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West State Private Hospital

Site Based Stormwater Management Plan

244765-ARUP-CI-REP-02

02 | 18 May 2017

PLANS AND DOCUMENTS referred to in the REFERRAL AGENCY RESPONSE

SARA ref: 2604-52045 SRA

Date: 9 June 2026

PLANS AND DOCUMENTS referred to in the REFERRAL AGENCY RESPONSE

SARA ref: DEPC20/1007 (DEPC18/98)

Date: 30 October 2020

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 244765-00

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ARUP

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1 Introduction

As part of the preliminary concept design works for West State Private Hospital a Site Based Stormwater Management Plan (SBSMP) has been prepared to support a Development Application (DA). The proposed development comprises a refurbishment of the existing heritage building with the addition of a new medical building and the provision of additional parking facilities.

The design of the development must give due consideration to the State Planning Policy (SPP) (April, 2016) and the Townsville City Council (TCC) stormwater quantity and quality requirements outlined in the Townsville City Plan.

This document presents the investigations that were undertaken to review the site at planning stage in terms of stormwater management, and reports on compliance with the design criteria outlined in Section 2 of this report.

2 Design criteria

The primary aim of a SBSMP is to ensure stormwater generated from developed catchments or sites causes minimal nuisance, danger and damage to people, adjacent properties and the surrounding environment.

In order to manage stormwater quantity and quality, the proposed development should meet the key design criteria outlined in Table 1.

Table 1: Legislation summary

Design Guideline/Authority	Key Design Criteria
Townsville City Council Development Manual Planning Scheme Policy (PSP)	Minimise the risk of causing environmental harm to receiving waters, damage to council infrastructure, and unnecessary financial burdens to council and the community.
Queensland Urban Drainage Manual (QUDM), 2013 (Provisional)	Stormwater Management Plans define the proposed management of stormwater quantity and quality, and the protection of receiving water features, such as the protection of existing waterways. Stormwater Management Plans should include consideration of issues such as: protection from flooding, measures to reduce changes to the volume and velocity of stormwater runoff, measures to minimise harm to receiving waters by stormwater, opportunities to prevent the initial contamination of stormwater and to remove introduced contaminants, and water conservation and recycling.
Environmental Protection Policy, 2009	Specific local Environmental Values (EVs) and/or Water Quality Objectives (WQOs) for Queensland catchments.
State Planning Policy (SPP), 2016	Maximum concentration based water quality objectives and minimum reduction targets in mean annual pollutant loads.

3 Existing site and drainage characteristics

3.1 General description

The proposed development site comprises a number of existing lots and a portion of road reserve that has been acquired for the project.

The site is bounded by residential lots to the west, Townsville West State School, Wilson Street and O'Brien Street to the north, Greenslade Street and Sturt Street to the east and Ingham Road to the south.

The site covers an area of 7944m² and encompasses 6 existing lots, including:

- Lot 707 on SP253232 (2 Wilson Street, West End);
- Lot 9 on T118290 (2 Wilson Street, West End);
- Lot 2 on SP234861 (2A Lamington Road, West End);
- Lot 1 on RP717784 (763 Sturt Street, West End);
- Lot 2 on T118434 (763 Sturt Street, West End); and
- Lot 5 on RP701541 (763 Sturt Street, West End).

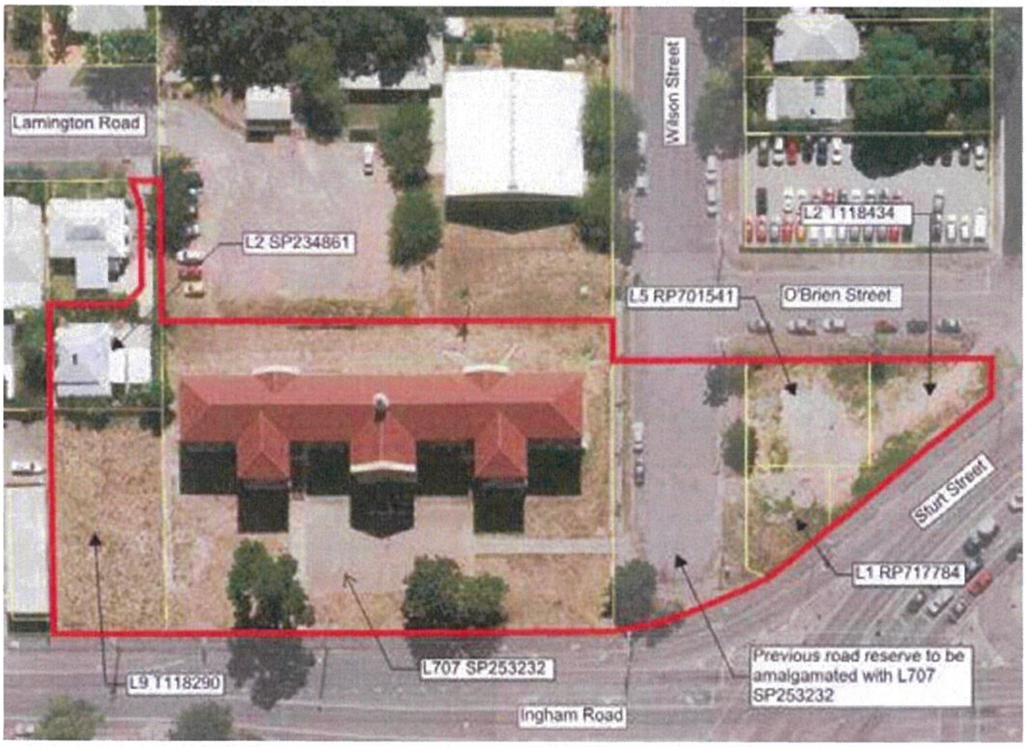

Figure 1: Site locality plan (Google Earth Pro 2015 with Queensland Globe data)

The proposed site is currently occupied by:

- An existing three storey heritage building with an adjacent car park previously part of Townsville West State School with driveway access from Wilson Street;

- A residential 'Queenslander' dwelling with driveway access from Lamington Road;
- The Wilson Street cul-de-sac; and
- Three vacant lots to the east of Wilson Street.

The surrounding land uses include retail, commercial, residential, and administrative and community uses.

Based on a review of contour data obtained from Council it is observed that the site has a gradual fall from the north-west and north-east corners to the south.

Surrounding services include reticulated water mains, electricity, gas, communications, stormwater drainage and sewerage. These have been identified through a Dial Before You Dig (DBYD) search and survey plans provided by TCC. It is assumed that there are service connections to the existing buildings on the site however the site survey does not identify existing underground conncections.

Refer to the Urban Infrastructure Assessment Report for further details and imagery of the existing site, topography, flooding conditions and existing services within and surrounding the site.

3.2 Existing Stormwater Drainage and Lawful Point of Discharge

Existing stormwater infrastructure exists within close proximity to and within the site along both Ingham Road and Wilson Street. TCC records indicate that there are existing stormwater kerb inlet pits collecting stormwater run-off along Wilson Street. These pits connect to a junction pit to the south of Wilson Street where stormwater is ultimately conveyed to a 900mm diameter reinforced concrete (RC) pipe crossing Ingham Road prior to outfall into the downstream stormwater network. Roof drainage from the existing residential dwelling is assumed to discharge as overland flow onto the site. It is assumed that the existing school building roof drainage connects underground into this network. The remainder of the site drains as overland flow from north to south.

Based on Arup's site inspection there is no evidence of rainwater harvesting or water treatment devices on the existing site.

Based on a review of Council records and observations made during site inspections it is understood that the lawful point of discharge for the site is the stormwater infrastructure on Wilson Street to the south of the site. It is assumed that the majority of the stormwater runoff from the site ultimately discharges into this stormwater network via a 375 mm diameter stormwater connection at the southern end of Wilson Street.

4 Stormwater Management

4.1 Requirements

4.1.1 Quantity

The TCC Stormwater Code stipulates that developments must provide a stormwater management system that safely conveys runoff, taking into account increased runoff due to any increase in impervious surfaces from development.

On the basis that there is a net increase in impermeable area, it is anticipated that the proposed development will increase the runoff from the site and therefore on site detention will be required.

