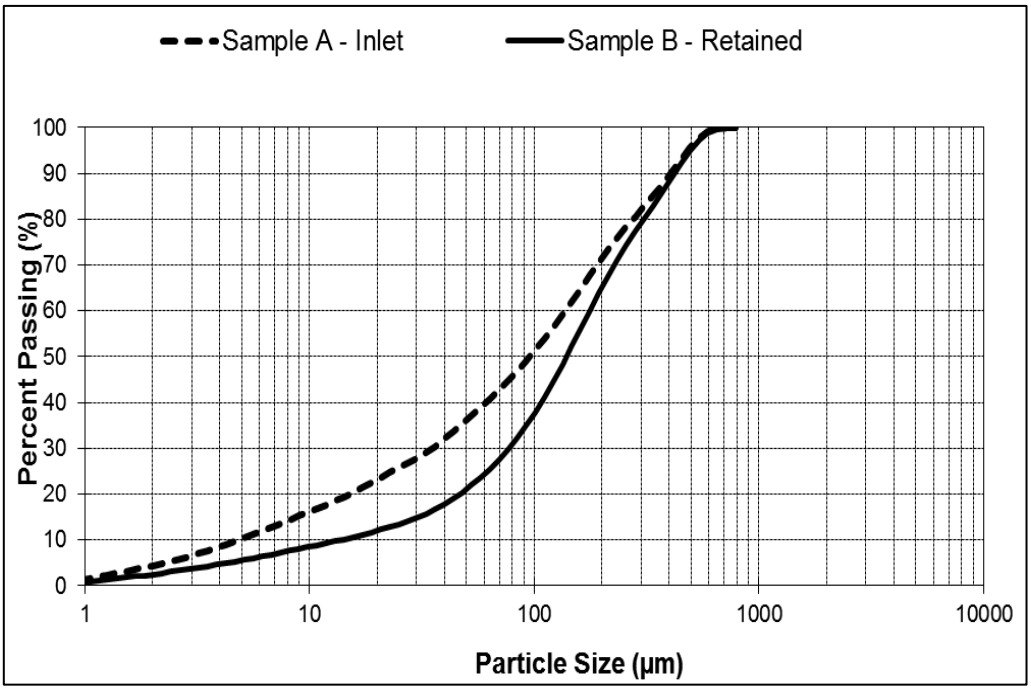

Figure 3: PSD of sediment at the inlet and retained by the SPEL Stormceptor (by laser diffraction)

