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Engineering

Working Beyond Expectations

Stormwater Management Report

Proposed Multi Use Development

Property:
Lot 1 DP1215257
795 Medowie Road, Medowie

Applicant:

MAVID PROPERTIES

Date:
November 2019

adw johnson

Project Management • Town Planning • Engineering • Surveying
Visualisation • Social Impact • Urban Planning

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Document Control Sheet

Issue No.	Amendment	Date	Prepared By	Checked By
A	Preliminary Issue	July 2019	BS	BM
B	Minor Wording	November 2019	BS	BM

Executive Summary

ADW Johnson has been commissioned by Mavid Properties Pty Ltd to prepare a Stormwater Management Report for the proposed multi use development of Lot 1 in DP 1215257, known as 795 Medowie Road, Medowie.

The proposed stormwater system has been designed to safely and efficiently convey the minor and major flows generated by the proposed development to the existing downstream stormwater infrastructure.

In accordance with Port Stephens Council's requirements, stormwater detention has been provided to ensure that the post developed peak discharges are attenuated back to pre-developed levels. As the development is to be a Torrens title development, detention tanks have been provided within each of the proposed lots with a total detention volume of 159 m^3 being required.

A treatment train process of litter baskets and filtration cartridges have been designed to effectively reduce the nutrients and gross pollutants from stormwater runoff from the proposed development.

An erosion and sedimentation control plan will be implemented to minimise the risk of erosion to disturbed areas and limit the transport of sediments from the development site to the receiving waters during construction.

The SWMP for the proposed development meets all of the objectives and requirements outlined in Port Stephens Council's DCP.

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APPENDICES

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1.0 Introduction

ADW Johnson has been commissioned by Mavid Properties Pty Ltd to prepare a Stormwater Management Report for the proposed multi use development of Lot 1 in DP 1215257, known as 795 Medowie Road, Medowie.

This report addresses the stormwater impact of the proposed development and has been prepared to accompany a Development Application (DA) for the proposed development.

This report documents the proposed stormwater system required to efficiently and effectively capture and convey stormwater from the proposed development and ensure there is no adverse effects from the proposed development on any downstream properties or infrastructure.

This report also details the design of onsite detention and water quality treatments for the development.

2.0 Site Description

The subject site, as shown in **Figure 1**, is identified as Lot 1 in DP 1215257 and is approximately 1.2ha in size. The site is bounded by existing commercial development to the south, Medowie Road to the east, Muir Street to the north and Peppertree Road to the west.

It is noted that the portion of the lot fronting Medowie Road is subject to a separate DA and stormwater management as this parcel will be considered within its own application.

Figure 1 – Proposed Development Site (Source: Sixmaps)

2.1 TOPOGRAPGHY AND EXISTING INFRASTRUCTURE

The site is primarily cleared and consists largely of maintained grasses with some smaller trees and shrubs dotted throughout the site. There are currently no existing structures contained within the site.

The site generally slopes east to west at slopes of approximately 4-5% with a steeper batter in the order of 30% present along the western boundary. Runoff generated by the site currently sheet flows to a drainage swale along the top of the western batter where it is captured via stormwater pit and conveyed to the existing stormwater infrastructure in Peppertree Road. It is proposed to connect the developments drainage infrastructure to the existing stormwater system within Peppertree Road.

The existing site topography and infrastructure can be seen in **Exhibit 1**.

2.2 PROPOSED DEVELOPMENT

The proposed development will transform the subject site into a mixed-use commercial development site consisting of a number of commercial facilities and associated car parking.

As part of the development it is proposed to split the subject site into a number of Torrens title lots. Accordingly, each of the individual lots will be required to provide their own stormwater detention and water quality treatment prior to runoff leaving the individual lots.

To enable each lot to drain to the public drainage system in Peppertree Road, a trunk stormwater drainage network has been provided by Port Stephens Council within the main east west access road. The location and design of this main has been coordinated with ADW Johnson to ensure conformity with the future development design. The proposed Torrens lots will each discharge into this trunk drainage line.

In addition to providing a connection for each of the proposed lots, the trunk drainage system also caters for the existing lots fronting Medowie Road. As such, the existing lots are not catered for within the modelling outlined in this report.

The proposed development can be seen in **Exhibit 2**.

3.0 Council Requirements

Port Stephens Council outlines the engineering requirements for stormwater management within the Port Stephens Development Control Plan 2014. Parts B4 and B5 of the DCP relate specifically to drainage, flooding and water quality.

3.1 CONCEPT STORMWATER DESIGN

A concept stormwater design is required to demonstrate that stormwater runoff generated by the development can be effectively and efficiently conveyed from the subject site to the existing downstream drainage infrastructure.

3.2 STORMWATER QUANTITY

To ensure that there is no adverse impact on downstream properties or infrastructure, the post development peak flow from the proposed development shall not exceed the pre-development peak flow for a number of storm events up to and including the 1% AEP.

3.3 STORMWATER QUALITY

The stormwater drainage system must effectively remove the nutrients and gross pollutants from the site prior to the runoff entering the existing downstream infrastructure.

The guidelines for stormwater quality treatment objectives are expressed as mean annual reductions of pollutant loads. The target objectives for developments within the PSC LGA are shown in **Table 1** below.

Table 1 – Post Development Water Quality Targets

Pollutant	Stormwater Treatment Objectives
Suspended Solids	90% retention of the average annual load
Total Phosphorus	60% retention of the average annual load
Total Nitrogen	45% retention of the average annual load
Gross Pollutants	90% reduction of litter and vegetation larger than 5mm

It is however noted that the proposed development is within Hunter Water's drinking water catchment and is therefore required to provide a Neutral or Beneficial Effect (NorBE) in relation to water quality.

In accordance with PSC's DCP the proposed development will provide a NorBE or comply with PSC stripping targets, depending on which provides the best environmental outcome.

3.4 EROSION AND SEDIMENTATION CONTROL

Erosion and sedimentation control measures need to be implemented during any construction activities to minimise the risk of erosion of disturbed areas and limit the transport of sediments from the construction site to downstream drainage infrastructure.

4.0 Concept Stormwater Design

A stormwater drainage concept plan has been prepared to demonstrate how the runoff generated by the proposed development is captured and conveyed to the existing downstream stormwater infrastructure.

The pit and pipe network will generally be designed to cater for the minor storm event without any surcharging within the system and minimising flow widths and ponding.