4.1.2 Quality

The State Planning Policy (SPP) (2016) defines a set of Water Quality Objectives (WQOs) that must be achieved by a material change of use for urban purposes development applications that involve a land area greater than 2500m^2 that:

(1) Will result in an impervious area greater than 25% of the net developable area, or

(2) Will result in six or more dwellings.

The proposed development has an approximate site area of 7944m^2 with 82% of this area proposed to be impervious comprising buildings, external hardstanding areas and car parking. Therefore the proposed development triggers the requirements to meet the WQOs.

4.1.3 Proposed Development

The proposed development comprises the refurbishment of the existing West State school building and provision of a new building as part of the Townsville West State Private hospital development. Figure 2 below shows the proposed site layout for the development.

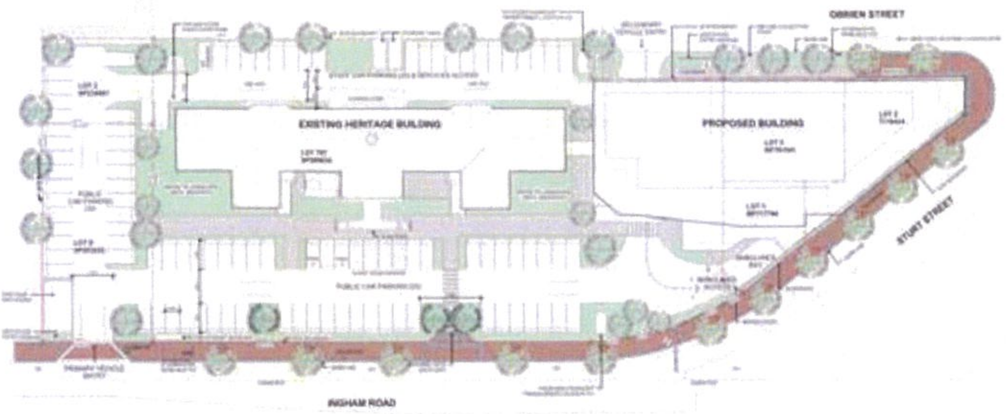

Figure 2 Proposed site plan

4.2 Opportunities and constraints

4.2.1 Opportunities

- The existing site does not include any water quality treatment devices. The proposed development provides the opportunity to incorporate water quality treatment devices to treat this run-off, and assist in improving the water quality of the downstream environment;
- Existing Council stormwater networks exist adjacent to the site in both Wilson Street and Ingham Road providing an outfall location in close proximity to the site;
- The use of proprietary stormwater quality treatment devices allow for easy maintenance, whilst allowing easy integration into the site layout; and
- An onsite detention tank can be constructed under the proposed car park/access road which will attenuate the increased flow rates.

4.2.2 Constraints

- The proposed development impacts the existing hydrology of the site, increasing the total impermeable urban area and subsequently increasing run-off and pollutant loading to receiving waters;
- Due to the extent of the proposed car park there is limited space available to incorporate treatment measures such as grass swales, bio-retention swales, bio-retention basins and wetlands;
- The site is located within the 1% and 2% AEP flood outline and therefore is susceptible to inundation from external sources; and
- The alignments and depths of existing underground services within the site are unknown and thus may conflict with the proposed stormwater strategy.

4.3 Stormwater drainage strategy

This section describes the route of stormwater flows generated by rainfall on the proposed development.

Water will be collected from the roof areas, access road and car park via a pit and underground pipe network. It will then be directed to an underground proprietary stormwater quality treatment device which will improve the quality of the stormwater before discharging to a detention storage tank to control the outflow from the site. The discharge from the tank will outfall to the Council stormwater network. Runoff from the car park will likely be contaminated for a range of reasons, as summarised in Table 2.

Table 2: Potential stormwater contaminants

Area	Contaminants
Car park	Oil or fuel spillage and gross pollutants

The sketch included in Appendix A illustrates a concept design for the proposed stormwater drainage strategy.

5 Water Quantity

5.1 Methodology

Peak flow rates produced from the 1 year to 100 year ARI events for existing and post-development site conditions were calculated.

5.2 Rational method analysis

5.2.1 Peak flow rate calculation

The Rational Method, which provides a simple means for the assessment of the peak flow rate for design storms, was used to determine the peak flow rates corresponding to the 100, 50, 20, 10, 5, 2 and 1 year ARI events draining from the proposed development site.

The site is currently comprised of the existing school building, residential dwelling, small car park area and two access driveways. The remainder of the site is open and well grassed.

The proposed site is largely impervious with small landscaped areas and will therefore result in an increase in volumetric discharge of stormwater runoff.

Table 3 summarises the catchment areas for the existing and proposed development, based on the assumptions previously outlined.

Table 3: Catchment areas summary

Characteristic	Pre-Development (existing)		Post-Development (proposed)	
Impervious (roofs, pavements etc.)	3067m^2	39%	6557m^2	82%
Pervious (landscaping etc.)	4877m^2	61%	1387m^2	18%

5.2.2 Rainfall intensity

Rainfall intensities for Townsville have been utilised in this study. The design parameters used in this assessment are listed in Table 4 and Table 5. Note that the design rainfall intensity corresponding to the 10 year 1 hour event for the site is 81.0mm/hr.

Table 4: Rainfall intensities and geographic parameters for Townsville

Storm Duration	2 year ARI (mm/hr)	50 year ARI (mm/hr)	Regional Parameters	
1 hr	53.7	110.5	G	0.06
12 hr	11.71	24.5	F2	3.93
72 hr	3.85	9.34	F50	17.10

Table 5: Design parameters

Parameter	Existing	Proposed
Time of Concentration (ToC)	14 minutes	5 minutes
Fraction impervious (f_i)	0.39	0.82
Coefficient of runoff (C10)	0.778	0.864

5.2.3 Results

Table 6 summarises the peak flow rates calculated for the existing development for various ARIs, while Table 7 shows the corresponding results for the proposed development.

Table 6: Peak flow rates (pre-development)

Fraction Impervious	Time of Concentration (min)	Area (ha)	ARI (years)	Runoff coefficient	Rainfall Intensity (mm/hr)	Q (m^3/s)
0.39	14	0.7944	100	0.934	242	0.499
			50	0.895	216	0.426
			20	0.817	182	0.328
			10	0.778	156	0.268
			5	0.739	137	0.223
			2	0.661	104	0.152
			1	0.622	80	0.110

Table 7: Peak flow rates (post-development)

Fraction Impervious	Time of Concentration (min)	Area (ha)	ARI (years)	Runoff coefficient	Rainfall Intensity (mm/hr)	Q (m^3/s)
0.82	5	0.7944	100	1.000	346	0.764
			50	1.000	308	0.680
			20	0.907	260	0.520
			10	0.864	223	0.425
			5	0.821	196	0.355
			2	0.734	149	0.241
			1	0.691	115	0.175

*Where the run-off coefficient is calculated to be greater than 1.0, a limiting value of 1.0 has been adopted in accordance with the recommendation of ARR (1998) for urban areas.

As shown in Table 8 below, the results demonstrate that there is an increase in peak flow for the post-development case.

Table 8: Comparison of peak flow rates

Scenarios	Q100	Q50	Q20	Q10	Q5	Q2	Q1
Post-development (m^3/s)	0.764	0.680	0.520	0.425	0.355	0.241	0.175
Pre-development (m^3/s)	0.499	0.426	0.328	0.268	0.223	0.152	0.110
Increase (m^3/s)	0.265	0.253	0.193	0.157	0.132	0.090	0.066
Increase (%)	53	59	59	59	59	59	60

5.3 Stormwater Detention

To ensure that the proposed development does not adversely impact adjacent properties and/or the Council stormwater network downstream from the site, stormwater runoff is to be attenuated within the site and discharged at flow rates not exceeding the flow rates calculated for the existing conditions.

Stormwater will be attenuated via a detention tank which is proposed to be installed below the car park pavement to minimise the impact on the architectural layout and spatial planning.

The conceptual volumetric size of the detention tank is 150m³ based on preliminary sizing calculations as per the manual flow routing calculations for the storage equation in Chapter 5.5 of QUDM. The tank size is to be refined in the Detailed Design stage via hydraulic modelling.