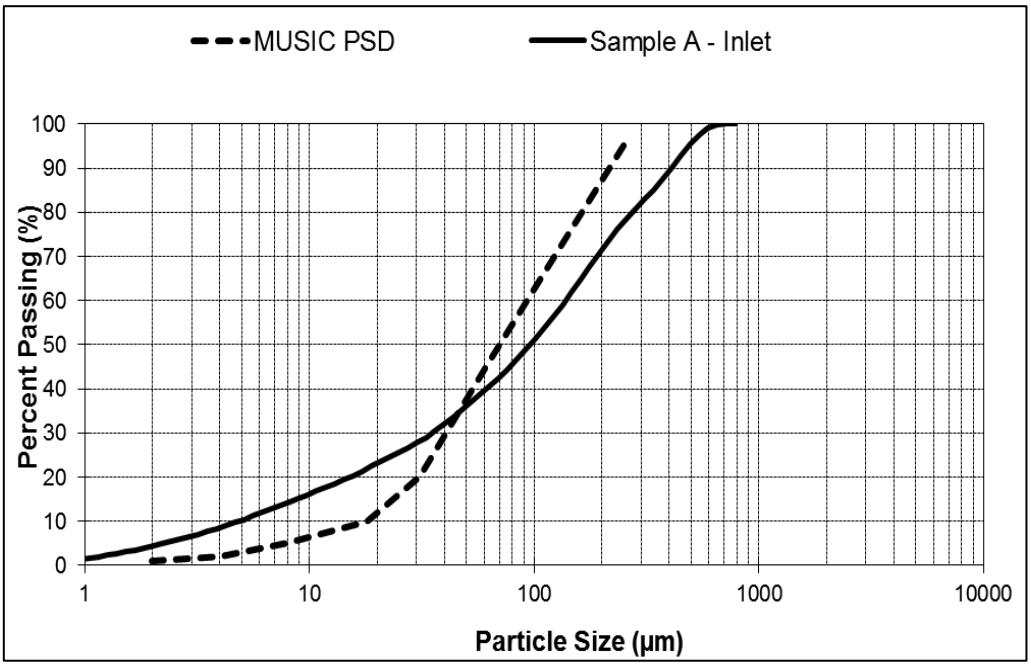

Figure 4: PSD of sediment at the inlet of the SPEL Stormceptor compared to that assumed in the MUSIC model (by laser diffraction)

TSS Summary of Findings

The results indicate that there is a consistent reduction in the sediment concentrations. Sieve testing of sediment at the inlet and retained by the SPEL Stormceptor Class 1™ indicated that most particles retained were in the larger particle size range. Removal of sediment was determined based on particle size as follows:

- For particles greater than 425 µm, over 96% of particles were retained
- For particles between 425 µm and 250 µm, over 98% of particles were retained
- For particles between 250 µm and 125 µm, over 99% of particles were retained
- For particles between 125 µm and 75 µm, over 99% of particles were retained
- For particles less than 75 µm, over 52% of particles were retained

Total Phosphorus

Tests were performed in flow mode at the UNISA Research facility and in-situ capture tests of units treating a commercial/mixed subdivision with removal particulate-bound.

Reduction of Total Phosphorus (TP)

In the meantime eight site tests were performed in western Sydney. Five tests were dismissed due to vagaries; either whilst sampling was being conducted or catchment activities that distorted the inflow concentration levels. The catchment is a mixed commercial/industrial subdivision with a typical suburban streetscape. The TSS inflow concentration is >500mg/l (upper Fletcher et al (2004)) .This is due to the catchment being flat with a gradient of <0.5% and the presence of gravel streets, excavated allotments and some construction activity within the catchment at the time of testing period. The data reveals a consistent reduction of >95% of TSS.

Gross Pollutants

SPEL Class 1™ retains 100% of gross pollutants >5mm size in treatable flow conditions.

Tank Structure-Certification & Maintenance for Class 1 Stormceptor

SPEL Stormceptor Class 1 units are glass reinforced plastic vessels made by the technical advanced chop hoop filament winding process (patented) producing circumferential and longitudinal strength complying with BS4994 FRP Pressure Vessel code and AS 2634FRP Chemical Equipment to ensure the construction meets the necessary strength and stability requirements. The tank is designed to accept ground conditions with low stiffness down to 4.8Mpa, water tables are set to ground level as standard with a minimum depth of cover, based on a standard soil density.

Maintenance Operation

Maintenance is performed at a minimum of every six months or if the probe alarm is activated, by eduction method (suction).

Coalescing Filter Media

The coalescer is a high- reticulated and high-contact surface filter with a minimum life span of eight years. It is mounted into the secondary chamber, providing a coalescing process for the separation of smaller oil droplets. Incorporated in the secondary chamber prevents the coalescer from being blocked by large amounts of heavy sediment that are separated in the primary chamber. It can be simply lifted out for cleaning during routine maintenance.

Sediment:

Sediment is removed by a vacuum loading truck from the base of the primary chamber. The cylindrical shape ensures sediment collects at the base of the chamber. Floatables: Gross pollutants and litter are removed by the same process described above.

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0033 16. Stormceptor inline/offline

SPEL ENVIRONMENTAL
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SPELFilter Hydrosystem

Environmentally aware and efficient.

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SPEL ENVIRONMENTAL
INTEGRATED WATER SOLUTIONS

The Technology

A specialist rainwater filter, designed for installation within load bearing shafts and chambers of concrete or plastic construction. The pre fitted plastic housing is safe and easy to fit at site.