The carpark will be graded to ensure major flows (1% AEP) are contained within the carpark and safely conveyed from the subject site to Peppertree Road without impacting the proposed buildings or any existing private property downstream of the subject site.

In order to adequately attenuate post developed peak flows back to pre-developed levels, it is proposed to provide underground OSD tanks within each lot.

Water quality treatment will be provided within each lot through the provision of litter baskets and proprietary "Stormfilter" cartridges provided within the OSD Tanks.

The concept stormwater design can be seen in **Exhibit 2.**

5.0 Water Quantity

To ensure there are no adverse impacts on downstream properties and stormwater infrastructure, the stormwater system will be designed to ensure that the post-development peak flows leaving the site are less than the existing peak flows for the 1EY, 20%,10% and 1% AEP design storm events.

To ensure the post developed peak flows are attenuated back to pre-developed levels, OSD tanks are to be provided as part of the development on each individual lot.

5.1 MODELLING

The quantity of required storage to reduce the post developed discharge from the site to less than or equal to the existing discharge for various storm events was analysed using the 'DRAINS' software, which uses the runoff routing method.

The DRAINS model was set up in accordance with AR&R 2019. The following sections outline the parameters adopted in the DRAINS model. A screenshot of the DRAINS model can be seen in Appendix A.

5.1.1 Rainfall Data

The IFD rainfall data adopted within the model was sourced from the Bureau of Meteorology website, using the online IFD data tool.

5.1.2 DRAINS Parameters

The parameters adopted in the DRAINS model were based upon experience on similar sites and guidance provided in AR&R 2019. The adopted parameters can be seen in **Table 2** below.

Table 2 – DRAINS Parameters

Condition	Depression Storage (mm)
Paved (Impervious)	1
Supplementary	0
Grassed (Pervious)	5
Soil Type	3

5.2 CATCHMENTS

Catchments were derived from a combination of detailed survey and the proposed layout. To ensure each lot only detains what it is required too, pre developed catchments for each lot were assumed to be the same area as the post developed catchments.

5.2.1 Pre-Developed Catchment

The pre developed catchments were derived from a combination of the detailed survey and the proposed layout.

The catchment data used in the pre developed model can be seen in **Table 3** below whilst the pre developed catchments can be seen in **Exhibit 1**.

Table 3 - Pre-Developed Catchment Parameters

Catchment	Area (ha)	% Impervious
1	0.36	5
2	0.24	5
3	0.22	5
4	0.40	5

5.2.2 Post Developed Catchment

The post developed catchment parameters were measured based upon the proposed layout and concept grading. The catchment data used in the post developed model can be seen in **Table 4** below whilst the post developed catchment can be seen in **Exhibit 2**.

Table 4 - Post Developed Catchment Parameters

Catchment	Area (ha)	% Impervious
1	0.32	90
1A*	0.04	100
2	0.24	85
3	0.22	80
4	0.32	70
4A*	0.09	50

* Catchments 1A and 4A bypass the proposed detention tanks.

5.3 ONSITE DETENTION (OSD) TANKS

As mentioned in section 5, it is proposed to provide an OSD tank underneath the proposed carpark in each Torrens title lot. Using the DRAINS model with the parameters listed in the sections above, the proposed tank was sized and concept outlet configurations designed to enable modelling of the development to demonstrate that the post developed peak flows are adequately attenuated back to pre-developed levels.

Due to the differing parameters of each lot, tanks were sized accordingly resulting in four (4) separate tanks.

The details for the proposed detention tanks are shown in **Table 5-8** below, whilst an indicative OSD tank can be seen in **Exhibit 4.**

Table 5 –Detention Tank Data – CATCHMENT 1

Tank Parameter	Detail
Tank Dimensions	4m W x 12m L x 1.0m D
Outlet Controls	Pipe – DN150 with 0.14m orifice plate – IL RL 0m*
	Cutout – 0.10m H x 0.55m L - IL RL 0.56m*
	Weir – 0.60m length - IL RL 0.75m*
Total Storage at 1% AEP Stage	48 m³

* Invert levels relative to tank invert. AHD levels to be provided once detail design complete

Table 6 –Detention Tank Data – CATCHMENT 2

Tank Parameter	Detail
Tank Dimensions	4m W x 10m L x 1.0m D
Outlet Controls	Pipe – DN150 with 0.12m orifice plate – IL RL 0m*
	Cutout – 0.10m H x 0.35m L - IL RL 0.5m*
	Weir – 0.4m length - IL RL 0.75m*
Total Storage at 1% AEP Stage	40 m³

* Invert levels relative to tank invert. AHD levels to be provided once detail design complete

Table 7 –Detention Tank Data – CATCHMENT 3

Tank Parameter	Detail
Tank Dimensions	3.5m W x 10m L x 1.0m D
Outlet Controls	Pipe – DN150 with 0.12m orifice plate – IL RL 0m*
	Cutout – 0.10m H x 0.35m L - IL RL 0.5m*
	Weir – 0.30m length - IL RL 0.8m*
Total Storage at 1% AEP Stage	35 m³

* Invert levels relative to tank invert. AHD levels to be provided once detail design complete

Table 8 –Detention Tank Data – CATCHMENT 4

Tank Parameter	Detail
Tank Dimensions	4m W x 9m L x 1.0m D
Outlet Controls	Pipe – DN150 with 0.14m orifice plate – IL RL 0m*
	Cutout – 0.10m H x 0.55m L - IL RL 0.54m*
	Weir – 0.54m length - IL RL 0.8m*
Total Storage at 1% AEP Stage	36 m³

* Invert levels relative to tank invert. AHD levels to be provided once detail design complete

5.4 RESULTS

The pre and post developed peak flows were calculated using the DRAINS model for the 1EY, 20%, 10% and 1% AEP storm events. A summary of the modelling results can be seen in **Tables 9 & 10** below.