6 Water Quality

6.1 Methodology

Runoff from the developed site requires treatment in order to ensure that the development has no detrimental impact on the water quality of downstream water courses in accordance with the SPP (2016).

The WQO's required under the SPP form the assessment criteria for stormwater quality management of the project.

6.2 Construction phase water quality management

In addition to the finished/operational phase of the development achieving the required WQO's, the construction phase should also be considered under stormwater quality management.

6.2.1 Construction phase pollutants of concern

Pollutants that are typically generated during the construction phase of a development have been identified by reviewing the Queensland Government Urban Stormwater Planning Guidelines. The various pollutants and their priority ratings are listed in Table 9 below.

Table 9: Water quality summary

Pollutant	Source	Priority
Litter	Paper, construction packaging, food packaging, cement bags, off-cuts	High
Sediment	Unprotected exposed soils and stockpiles during earthworks and building	High
Hydrocarbons	Fuel and oil spills, leaks from construction equipment and temporary car park areas	High
Toxic materials	Cement slurry, asphalt prime, solvents, cleaning agents, washwaters (e.g. from tile works)	High
pH altering substances	Acid sulfate soils, cement slurry and washwaters	High

6.2.2 Construction phase performance criteria

The performance criteria are limited to those parameters that are directly linked to construction site management practices. These criteria are discharge standards, so they are applicable to runoff events or pumped discharges from development sites as identified in Table A of the SPP (2016). They have been summarised in

Table 10.

Table 10: Construction phase performance criteria

Issue		Construction Phase Stormwater Design Objectives
Drainage Control	Temporary Drainage Works	1. Design life and design storm for temporary drainage works: • Disturbed area open for <12 month - 1 in 2-year ARI event • Disturbed area open for 12-24 months - 1 in 5-year ARI event • Disturbed area open for > 24 months - 1 in 10-year ARI event 2. Design capacity excludes minimum 150mm freeboard. 3. Temporary culvert crossing – minimum 1 in 1-year ARI
Erosion Control	Erosion Control Measures	1. Minimise exposure of disturbed soils at any time 2. Divert water run-off from undisturbed areas around disturbed areas 3. Determine the erosion risk rating using local rainfall erosivity, rainfall depth, soil-loss rate or other acceptable methods 4. Implement erosion control methods corresponding to identified erosion risk rating

Issue		Construction Phase Stormwater Design Objectives
Sediment Control	Sediment control measures Design storm for sediment control basins Sediment basin dewatering	1. Determine appropriate sediment control measures using: • Potential soil loss rate, or • Monthly erosivity, or • Average monthly rainfall 2. Collect and drain stormwater from disturbed soils to sediment basin for design storm event: • Design storm for sediment basin sizing is 80th % five-day event or similar 3. Site discharge during sediment basin dewatering: • TSS < 50mg/l TSS, and • Turbidity not > 10% receiving water turbidity, and • pH between 6.5 and 8.5
Water Quality	Litter and other waste, hydrocarbons and other contaminants	1. Avoid wind-blow litter; remove gross pollutants 2. Ensure there is no visible oil or grease sheen on released waters 3. Dispose of waste containing contaminants at authorised facilities
Water stability and flood flow Management	Changes to the natural waterway hydraulics and hydrology	1. For peak flow for the 1-year and 100-year ARI event, use constructed sediment basins to attenuate the discharge rate of stormwater from the site

6.3 Operational phase stormwater management

6.3.1 Operational phase pollutants of concern

Pollutants that are typically generated during the operational phase of a development have also been identified by reviewing the Queensland Government Urban Stormwater Planning Guidelines. The various pollutants and their presence on site during the operational phase are summarised in Table 11.

Table 11: Operational phase performance criteria

Pollutant	Development
Litter	Yes
Sediment	Yes
Oxygen demanding substances (organic and chemical matter)	No
Nutrients (N&P)	Yes
Pathogens / Faecal Coliforms (bacteria and viruses)	No
Hydrocarbons (including oil and grease)	Yes
Heavy Metals (often associated with fine sediment)	No
Surfactants (e.g. detergents from car washing)	Yes
Organo-chlorines and organophosphates (e.g. pesticides, herbicides)	No
Thermal pollution (heat)	No
pH altering substances (other than Acid Sulfate Soils)	No

*Shading denotes the key pollutant to be targeted for trapping/treatment.

Water quality modelling will be based on typical export pollutant loading for commercial urban developments.

6.3.2 Water quality objectives

The WQOs for runoff during the operational phase of the site are derived from the SPP (2016), published by the Department of State Development, Infrastructure and Planning.

Table 12: Water quality objectives for Townsville

	Total Suspended Solids (TSS)	Total Phosphorus (TP)	Total Nitrogen (TN)	Gross Pollutants >5mm
Reduction Target Objective	80%	65%	40%	90%

6.4 Water quality modelling

Mathematical modelling was undertaken to assess the stormwater treatment strategy for the proposed development during the operational phase. Modelling was undertaken using MUSIC version 6 software package. MUSIC has the capability to simulate discharge loads and concentrations of TN, TP and TSS.

6.4.1 Model assumptions

- Sources nodes and treatment nodes have been specified to represent the generation and treatment of stormwater under existing and developed conditions;
- The six minute rainfall data extending for 1980 – 1990 recorded for Townsville was used to set up the meteorological template in the model; and
- The time step selected for modelling the existing and developed scenarios was 6 minutes.

6.4.2 Input data

6.4.2.1 Meteorological data

A MUSIC meteorological template for West State Hospital was created using rainfall data for Townsville (Station No. 32040) from 1980 to 1990, obtained from BOM, using a 6 minute time-step. The mean annual rainfall for this period was 887mm.

Monthly average potential-evapotranspiration (PET) data for the region was obtained from BOM. MUSIC does not include in-built supplied data for Townsville and therefore the PET data is user-defined.

6.4.2.2 Rainfall run-off parameters

MUSIC modelling rainfall run-off parameters used for the proposed development are as documented in Table 13 below. These rainfall run-off parameters are as documented in Water by Design (WbD) MUSIC Modelling Guidelines (2010).

Table 13: MUSIC model runoff generation parameters (WbD, 2010)

MUSIC model parameter	**Commercial**
Rainfall threshold (mm)	1
Soil storage capacity (mm)	18
Initial storage (% capacity)	10
Field capacity (mm)	80
Infiltration capacity co-efficient (a)	243
Infiltration capacity co-efficient (b)	0.6
Initial depth (mm)	50
Daily recharge rate (%)	0
Daily baseflow rate (%)	31
Daily deep seepage rate (%)	0

6.4.3 Pollutant source nodes and proposed treatment train

Table 14 identifies the catchment split for the determination of pollutant surface type modelled in MUSIC.

Table 14: Catchment delineation and pollutant sources

Catchment ID	Area (m^2)	Surface Type	Fraction Impervious (%)
Roof	2,710	Tiles/tin	100
Car park, access road	3,847	Asphalt	100
Landscaping	1,387	Gardens/turf	10

Based on these values, a conceptual layout of the proposed treatment train modelled in MUSIC is shown below in Figure 3.

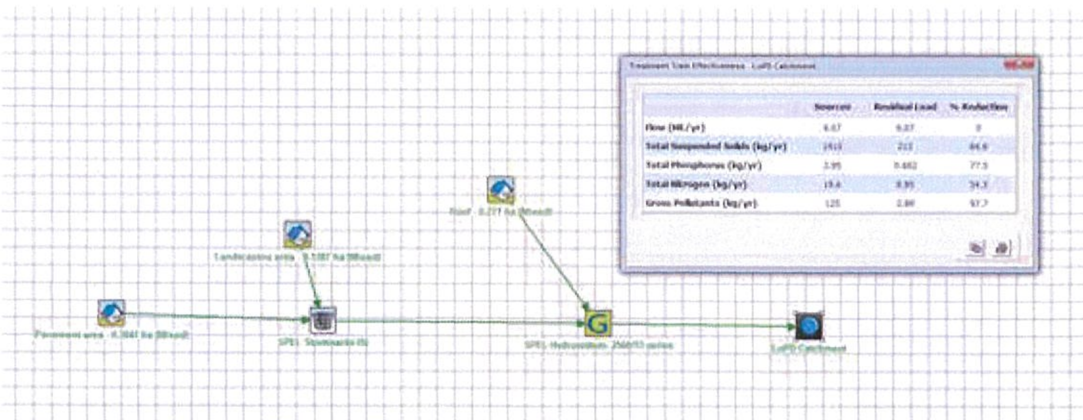

Figure 3: MUSIC model treatment train

The MUSIC model is based on the incorporation of proprietary stormwater quality treatment devices manufactured by SPEL Environmental Pty Ltd (SPEL).