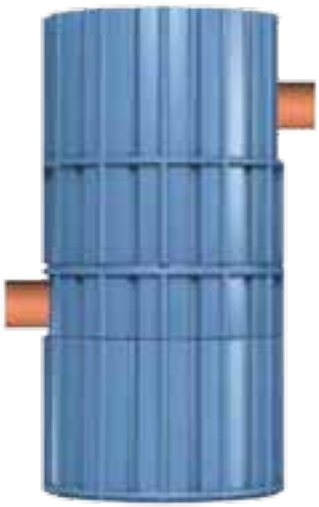
The Hydrosystem 1000 Filter uses an up-flow process. This means there is a minimal head drop between the inlet and the outlet. The cleaned water is of an outstanding water quality. The rainwater is treated within the unit by the following processes: sedimentation, filtration, adsorption and precipitation.

The initial treatment steps take place in the Dynamic Separator, where sedimentation of solid particles occurs within a radial flow regime, characterised by secondary flows.

A settling funnel to the silt trap chamber entrance ensures sediments are not remobilised. Above the separator are the filter inserts, covering the entire diameter of the unit's housing, where the second treatment step takes place.

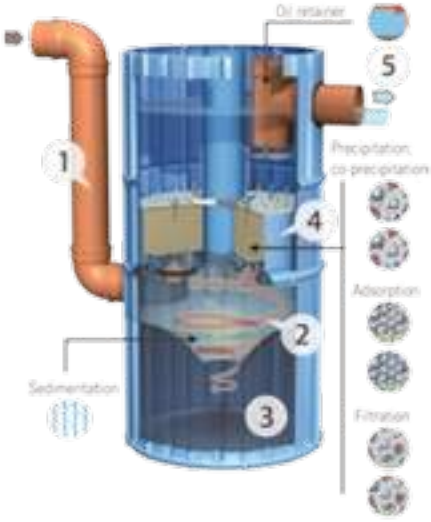
Water flows upwards through the removable filter element. As a result of both the upward flow within the filter element and the fact that the filter remains saturated, the rate of filter clogging by solids is both very limited and slow.

The filter inserts are easy to exchange.



How it works

1. The stormwater from the drained area is fed into the inlet, which is at the lower end of the shaft. A deflector plate sets up a radial flow.
2. Here, sedimentation of particles, especially the sand faction and above, takes place in the hydrodynamic separator. This is due to turbulent secondary flows within a radial laminar flow regime.
3. The settlable solids are collected via an opening in the silt trap chamber. This chamber is evacuated periodically, via the by-pass central tube at intervals.
4. Four filter elements are located within the filter shaft. As waters flow upwards the finer particles are filtered out, whilst the dissolved pollutants are precipitated and absorbed. The filter is easily backwashed, and if completely clogged or exhausted, is easily replaced.
5. Clean water above the filter elements passes to discharge via an oil trap assembly. In the event of major spill, free floating oils etc are retained here. Normal concentrations of dissolved oils are retained within the filter elements.



Technical Data

Stormwater filter complying with DIN 1989-2. Connections: DN 200; the various types of filter elements have different material structures.

Housing material: Polyethylene
Housing weight: 68 kg
Total weight: 220 to 350 kg depending on filter type
Packing unit SPEL Hydrosystem 1000: Pallet: 1 piece

Accessories 1

SPELFilter element
Weight per filter element:
34 kg (roof / traffic)

Accessories 2

SPELFilter element
Weight per filter element:
54 kg (heavy traffic)
66 kg (metal)

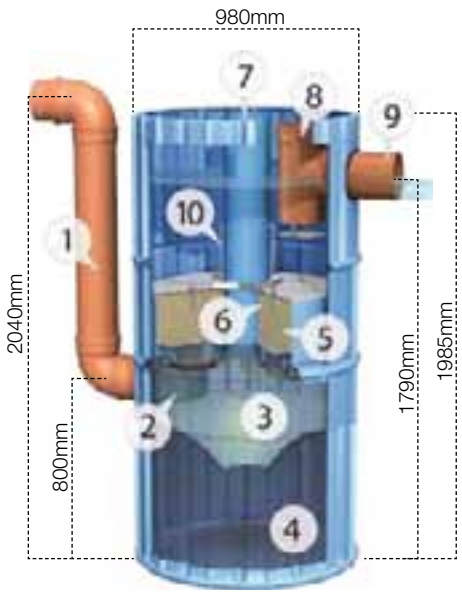
Example: Installation in a shaft made of plastic

Example:

The SPEL Hydrosystem 1000 traffic installed in a concrete shaft DN1000. The cleaned storm water is then discharged into an infiltration system using plastic crates.