Table 9 - Pre vs post (no detention)

Storm Event (ARI)	Pre-Development Peak Flow (m³/s)				Post-Development Peak Flow Without Detention (m³/s)			
	Catchment				Catchment			
	1	2	3	4	1	2	3	4
1	0.035	0.024	0.022	0.040	0.073	0.045	0.043	0.066
5	0.094	0.064	0.058	0.105	0.131	0.085	0.079	0.129
10	0.135	0.092	0.083	0.151	0.166	0.110	0.101	0.175
100	0.242	0.164	0.150	0.270	0.290	0.193	0.177	0.304

Table 10 Pre vs post with detention

Storm Event (ARI)	Pre-Development Peak Flow (m^3/s)				Post-Development Peak Flow With Detention (m^3/s)			
	Catchment				Catchment			
	1	2	3	4	1	2	3	4
1	0.035	0.024	0.022	0.040	0.034	0.021	0.021	0.037
5	0.094	0.064	0.058	0.105	0.091	0.060	0.057	0.103
10	0.135	0.092	0.083	0.151	0.129	0.078	0.072	0.137
100	0.242	0.164	0.150	0.270	0.240	0.162	0.147	0.269

From the results, it can be seen that the inclusion of OSD tanks on each individual lot with the parameters outlined in Section 5.3, ensures that the post developed flows are adequately attenuated back to pre-developed levels. A screenshot of the DRAINS model can be seen in **Appendix A.**

6.0 Water Quality

The proposed stormwater system, as detailed in Section 5, uses a combination of pit and pipe networks and water quality devices to convey stormwater runoff from the site. It is intended to use a combination of treatment devices within the drainage system to remove nutrients and sediments from the stormwater prior to the runoff leaving the site.

6.1 TREATMENT DEVICES

The stormwater design for the proposed subdivision will consist of a combination of conveyance and end of line controls to treat the stormwater runoff generated on the site.

Conveyance

It is proposed to provide an Ecosol (or approved equivalent) Litter Baskets directly within all stormwater pits to capture litter and other gross pollutants. Further information regarding the Litter Baskets can be seen in **Appendix B**.

End of Line

It is proposed to provide Stormwater 360 "Stormfilter Cartridges" (or approved equivalent) within the proposed detention tanks to provide end of line treatment.

Further information regarding the Stormwater 360 treatment devices can be seen in **Appendix B.**

6.2 MODELLING

The effectiveness of the proposed treatment train was modelled using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC). MUSIC is well regarded as industry best practice for analysis of the effectiveness of treatment mechanisms on the quality of stormwater runoff from a development site of this size.

The MUSIC model parameters were adopted using the MUSIC-LINK feature, whilst treatment node parameters were based upon a combination of Council's guidelines and information provided by individual device providers.

6.2.1 Catchment Data

To accurately model the pollutant loads generated by the proposed development, the catchments were split into multiple sub catchments representing roof, carpark and open space areas. Catchment data for each lot can be seen in **Table 11** below.

Table 11 - Sub catchment areas

Catchment	Sub catchment	Total Area (ha)	Impervious %
1	Roof	0.04	100
	Carpark	0.235	100
	Open Space	0.04	10
1A	Roof	0.0	100
	Carpark	0.04	100
	Open Space	0.0	10
2	Roof	0.08	100
	Carpark	0.12	100
	Open Space	0.05	10
3	Roof	0.07	100
	Carpark	0.1	100
	Open Space	0.06	10
4	Roof	0.08	100
	Carpark	0.13	100
	Open Space	0.11	10
4A	Roof	0.0	100
	Carpark	0.04	100
	Open Space	0.05	10

6.3 RESULTS

As mentioned in Section 3.3, as the proposed development is within the Hunter Water drinking catchment, it is required to provide a NorBE or meet council's stripping targets, whichever is greater.

The MUSIC model was set up and run using the parameters mentioned above to analyse the effectiveness of the treatment train and to determine if it meets the required targets.

A summary of the modelling results can be seen in **Tables 12 - 13** below.

Table 12 – Pre developed vs Post developed - Site Pollutant Loads

Pollutant	Pre developed	Post developed
Total Suspended Solids (kg/yr)	951	250
Total Phosphorus (kg/yr)	1.66	0.90
Total Nitrogen (kg/yr)	12.5	12.5
Gross Pollutants (kg/yr)	37.9	1.38

Table 13 – Site Pollutant Loads and Reductions

Pollutant	Source Load	Residual Load	Modelled Reduction (%)	Target (%)
Total Suspended Solids (kg/yr)	2740	250	90.9	90
Total Phosphorus (kg/yr)	4.93	0.902	81.7	60
Total Nitrogen (kg/yr)	26.9	12.5	53.5	45
Gross Pollutants (kg/yr)	279	1.38	99.5	90

As can be seen from **Table 12 and 13** above, the MUSIC modelling indicates that the proposed treatment train not only meets the stormwater quality requirements of Port Stephens Council but also provides a Neutral or Beneficial effect. A screenshot of the MUSIC model can be seen in **Appendix C**.

As mentioned above, a key part of the treatment train is the "Stormfilter Cartridges", which are to be supplied within the detention tanks. A summary of the cartridges required for each tank can be seen in **Table 14** below.

Table 14 – Proposed Stormfilter Cartridges

Catchment	Number of Cartridges	Cartridge Size (mm)
Catchment 1	4	690
Catchment 2	4	690
Catchment 3	3	690
Catchment 4	4	690

Further details surrounding the Stormfilter cartridges and their inclusion within the detention tanks can be seen in **Exhibit 4**.

7.0 Erosion and Sedimentation Control

Erosion and sedimentation control measures need to be implemented during construction works to minimise the risk of erosion to disturbed areas and limit the transport of sediments from the construction site to downstream waterways. An Erosion and Sedimentation Control Plan can be seen in **Exhibit 3**. It should be noted that the attached Erosion and Sedimentation Control Plan is indicative only and will be amended during the detailed design and construction phases of the project.

8.0 Conclusion

The proposed stormwater system has been designed to safely and efficiently convey the minor and major flows generated by the proposed development, to the downstream stormwater infrastructure.

Stormwater detention, provided by a number of OSD tanks, has shown that the peak post developed discharges can be adequately attenuated back to pre-developed levels in accordance with PSC requirements.

A treatment train process of litter baskets and filtration cartridges have been designed to effectively reduce the nutrients and gross pollutants from stormwater runoff from the proposed development.

An erosion and sedimentation control plan will be implemented to minimise the risk of erosion to disturbed areas and limit the transport of sediments from the development site to the receiving waters during construction.