6.4.4 Pollutant export parameters

The MUSIC model was set up using split catchment nodes for Urban Commercial roofs, roads and ground level areas as outlined in Table 14. The pollutant export parameters for each specific surface type utilised within the models are based on the recommendations of WbD MUSIC Modelling Guidelines Version 1.0 (2010) as summarised in Table 15 below.

Table 15: Expected pollutant concentrations (WbD MUSIC Guidelines 2010)

Surface Type	Flow Type	Total Suspended Solids (TSS) (Log 10 mg/L)		Total Phosphorus (TP) (Log 10 mg/L)		Total Nitrogen (TN) (Log 10 mg/L)	
		Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Commercial – Roof	Base Flow	N/A	N/A	N/A	N/A	N/A	N/A
	Storm Flow	1.30	0.38	-0.89	0.34	0.37	0.34
Commercial – Roads	Base Flow	0.78	0.39	-0.60	0.50	0.32	0.30
	Storm Flow	2.43	0.38	-0.30	0.34	0.37	0.34
Commercial – Ground Level	Base Flow	0.78	0.39	-0.60	0.50	0.32	0.30
	Storm Flow	2.16	0.38	-0.39	0.34	0.37	0.34

6.4.5 Treatment system parameters

As outlined in Section 6.4.3, the proposed stormwater treatment trains incorporates SPEL treatment devices. The following devices have been specified:

- 5 no. SPEL Stormsacks (Gross Pollutant Traps (GPTs)); and
- 1 no. SPEL Hydrosystem 2500/13 Series.

In order to demonstrate compliance with the SPP (2016), SPEL has modified the transform functions for a generic node within the MUSIC model to represent the SPEL Stormsack and SPEL Filter. The use of SPEL products is subject to approval by Council.

6.4.6 MUSIC modelling results

The results of the MUSIC modelling predict that the water treatment measures incorporated meet the WQOs set out in the SPP. The MUSIC modelling results for pollutant loads entering the downstream receiving waters are summarised in Table 16 below.

Table 16: MUSIC Modelling Pollutant Reductions

Pollutant	Reduction Achieved (%)	Water Quality Objective (%)	Objective Achieved (Yes/No)

Total Suspended Solids	84.9%	80	Yes
Total Phosphorous	77.5%	65	Yes
Total Nitrogen	54.3%	40	Yes
Gross Pollutants	97.7%	90	Yes

7 Maintenance requirements

7.1 General

During the operational life of the development the treatment devices will require regular simple maintenance in order to ensure its effective long term operation and to minimise lifecycle cost. This maintenance generally comprises:

- Removal of litter and debris;
- Periodic filter insert replacement;
- Sediment removal; and
- Unblocking inlets and outlets (system flushing).

For further details refer to SPEL product information provided in Appendix B.

7.2 Inspection frequency

Inspection frequency is as recommended by the manufacturer. Inspection frequency will depend in part on the manufacturers' recommendations for the type of proprietary product specified. SPEL recommend that maintenance of Stormsacks be undertaken approximately every three months.

For the Hydrosystem treatment device, it is generally recommended that two inspections should be scheduled per year following the installation of a new unit. These may be either minor maintenance activities (routine inspection, debris removal etc.) or major maintenance activates (sediment sampling, filter insert replacement etc.). Spel advises that filter cartridges require placement every five to seven years.

7.3 Access requirement for maintenance

For the concept design, it is proposed that both the treatment device and the detention tank are located beneath the pavement at the southern end of the access road. This will enable a maintenance vehicle to gain easy access. Traffic management of vehicles entering/exiting the development may be required whilst maintenance is being completed. Refer to the civil concept sketch in Appendix A for the proposed location of the treatment device.

8 Public access and safety

During minor storm events, water is directed 'offline' to the chosen treatment device to be treated prior to discharge. During major storm events, only a proportion of the stormwater will be treated; the remainder will be conveyed through a by-pass pipe directly to the outfall. This will also enable the device to be accessed offline during designated maintenance periods.

Covers to all chambers/inlets are to be lockable to prevent unauthorised access or displacement, which could pose a safety risk to the general public.

9 Conclusion

This SBSMP has been developed in accordance with the design guidelines and codes listed in Table 1, to manage the potential impacts of the proposed development. The plan has the following key outcomes:

- Best practice stormwater quality management using gross pollutant traps and stormwater treatment devices; and
- Install erosion and sediment control measures during construction phases to minimise soil erosion and control sediment discharge from site.

The implementation of the measures outlined above in the redevelopment of the West State Hospital site in Townsville will result in no worsening to stormwater quantity conditions and will provide significant improvement to the quality of the runoff discharged from the site. The proposed measures will also ensure that the quality of the discharged stormwater meets the pollutant reduction targets as previously identified.

10 References

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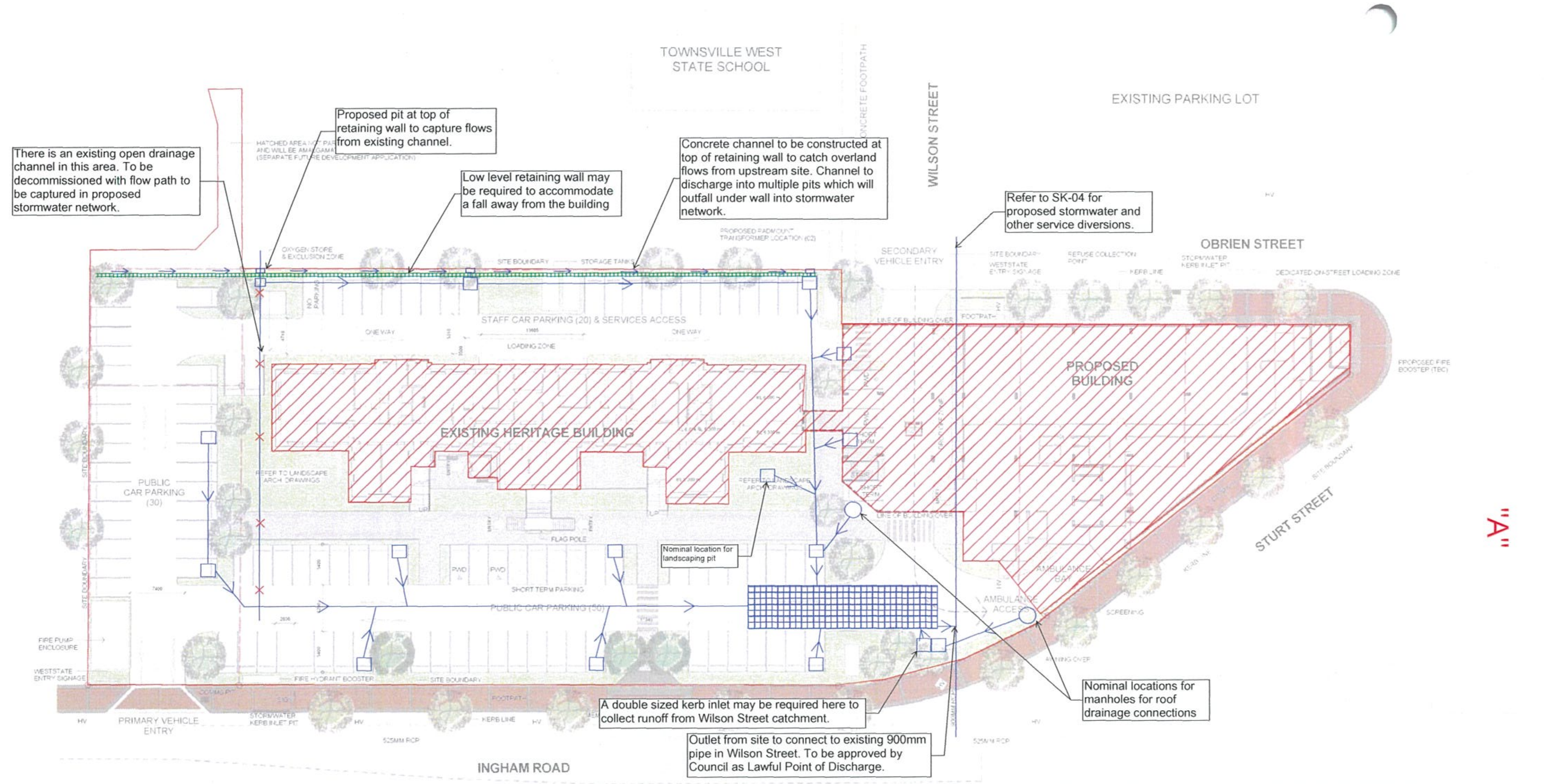
Appendix A