Product structure:

1. Stormwater inlet (DN 200)
2. Deflector plate
3. Hydrodynamic separator
4. Silt trap
5. Filter element
6. Extraction aid for filter element
7. Overflow and suction pipe
8. Oil trap
9. Outlet stormwater storage, soakaway system or surface waters
10. Buoyancy restraint for filter elements



The SPEL Hydrosystem is available with various filter types, depending on the usage of the connected area. The Roof type is used for roof areas that do not have a significant proportion of uncoated metals; the Metal type is employed for metal roof areas, and the Traffic type is used for slightly polluted traffic areas.

The Heavy Traffic type is employed for heavily polluted traffic areas and has been granted general technical approval (Z-84.2-4) by the German Institute for Structural Engineering (DIBt). The maximum areas that may be drained depend on the nature of the surfaces. These are given in the following table.

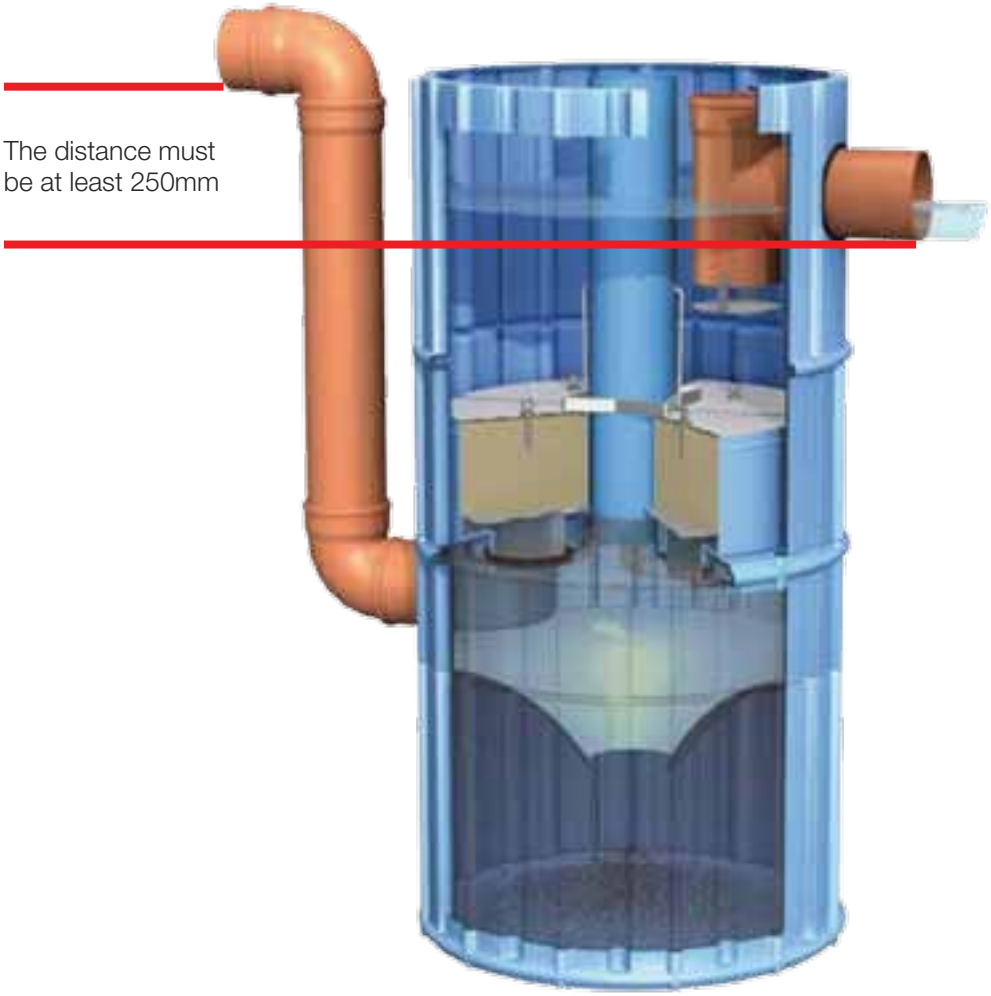
Type	**Nature of the surface to be drained**	**Weight of filter element / piece**	**Total Weight**
Heavy traffic with technical approval (Z-84.2-4)	Highly polluted traffic areas (car parks in front of supermarkets, main roads, HGV access roads)	54kg	300kg
Traffic	Slightly polluted traffic areas (side streets, staff car parks, yards)	34kg	220kg
Roof	Roofs without a significant proportion of uncoated metals (< 50m²)	34kg	220kg
Metal	Roofs made of uncoated metals (copper, zinc, lead)	66kg	350kg