Exhibits

190514-EX-001

LEGEND

- SITE BOUNDARY
- EXISTING LOT BOUNDARY
- EXISTING CONTOURS
- EXISTING CONTOURS
- EXISTING KERB
- ex sw — EXISTING STORMWATER
- D/H — EXISTING OVERHEAD POWER
- EXISTING FENCE
- TREE
- GATE
- BOTTOM OF BANK
- TOP OF BANK
- SMH — SEWER MAN HOLE
- HYD — HYDRANT
- SV — STOP VALVE
- PP — POWER POLE
- SL — STREET LIGHT
- TEL — COMMUNICATIONS PIT

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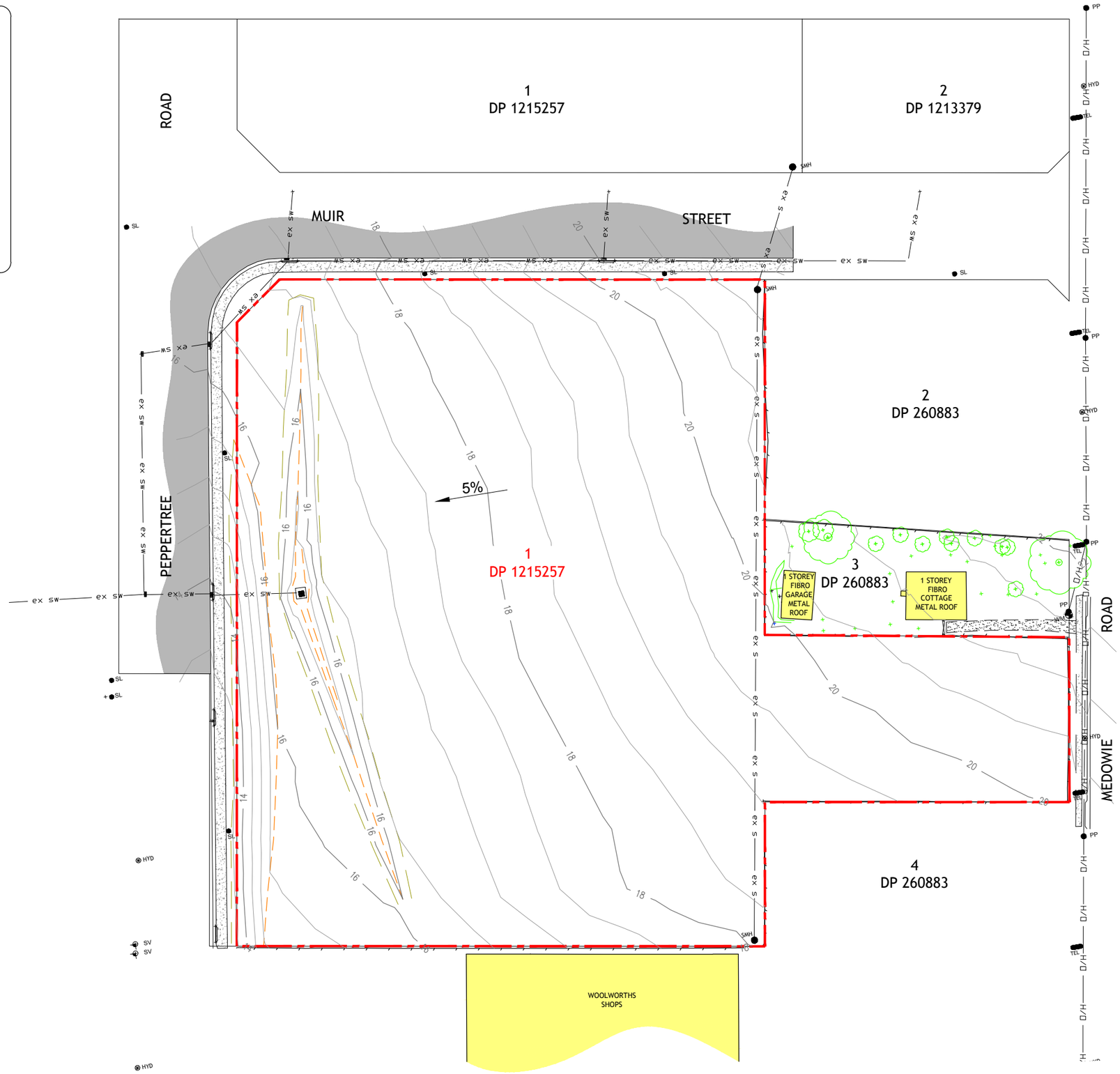

DETAIL & SURVEY PLAN
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ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
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drawing title:
EXISTING SITE PLAN

location: MEDOWIE COMMERCIAL
council: MAITLAND
dwg ref: 190514-EX-001
client: MAVID PROPERTIES

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190514-EX-002

PEPPERTREE ROAD

MUIR STREET

RETAIL

CATCHMENT 3

RETAINING WALL

ROAD No.1

CATCHMENT 4A

CATCHMENT 1

FOOD PAD

CATCHMENT 1A

ROAD No.2

CHILDCARE

CATCHMENT 4

CATCHMENT 2

RETAIL

1 DP1196650

6 DP19101

4 DP260883

3 DP260883

2 DP260883

LEGEND

- SITE BOUNDARY
- PROPOSED BUILDING STAMP
- MAJOR CONTOURS
- MINOR CONTOURS
- PROPOSED KERB
- EXISTING KERB
- SW — PROPOSED STORMWATER
- ex sw — EXISTING STORMWATER
- PROPOSED RETAINING WALL
- PROPOSED SW PIT
- PROPOSED LINTEL
- CATCHMENT 1
- CATCHMENT 1A
- CATCHMENT 2
- CATCHMENT 3
- CATCHMENT 4
- CATCHMENT 4A