Concept Stormwater Layout



Legend:

- Approximate Site Boundary (to be confirmed by survey)
- Proposed roofed area, refer to architectural drawings
- Proposed Stormwater Pipe, 375mm RCP (maximum)
- Proposed Stormwater Pit, 600mm x 600mm (maximum), Trafficable Grate Load Class D
- Proposed Stormwater Manhole, 1050mm (maximum), Trafficable Lid Load Class D
- Proposed Stormwater Detention Tank and Treatment Device, Refer to notes for details
- Proposed concrete channel at top of retaining wall

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Notes:

1. Alignment and locations of proposed stormwater infrastructure to be coordinated with existing and new services to be installed (e.g. water and sewer connections).
2. Existing stormwater infrastructure (pipes and pits) within the site to be removed and disposed of. Existing roof drainage network to be modified by hydraulic engineer to connect into proposed civil network, and thus pass through the detention tank and treatment device.
3. Stormwater detention tank requires an approximate volume of 150m3. The shape/configuration of the tank to achieve this volume can be modified to suit site constraints (e.g. location of other services/landscaping). Refer to the Site Based Stormwater Management Plan for further details on stormwater detention and treatment requirements.

ARUP

Job title	West State Hospital, Townsville
Job no.	244765
Drawing title	Stormwater Drainage Layout
Date	18/05/17
Status	Concept
Drawing no.	CI-SK-02
Rev.	02

FOR INFORMATION ONLY

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Appendix B

SPEL Product Details

"A"

SPELFilter Hydrosystem

Environmentally aware and efficient.

www.spel.com.au

SPEL ENVIRONMENTAL
INTEGRATED WATER SOLUTIONS

"A"

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.

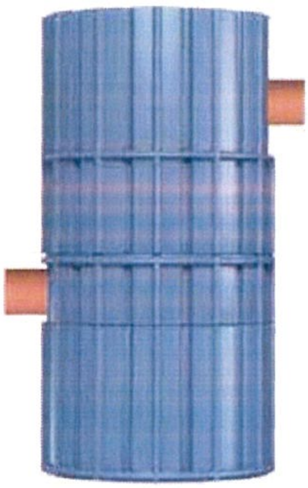
The Hydrosystem 1000 Filter uses an up-flow process. This means there is a minimal head drop between the inlet and the outlet. The cleaned water is of an outstanding water quality. The rainwater is treated within the unit by the following processes: sedimentation, filtration, adsorption and precipitation.

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.

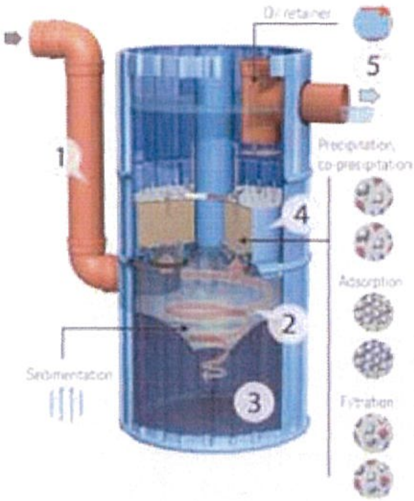
Water flows upwards through the removable filter element. As a result of both the upward flow within the filter element and the fact that the filter remains saturated, the rate of filter clogging by solids is both very limited and slow.

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.



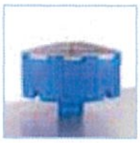
Technical Data

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

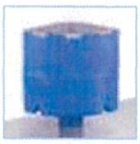
Accessories 1

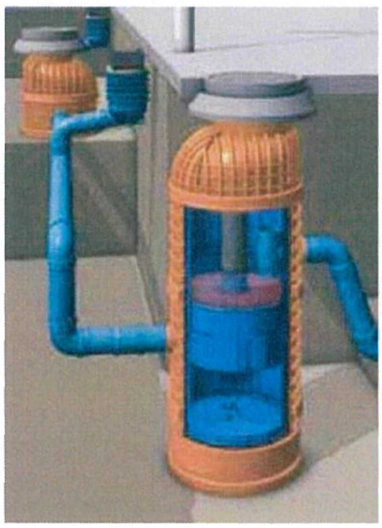
SPELFilter element
Weight per filter element:
34 kg (roof / traffic)



Accessories 2

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





Example: Installation in a shaft made of plastic

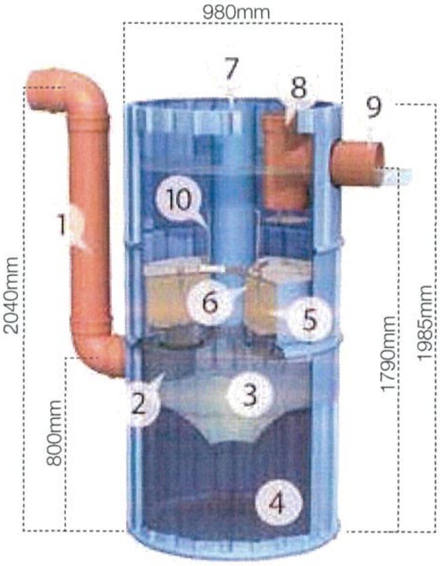
Example:

The SPEL Hydrosystem 1000 traffic installed in a concrete shaft DN1000.

"A"

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.

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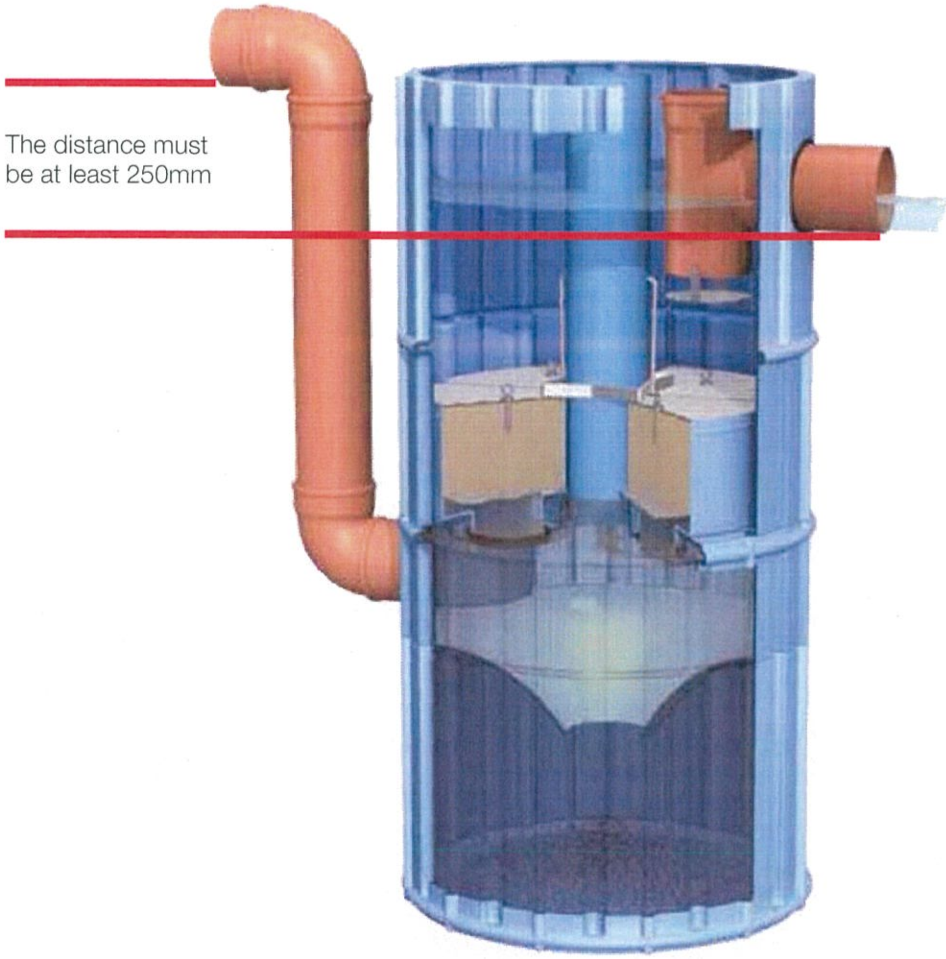
"A"

Installation

CAUTION! Important information, please observe.