Parameter	Unit	Non Metal Roof		Copper Roof		Zinc Roof		Parking lot, residential street		Main road Distributer		1 Aims of LAWA	2 Drinking Water	3 Seepage	4 SPEL Hydrosystem
		from	to	from	to	from	to	from	to	from	to	permissible limit	permissible limit	control value	aim
Phsico-chemical parameters												90 Percentile			
electrical conductivity	[uS/cm]	25	270	25	270	25	270	50	2400	110	2400	–	2500	–	< 1500
pH value	[–]	4.7	6.8	4,7	6,8	4,7	6,8	6,4	7,9	6,4	7,9	–	6,5 – 9,5	–	7,0 – 9,5
Nutrients															
phosphorous (P ges)	[mg/l]	0,06	0,50	0,06	0,50	0,06	0,50	0,09	0,30	0,23	0,34	–	–	–	0,20
ammonium (NH_4)	[mg/l]	0,1	6,2	0,1	6,2	0,1	6,2	0,0	0,9	0,5	2,3	–	0,5	–	0,3
nitrate (NO_3)	[mg/l]	0,1	4,7	0,1	4,7	0,1	4,7	0,0	16,0	0,0	16,0	–	50,0	–	–
Heavy Metals															
cadmium (Cd)	[µg/l]	0,2	2,5	0,2	1,0	0,5	2,0	0,2	1,7	0,3	13,0	1,0	5,0	5,0	< 1,0
zinc (Zn)	[µg/l]	24	4.880	24	877	1.731	43.674	15	1.420	120	2.000	500	–	500	< 500
copper (Cu)	[µg/l]	6	3.416	2.200	8.500	11	950	21	140	97	104	20	2000	50	< 50
lead (Pb)	[µg/l]	2	493	2	493	4	302	98	170	11	525	50	10	25	< 25
nickel (Ni)	[µg/l]	2	7	2	7	2	7	4	70	4	70	50	20	50	< 20
chromium (Cr)	[µg/l]	2	6	2	6	2	6	6	50	6	50	50	50	50	< 50
Organic Substances															
polynuclear aromatic hydrocarbons (PAK)	[ug/l]	0.4	0.6	0.4	0.6	0.4	0.6	0,2	17,1	0,2	17,1	–	0,1 6 compounds	0,2	< 0,2
petroleum-derived hydrocarbons (MKW)	[mg/l]	0,1	3,1	0,1	3,1	0,1	3,1	0,1	6,5	0,1	6,5	–	–	0,2	< 0,2

1 Aims of the German working group on water issues of the Federal States and the Federal Government (LAWA) for surface water, usage as potable water (1998). 2 Permessible of the German Drinking Water Ordinance (2001). 3 Control value for seepage of the German Federal Soil Protection Act an Ordinance (1999) according to § 8 1,2. 4 The aims of the system refer to average annual loads.