CONTOUR INTERVAL = 0.2m

STORMWATER CATCHMENT PLAN

SCALE 1:250

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
B	31.07.19	INITIAL ISSUE	AE	BMc	DATUM: AHD CONTOUR INTERVAL: 0.2m	0 5.0 10.0 12.5m SCALE: 1:250 (FULL)	

drawing title: PROPOSED CATCHMENTS

location: MEDOWIE COMMERCIAL

council: MAITLAND

dwg ref: 190514-EX-002

client: MAVID PROPERTIES

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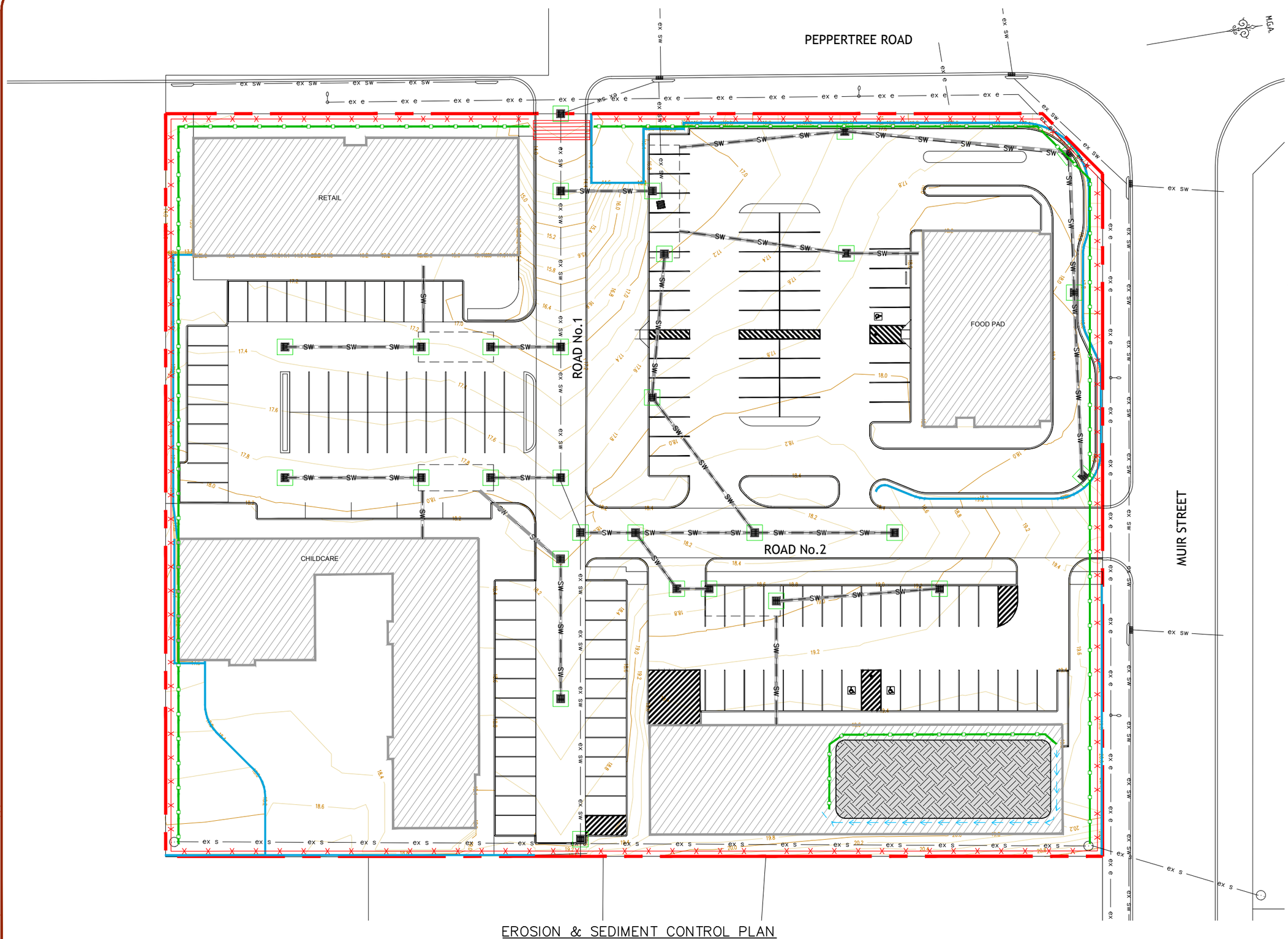
190514-EX-003



EROSION & SEDIMENT CONTROL PLAN
SCALE 1:250

LEGEND

- SITE BOUNDARY
- PROPOSED LOT BOUNDARY
- EXISTING LOT BOUNDARY
- FUTURE LOT BOUNDARY
- MAJOR CONTOURS
- MINOR CONTOURS
- PROPOSED KERB
- EXISTING KERB
- PROPOSED RETAINING WALL
- EXTENTS OF BATTER
- SW — PROPOSED STORMWATER
- ex sw — EXISTING STORMWATER
- ex s — EXISTING SEWER
- ex e — EXISTING ELECTRICITY
- PROPOSED SW PIT
- PROPOSED LINTEL
- SEDIMENT/SILT FENCING
- NO-GO FENCING
- PROPOSED PIT INLET FILTER
- PROPOSED LINTEL INLET FILTER
- DIVERSION DRAIN
- STOCKPILE LOCATION
- SITE ACCESS/SHAKER RAMP

CONTOUR INTERVAL =0.2m

NOTE:

1. DETAIL EROSION & SEDIMENT CONTROLS TO BE SPECIFIED AT DETAILED DESIGN STAGE.

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
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drawing title:
EROSION AND SEDIMENT CONTROL PLAN

location: MEDOWIE COMMERCIAL

council: MAITLAND

dwg ref: 190514-EX-003

client: MAVID PROPERTIES

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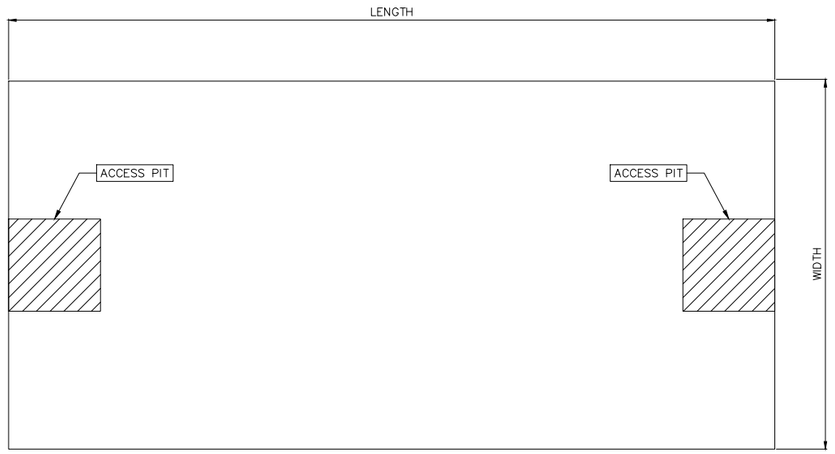
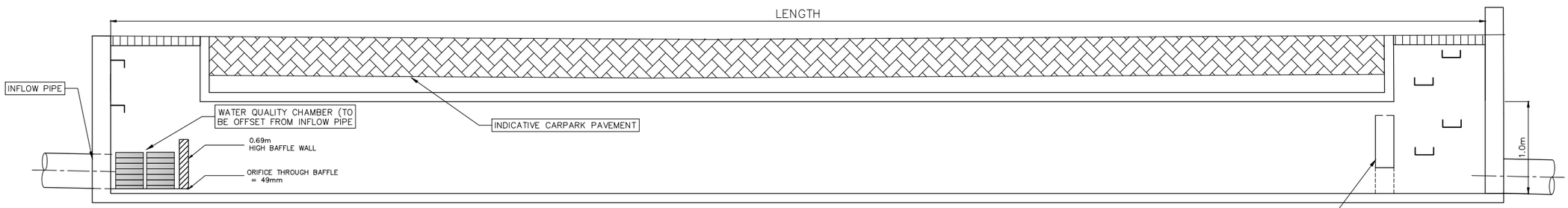
NOTE:

1. REFER TO REPORT FOR INDIVIDUAL TANK DIMENSIONS AND DETAILS.



INDICATIVE OSD TANK

SCALE 1:100



INDICATIVE TANK SECTION

SCALE 1:25

working beyond expectations

drawing title:

OSD TANK PLAN & SECTION

location: MEDOWIE COMMERCIAL

council: MAITLAND

dwg ref: 190514-EX-004

client: MAVID PROPERTIES

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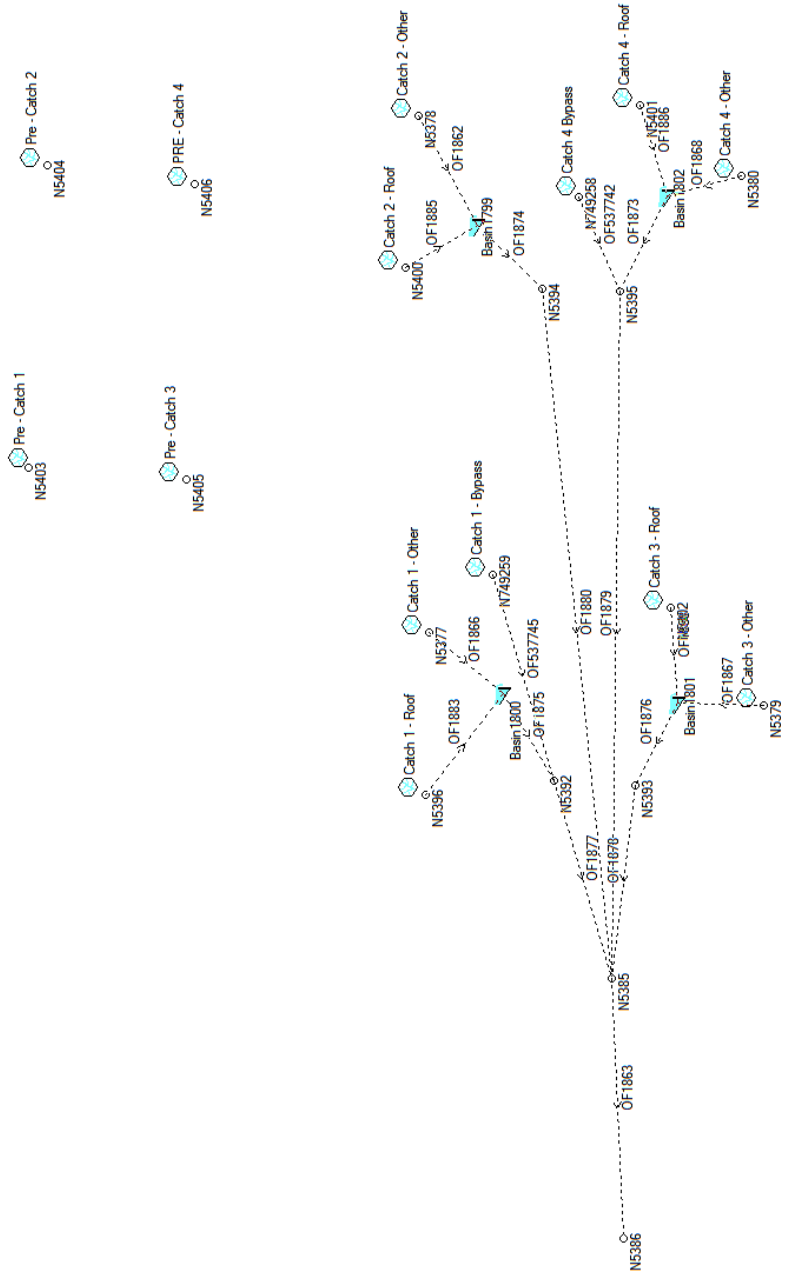
ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
A	09.07.19	INITIAL ISSUE	AE	BMc	DATUM: AHD CONTOUR INTERVAL: N/A	0 2.5 5.0m SCALE: 1:100 (FULL)	0 0.25 0.50 0.75 1.00 1.25m SCALE: 1:25 (FULL)

• project management • civil engineering • infrastructure • superintendency • economic analysis • social impact • town planning • surveying • development feasibility • visualisation • urban design

APPENDIX A

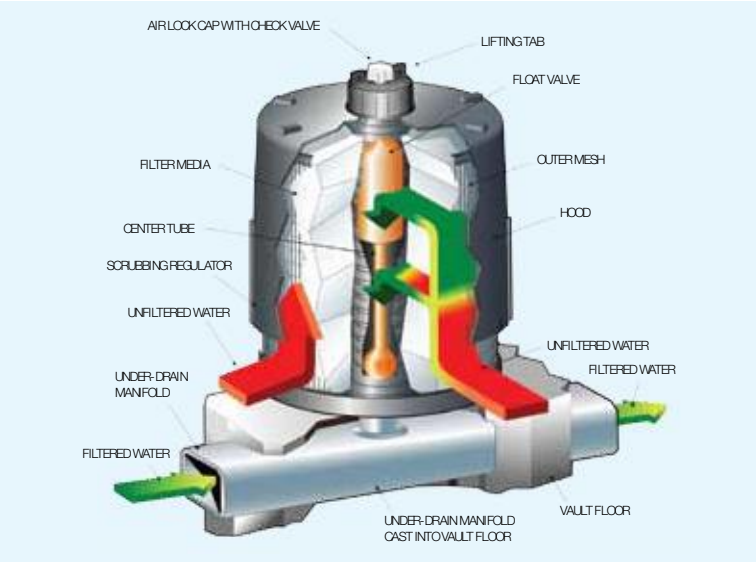
DRAINS MODEL



APPENDIX B

WATER QUALITY INFORMATION

The Stormwater Management StormFilter



Removing the most challenging target pollutants

The Stormwater Management StormFilter is a best management practice (BMP) designed to meet stringent regulatory requirements. It removes the most challenging target pollutants – including fine solids, soluble heavy metals, oil, and total nutrients (inc. soluble) – using a variety of media. For more than two decades, StormFilter has helped clients meet their regulatory needs and through product enhancements the design continues to be refined for ease of use.

Why StormFilter is the best filter available

Superior hydraulics

- External bypass – protects treatment chamber from high flows and ensures captured pollutants are not lost during low frequency, high intensity storm events
- Multiple cartridge heights – minimises head loss to fit within the hydraulic grade line and shrink system size, reducing installation costs
- Multiple StormFilter configurations in use across the country

Reliable longevity

- One-of-a-kind self-cleaning hood – prevents surface blinding, ensures use of all media, and prolongs cartridge life
- Customised maintenance cycles – fewer maintenance events compared to similar products, which reduces costs over the lifetime of the system
- 12 years of maintenance experience – predictable long-term performance comes standard

Proven performance

- Only filter on the Australian market tested within Australia achieving best practice guidelines, for TSS, TP and TN
- Qualifies for a minimum 2 EMI 5 Green star credits
- Achieve water quality goals with confidence – easy approval speeds development assessment process
- 8th generation product – design refined and perfected over two decades of research and experience

Maximising your land use and development profitability

StormFilter systems are utilised in below ground systems. The advantages this offers over above ground systems includes:

- Land space saving that enable an increase in development density and reduce sprawl
- The potential to add car parking, increase building size, and develop out parcels

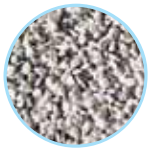
In addition, StormFilter's compact design reduces construction and installation costs by limiting excavation.

Media options

Our filtration products can be customised using different filter media to target site-specific pollutants. A combination of media is often recommended to maximise pollutant removal effectiveness.

PhosphoSorb™ is a lightweight media built from a Perlite-base that removes total phosphorus (TP) by adsorbing dissolved-P and filtering particulate-P simultaneously.

Perlite is naturally occurring puffed volcanic ash. Effective for removing TSS, oil and grease.



Zeolite is a naturally occurring mineral used to remove soluble metals, ammonium and some organics.

GAC (Granular Activated Carbon) has a micro-porous structure with an extensive surface area to provide high levels of adsorption. It is primarily used to remove oil and grease and organics such as PAHs and phthalates.

	PhosphoSorb	Perlite	ZPG	Zeolite	GAC
Sediments	•	•	•		
Oil and Grease	•	•	•		
Soluble Metals	•		•	•	
Organics			•	•	•
Nutrients	•	•	•	•	•
Total Phosphorus	•		•		

Note: Indicated media are most effective for associated pollutant type. Other media may treat pollutants, but to a lesser degree.

ZPG™ media, a proprietary blend of zeolite, perlite, and GAC.

Cartridge options

With multiple cartridge heights available, you now have a choice when fitting a StormFilter system onto your site.

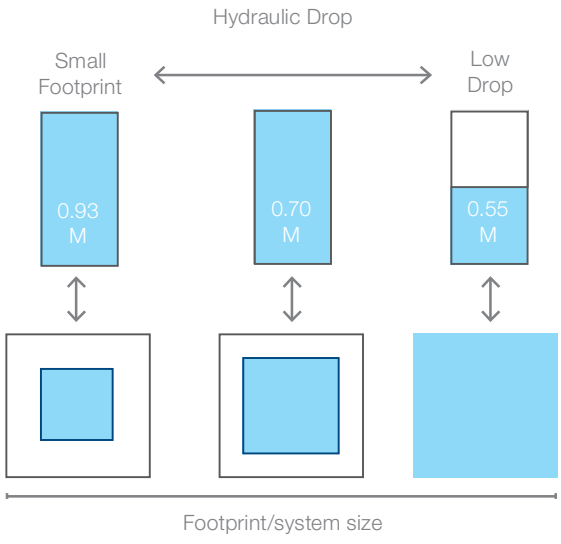
The 69cm cartridge provides 50% more treatment than the previously standard 46cm cartridge, which enables you to meet the same treatment standards with fewer cartridges, and via a smaller system.

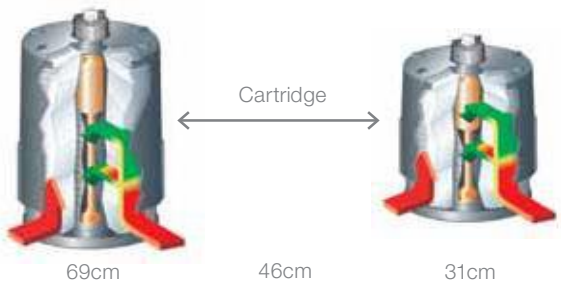
If you are limited by hydraulic constraints, the low drop cartridge provides filtration treatment with only 0.55m of headloss.

Cartridge flow rates

Cartridge Type	Hydraulic Drop	Treatment Capacity (l/sec)	
		0.7 l/s/m²	1.4 l/s/m²
StormFilter 69cm	0.93 m	0.71	1.42
StormFilter 46cm	0.70 m	0.47	0.95
StormFilter Low Drop	0.55 m	0.32	0.63

Selecting cartridge height





Configurations and applications

The StormFilter technology can be configured to meet your unique site requirements. Here are a few of the most common configurations, however many other configurations are available. A Stormwater360 engineer can assist you evaluate the best options for your site or you can find out more by downloading the StormFilter Configuration Guide from www.stormwater360.com.au

Upstream treatment configurations

The following suite of StormFilter configurations are easily incorporated on sites where WSUD is recommended. These low-cost, low-drop, point-of-entry systems also work well when you have a compact drainage area.

GullyPit StormFilter

Combines a gullypit, a high flow bypass device, and a StormFilter cartridge in one shallow structure.

- Treats sheet flow
- Uses drop from the inlet grate to the conveyance pipe to drive the passive filtration cartridge
- No confined space required for maintenance

Gully inlet

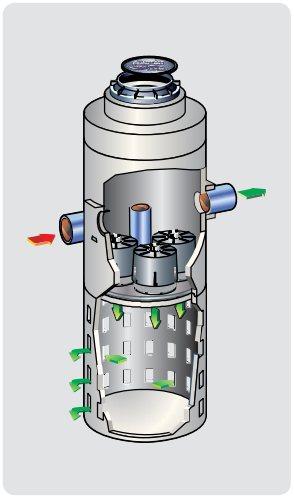
- Accommodates kerb inlet openings from 900 to 3000mm long
- Uses drop from the kerb inlet to the conveyance pipe to drive the passive filtration cartridges

Linear grate

- Can be designed to meet volume based sizing requirements
- Can be installed in place of and similar to a typical gullypit
- No confined space entry required for maintenance
- Accommodates up to 29 StormFilter cartridges

Infiltration/retrofit configuration infiltration

- Provides treatment and infiltration in one structure
- Available for new construction and retrofit applications
- Easy to install
- Re-charge groundwater and reduces run-off



Roof runoff treatment configuration

Down pipe

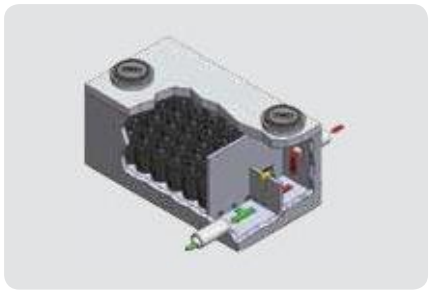
- Easily integrated into existing gutter systems to treat pollution from rooftop runoff
- Fits most downpipe configurations and sizes; single or dual-cartridge models available
- Treats up to 1300m^2 of rooftop area per dual-cartridge system

Downstream treatment configurations

Conventional stormwater treatment involves collecting, conveying and treating stormwater runoff with an end-of-pipe treatment system before discharging off-site. StormFilter configurations suitable for these applications are listed below and can be engineered to treat a wide range of flows.

Peak diversion

- Provides off-line bypass and treatment in one structure
- Eliminates material and installation cost of additional structures to bypass peak flows
- Reduces the overall footprint of the treatment system, avoiding utility and right-of-way conflicts
- Internal weir allows high peak flows with low hydraulic head losses
- Accommodates large inlet and outlet pipes (up to 900mm) for high flow applications



Vault / manhole

- Treats small to medium sized sites
- Simple installation – arrives on-site fully assembled
- May require off-line bypass structure

High flow

- Treats flows from large sites
- Consists of large, precast components designed for easy assembly on-site
- Configurations available, include, Panel Vault and Cast-In-Place

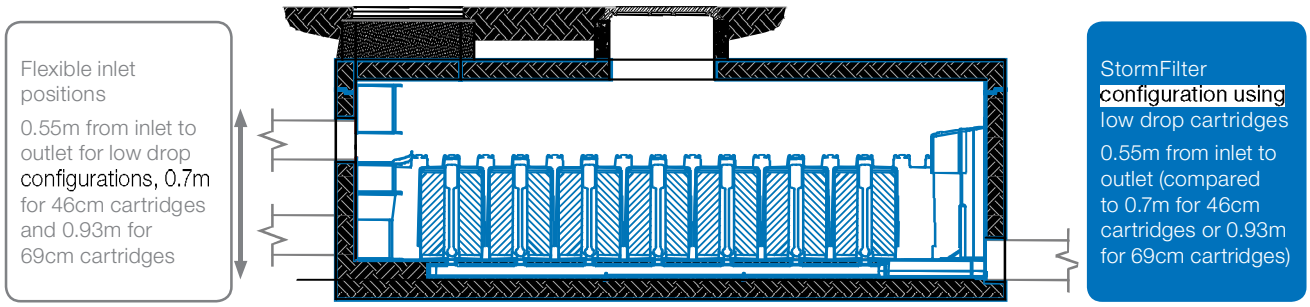
Volume

- Meets volume-based stormwater treatment regulations
- Captures and treats specific water quality volume (WQv)
- Provides treatment and controls the discharge rate
- Can be designed to capture all, or a portion, of the WQv

Filtration for low drop sites

Designing for limited drop

In some cases, site constraints limit the hydraulic drop that is available to drive the passive filtration cartridges. Following are a variety of solutions to either create the required drop or work around the limited drop without impacting the performance of the system.



Solutions for Low Drop Sites

Site modfications

Reduce pipe slope

Use an alternate pipe material with a lower Manning's n value for a portion of the site and reduce the pipe slope.

Reduce pipe cover

Use controlled density fill (CDF) at the front-end of the conveyance system to minimise pipe cover and raise the conveyance system. CDF, a method of pouring concrete with fine aggregate (sand vs. gravel) around pipe, allows the use of most pipe materials with limited cover.

Drain inlet treatment

Substitute several shallow inlet configurations for the single end-of-pipe system. Shallow options include the Catchpit/Gullypit StormFilter, CurbInlet StormFilter, Manhole StormFilter and the Linear StormFilter. These systems still require the normal drop (0.7m for 46cm cartridges) but utilise the drop into the conveyance system to drive the cartridges.

Provide pumping system

Stormwater360 offers the Integrated Pumping System (IPS), which can be designed in tandem with filtration system sizing.

Treatment system modfications

Use low drop cartridges

The StormFilter can be configured with low drop cartridges that activate at 31cm, reducing the overall head loss to only 0.55m, compared to 0.7m for the 46cm cartridge or 0.93m for the 69cm cartridge.

Surcharge the inlet pipe

Backing-up water into the conveyance system can create the necessary drop to drive the StormFilter cartridges. This will affect the HGL and increase the volume of water required to activate the cartridges, which could have a detrimental effect on system longevity. The following design modifications mitigate these risks:

- Confer with a Stormwater360 design engineer before surcharging the inlet pipe
- Verify this is an acceptable practice in your local jurisdiction
- Modify the overall system design to accommodate the increased HGL
- Calculate the additional treatment volume and consider using more cartridges

APPENDIX C

MUSIC MODEL