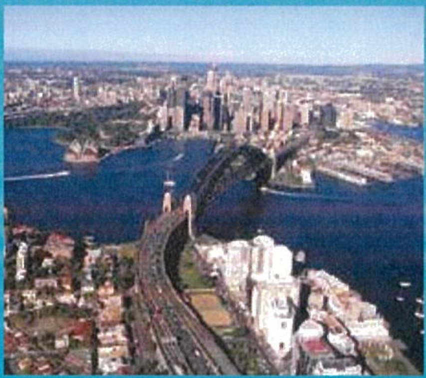


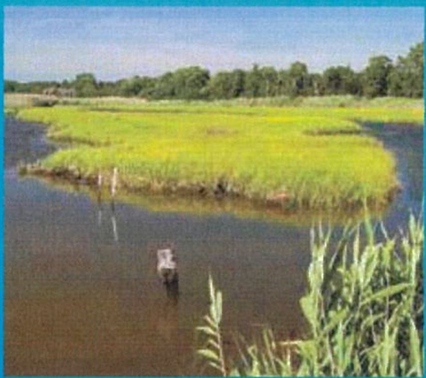
The following is to be checked before installation:

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.

"A"





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SPELFilter Hydrosystem 1.0

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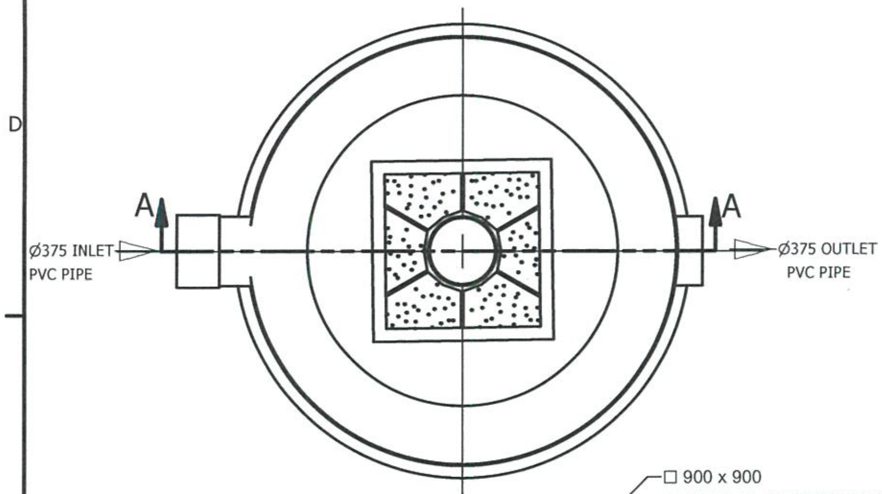
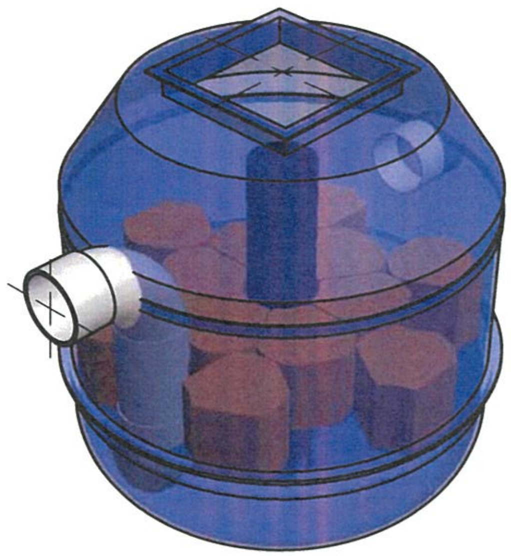
REVISION HISTORY				
REV	DESCRIPTION	DESIGNER	DATE	CHECKED BY
1	INITIAL DESIGN	M.M.	22/10/2014	

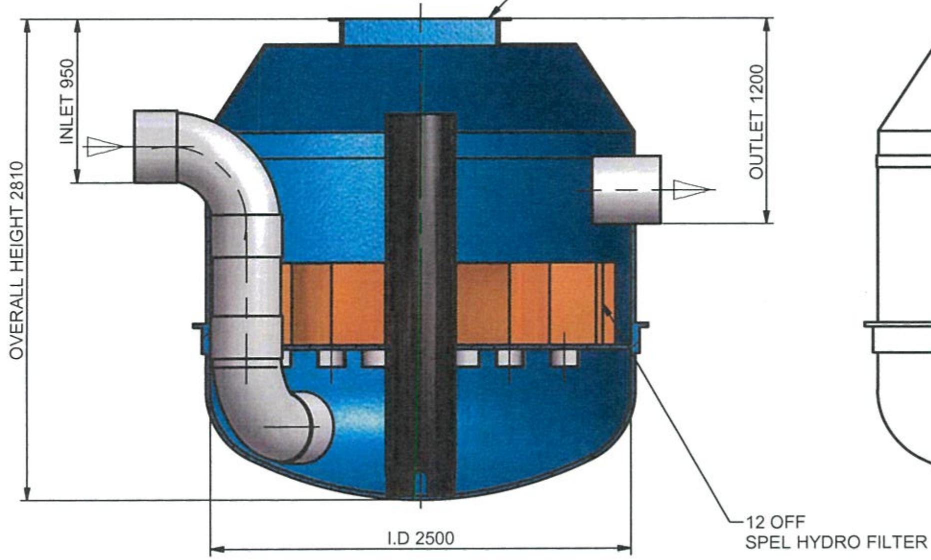


PLAN VIEW

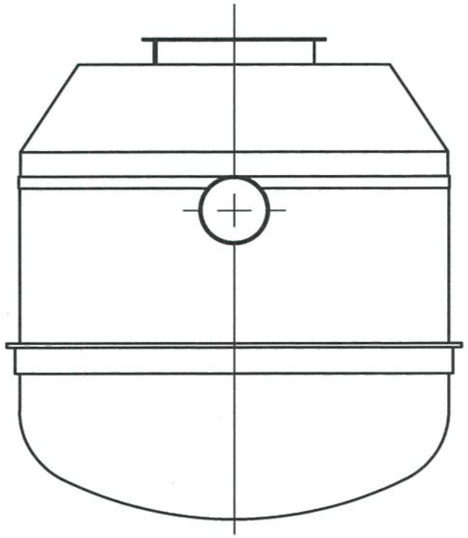
Site Level Confirmation	
Finished Surface Level (FSL)	RL:
Access Cover Thickness	mm
Inlet Invert Level	RL:
Outlet Invert Level	RL:
Company:	
Name:	
Date:	



ISOMETRIC VIEW



SECTION A-A



SIDE VIEW
OUTLET

APPROVED................ □
NAME...............................
SIGNED............................
DATE........../........../.........

ISSUE FOR APPROVAL
NOT FOR CONSTRUCTION

D:\Vault Working Folder\Designs\SPEL PRODUCTS\HYDROSYSTEM\2500 - SERIES\SP14-HY9630-P.idw

TOLERANCE: ALL DIMENSIONS 10mm UNLESS OTHERWISE STATED.

CLIENT:
145

DISTRIBUTOR :

Drawn	Date
M.M.	22/10/2014
Check	Date
Verified	Date
Approved	Date
Request No. D20768	

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INTEGRATED WATER SOLUTIONS
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PROJECT : STANDARD DRAWING
PROJECT :

TITLE SPEL HYDROSYSTEM 2500
HS.2500.FG.375
FRP TANK 2500 DIA.- 12 FILTER CARTRIDGES
GENERAL ARRANGEMENT

SCALE N.T.S	SIZE A3	SHEET 1	REV 1
CUSTOMER CODE :	DWG No. SP14-HY9630-P		

"A"

SPEL Stormsack

At-source Gross Pollutant Trap

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SPEL ENVIRONMENTAL
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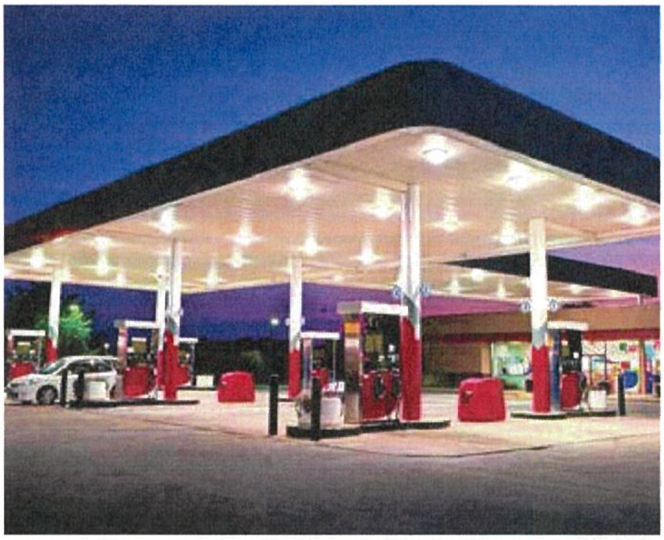
"A"

Stormwater Treatment



An all too common issue with today's highly impervious landscape is how to meet stormwater regulations with limited budgets and tight space constraints.

SPEL StormSack filtration solutions are highly engineered water quality devices that are deployed directly in the stormwater sewer system to capture contaminants close the surface for ease of maintenance. Easily retrofitted into new or existing structures, SPEL StormSack filtration technology is a decentralized approach to stormwater treatment that essentially repurposes traditional site infrastructure and customizes it to meet specific site water quality goals. In this way, it satisfies important objectives of today's LID (Low Impact Development) criteria.

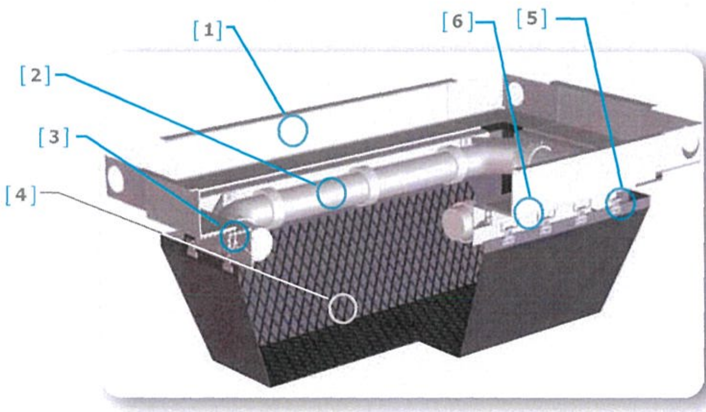
From an operations perspective, catch basins with SPEL Stormsack filters are also easier and quicker to clean out because pollutants are trapped just under the grate.

StormSack

The SPEL StormSack is specifically designed for the capture of gross pollutants: sediment, litter, and oil and grease. Ideally suited for municipal storm drain retrofits, the SPEL StormSack's unique design allows maintenance to be performed using conventional vacuum suction equipment.

Application	Regulatory Issue	Target Pollutants
Council Storm Drain Retrofits	At-source litter capture	Sediment, Litter, O&G
Commercial/Retail/Residential	Stormwater Compliance	Sediment, Litter, O&G
Litter Prone Urban Areas	Cost effective litter control	Litter ≥ 5 mm
Scrap Metal/Solid Waste/Oil Storage/Etc	Industrial Multi-Sector General Permit	Gross Pollutants, O&G
Part of Treatment Train	Council Stormwater Quality Improvement Targets	Sediment, Litter, O&G
Construction Sediment/Erosion	Sediment Control Plan	Sediment/Erosion Control

Features	
1.	Durable, aluminum frame construction has 15 year service life
2.	Integral oil boom effectively captures oil and grease from spills
3.	Patented dovetailed flange – allows 12cm of length/width field adjustment
4.	Polypropylene netting protects sack from suction hose during maintenance
5.	Steel clip with locking tab holds replaceable filter sack in place
6.	Baffled bypass traps floatables



Standard SPEL Stormsack to suit Pit Sizes
450x450mm
600x600mm
900x600mm
900x900mm

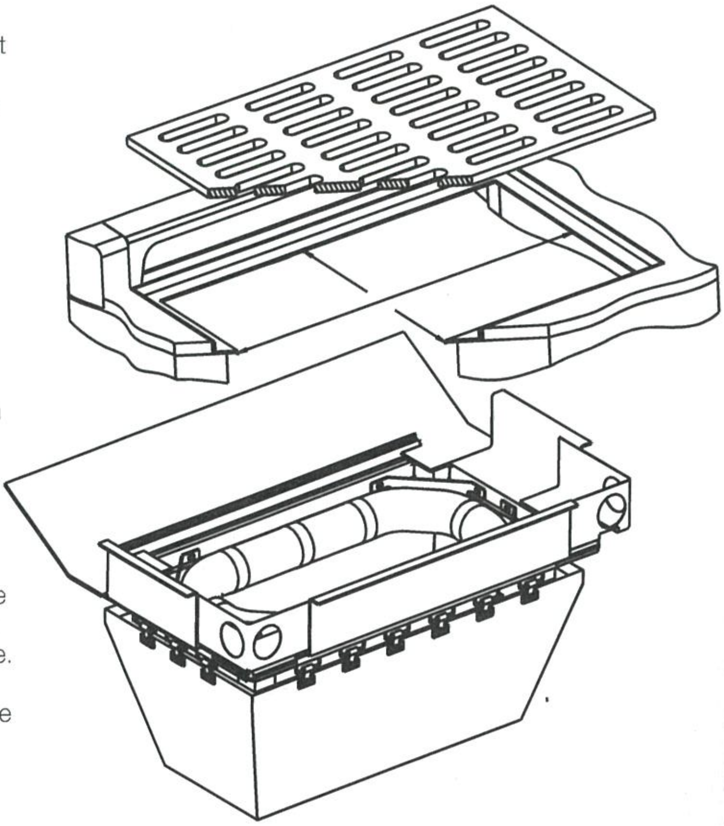
Custom sizes (i.e. 1200x900mm) can be manufactured on short lead times

"A"

Specifications & Details

General Description

This technology is a post developed stormwater treatment system. The SPEL StormSack provides effective filtration of solid pollutants and debris typical of urban runoff, while utilising the existing or new storm drain infrastructure. The StormSack is designed to rest on the flanges of conventional catch basin frames and is engineered for most hydraulic and cold climate conditions.



Installation And Maintenance

Installation procedures shall include removing the storm grate, cleaning the ledge of debris and solids, measuring catch basin clear opening and adjusting flanges to rest on grate support ledge. Install SPEL StormSack with splash guard under curb opening so the adjustable flanges are resting on the grate support ledge. Install corner filler pieces. Reinstall storm grate directly on support flanges [rise shall be no more than 1/8 inch (3 mm)].

Maintenance: Typically the SPEL StormSack is serviceable from the street level, and therefore maintenance does not require confined space entry into the catch basin structure. The unit is designed to be maintained in place with a vacuum hose attached to a sweeper or a vactor truck. The oil boom is also designed to easily be replaced from the street level. Use only SPEL replaceable parts.

Products

Material and Design

A. Adjustable Flange and Deflector: Aluminum Alloy 6063-T6

B. Splash Guard: neoprene rubber

C. Stormsack: woven polypropylene geotextile with US Mesh 20

D. Corner Filler: Aluminum Allow 5052-H32

E. Lifting Tabs: Aluminum Allow 5052-H32

F. Replaceable Oil Boom: polypropylene 3 inch (76 mm) diameter

G. Mesh Liner: HDPE, diamond configuration

H. Support Hardware: CRES 300 Series

Typical Performance Characteristics

A. Debris capacity: 8.5cu. ft. (0.24 m3)

B. Filtered flow rate: 7.3 cfs (207 lps)

C. Primary baffled bypass flow rate: 4.2cfs (119 lps)

D. Secondary bypass flow rate: 0.4 cfs (10 lps)

E. Total bypass flow rate: 4.6 cfs (130 lps)

F. Oil boom sorption capacity: 376 oz (11 L)

Recommended minimum clearance from bottom of SPEL StormSack to inside bottom of vault is 2 inches (50 mm) Typical frame adjustability range of 5 inches (127 mm) in each direction.

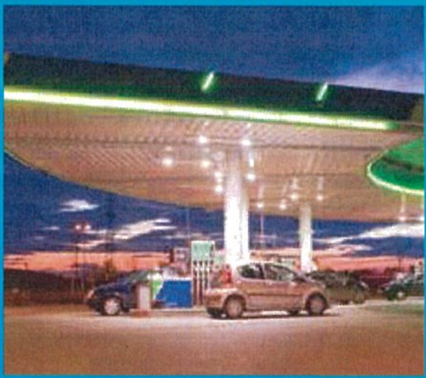
Benefits

- Low cost gross pollutant capture
- Quick & easy installation
- Simple maintenance
- At source capture
- Adjusts to custom pit sizes

Field Performance

The SPEL Stormsack was introduced to the Australian market in 2012 and field testing is underway at several locations in South-east Queensland. Laboratory testing has shown capture of 99.99% of gross pollutants up to the bypass flow rate.* Further results will be provided as they become available.

"A"



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0033 SPEL StormSack 2.0

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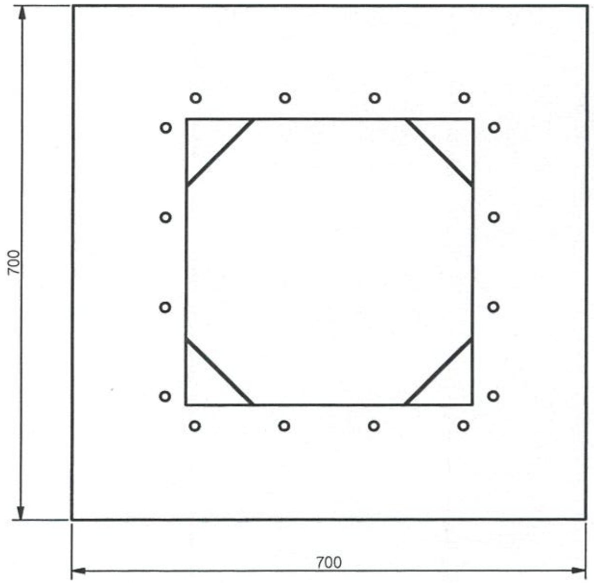
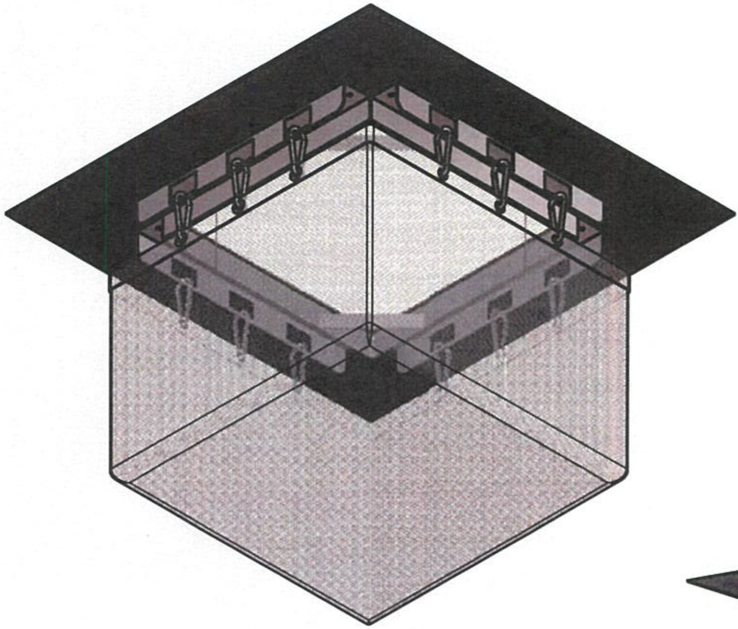
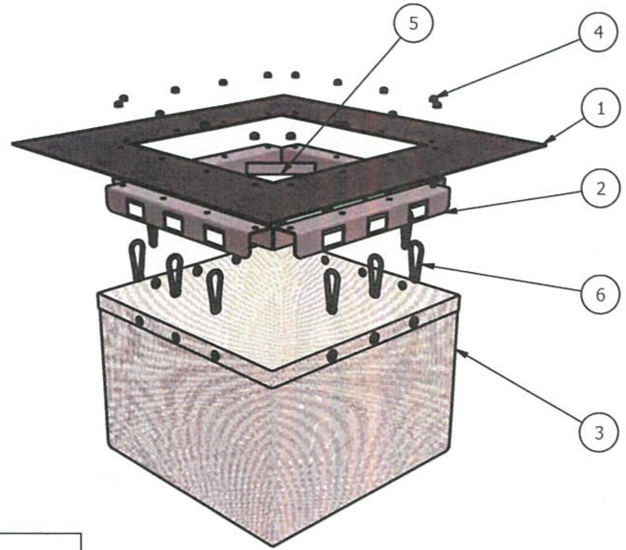
REVISION HIST				
REV	DESCRIPTION	DESIGNER	DATE	CHECKED BY
1	INITIAL RELEASE	M.M	25/03/2015	



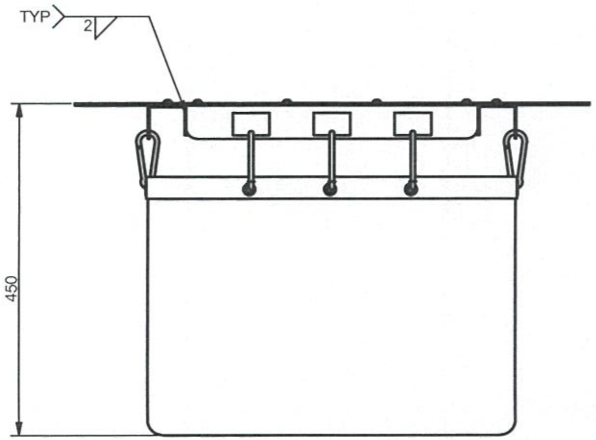
PLAN VIEW



ISOMETRIC VIEW
BOTTOM VIEW



ISOMETRIC VIEW
EXPLOSION



ELEVATION VIEW

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	PLASTIC SHEETING	HDPE
2	4	SHEET METAL BENDING	STAINLESS STEEL 304
3	1	TEXTILE FABRIC & MESH LINER	HDPE
4	16	BLIND RIVIT 7 DIA.	STAINLESS STEEL 304
5	4	CORNER ESTIFFENER - FLAT BAR 25 x 2 - 141 LG	STAINLESS STEEL 304
6	12	CARABINER CLIP 6	ALUMINIUM

CLIENT: 150

DISTRIBUTOR

Drawn	Date
M.M	25/03/2015
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Verified	Date
Approved	Date
Customer Code :	

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www.spel.com.au

TITLE
SPEL STOMSACK
FRAME 600 x 600
BASKET MOUNTING ASSEMBLY DRAWING

REQUEST No.	SIZE	SHEET	REV
D20194	A3	1	1
SCALE	DWG No.		
N.T.S	SP15-BB4610-S		