Installation

CAUTION! Important information, please observe.



The following is to be checked before installation:

The filter must be installed with a so-called fall. This means that the incoming pipe (stormwater inlet) is led downwards just ahead of the shaft and can be connected to the lower connection as described.

The difference in invert between the incoming pipe and the outlet to discharge must be at least 250mm.

VICTORIA & TASMANIA OFFICE

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Canberra	61 2 6128 1000
Queensland	61 7 3277 5110
Victoria & Tasmania	61 3 5274 1336
South Australia	61 8 8275 8000
West Australia	61 8 9350 1000
Northern Territory	61 2 8838 1055
Auckland	64 9 276 9045

www.spel.com.au

SPELFilter Hydrosystem 1.0

SPEL ENVIRONMENTAL
INTEGRATED WATER SOLUTIONS

Appendix 2 – Draft Treatment Train Maintenance Contract

SPEL STORMWATER





CLAYTON ROAD, CLAYTON VIC

VIC 20-0652 -MC

10 YEAR MAINTENANCE CONTRACT

SPEL STORMWATER
PHONE 1300 SPEL 00 (773 500)
FAX +61 (0) 2 8014 8699

SPEL STORMWATER QUALITY TREATMENT DEVICE MAINTENANCE AGREEMENT

FOR

VIC 20-0652 -MC- CLAYTON ROAD, CLAYTON VIC

This Equipment Maintenance Agreement (the "Maintenance Agreement") is made and effective __/ __/ ____

BETWEEN: SPEL Total Stormwater (the "Service Provider"), of
191 Station Street, Corio VIC 3214 (ABN:32 379 724 600) hereafter known as SPEL

AND: _____ (the "Client") of
_____

SUMMARY

This 10 year maintenance contract covers the monitoring and servicing of the SPEL Stormceptor and SPEL Hydrosystem at Clayton Road, Clayton VIC

Where the Client has requested the provision of maintenance and the Service Provider is willing to provide such services as per the terms of this agreement both parties agree to:

1. WARRANTY

SPEL operational warranty on the Stormceptor and Hydrosystem is in place for as long as there is an active maintenance regime with SPEL on the specified units.

- Excludes construction silt loads
- Excludes unusual/accidental silt loads
- SPEL maintains the site

Goods sold shall only have the benefit of a manufacturer's warranty if the purchaser has complied with the manufacturer's instructions in relation to installation, maintenance and operation of the said goods.

2. MAINTENANCE CALLS

Service Provider agrees to provide maintenance service including up to three [3] maintenance calls annually and interim calls as required at the installation address specified above on the equipment listed. All charges specified are those currently in effect and are subject to change only at the time of subsequent annual renewal. The new charges shall become effective upon the date specified in the renewal invoice. Client calls hereunder are restricted to the normal working hours of the Service Provider.

All service commenced outside of Service Provider's normal working hours will be charged at published rates for service time and expense only.

3. SERVICES

The following services are included:

Maintenance Summary

The SPEL Stormceptor and Hydrosystem treatment train system will be inspected in accordance with the Maintenance Manual

Stormceptor

- Visual inspection of the Stormceptor conditions every four (4) months
- Includes inspection of the containment chamber and coalescer chamber & unit.
- If there is an oil/fuel build up (approx. 50mm) or after a spill, it will need to be vacuumed out. Costing to be confirmed at time of activity and will be additional cost to the standard contract value outlined below.

Hydrosystem

- The SPEL Hydrosystem system will be inspected annually.
- The SPEL Hydrosystem change out maintenance process comprises the removal and replacement of each SPEL Hydrosystem cartridge and the cleaning of the silt out of the vault or manhole with a vacuum truck. In the event these works are required, Client will be notified accordingly.

The SPEL personnel that enter the tank [if necessary] will be trained in confined space entry

Life Cycle Cost (LCC) – The maintenance requirements for the SPEL Stormceptor and SPEL Hydrosystem is very site specific and actually relates to the sediment load and sediment characteristics.

Maintenance Triggers

The basic activities included in the maintenance contract are as follows:

- Visual inspection of the vault and filter conditions annually
- If there is a silt build up, it will need to be vacuumed out an additional cost. Costing to be confirmed at time of activity and will be additional cost to the standard contract value outlined below.
- TSS accumulation in the filters is what dictates the life cycle of individual filter.

Optimum performance of the equipment covered by this Agreement can be expected only if supplies provided by, or meeting the specifications of Service Provider are used. Service Provider shall have full and free access to the equipment to provide service thereon. If persons other than Service Provider's representatives perform maintenance or repairs, and as a result further work is required by Service Provider to restore the equipment to operating condition, such repairs will be billed at Service Provider's published time and material rates then in effect.

4. ANNUAL RATE FOR SERVICES

ACTIVITY	FREQUENCY [subject to site characteristics]	COST BREAK-DOWN [subject to CPI index]
1 SPEL Stormceptor and 2 cartridges Hydrosystem system - Visual inspection of the Stormceptors, vault and filter conditions – SPEL technician onsite. Empty the Stormceptors.	Every four months	$3,141.00 per annum
SPEL Hydrosystem replacement – allowance for 1 time replacement of Hydrosystem cartridges throughout the 10 year period. All old cartridges removed, disposed and replaced. Vault to be cleaned out via vacuum truck prior to installation of new replacements.	Based on the past experience we estimate the life of the SPEL Hydrosystem to be between 5 – 7 years, subject to silt condition on the site. SPEL System Silt Removal is dictated by silt condition on site	1 x Labour, travel expenses 02x SPEL Hyrdosystem HS. 400/2 Cartridges Replacement Total once in 10 years = $5,655.00 Per annum = $565.50
SUMMARY		
SPEL will inspect onsite 3 times per annum - $3,141.00 per annum **Replace the 2 Hydrosystem cartridges in accordance with above in 10 years, turnkey operation** **$5,655.00 spread over 10 years equals $565.50 per annum** **Total value Per Annum $3,706.50 + GST**		

The annual rate for maintenance of SPEL Stormceptor & SPEL Hydrosystem for a 10 year term is $3,706.50 + GST and shall be paid in advance as at the renewal date each year. The annual rate shall be indexed by CPI at each annual renewal date. Any payment not made by the 30th day of the month shall be considered overdue and in addition to Service Provider's other remedies, Service Provider may levy a late payment charge equal to 4% per month on any overdue amount.

4.2 EXCLUSIONS

ACTIVITY	FREQUENCY [subject to site characteristics]	COST BREAK-DOWN [subject to CPI index]
Vacuum out the hydrodynamic separator, removal and disposal of pollutants	When necessary, based on the maintenance inspection and report	**This is an additional cost to the regular maintenance contract and has not been included in the annual rate indicated below.** Costing to be confirmed at time of activity based on extent of pollutants removed and disposed.

5. PAYMENTS

For service as specified above on the equipment listed, the undersigned Client agrees to pay in advance the total annual charge specified below to Service Provider, in accordance with the terms specified on the face of the invoice. There shall be added to the charges provided for in this Agreement amounts equal to any taxes, however designated, levied or based on such charges or on this Agreement, or on the services rendered or parts supplied pursuant hereto, including GST.

6. BINDING AGREEMENT

The undersigned Client represents that he is the owner of the equipment, or that they have the owner's authority to enter into this agreement.
This Agreement is subject to acceptance by Service Provider. It takes effect on the date written above and continues in effect for one year and will remain in force thereafter, with automatic annual renewal at the indexed rates, until cancelled in writing by either party or at the end of a ten year period – whichever is earlier.

IN WITNESS WHEREOF, the parties hereto have executed this contract as of the day and year first above written.

Client Signature

_____
Authorized Signature
Name:

Date:

Billing Entity:

ABN:

Contact:

Phone:

SPEL Total Stormwater
191 Station Street, Corio VIC 3214

_____
Authorized Signature
Name:

Date: