STORMWATER MANAGEMENT PLAN

Proposed Piping Storage Facility
75-87 Dunheved Circuit
St Marys NSW 2760

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REVISION STATUS

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1	For Development Application	12 October 2021	Nathan Taufer

Recipients are responsible for eliminating all superseded documents in their possession.

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Table of Contents

1 Introduction 1
2 Design Control and Guidelines 2
2.1 Penrith City Council Development Control Plan (2014) 2
2.2 Penrith City Council Design Guidelines for Engineering Works for Subdivisions and Developments (2013) 2
2.3 Penrith City Council Stormwater Drainage Specification for Building Developments (2018) 2
2.4 Penrith City Council Water Sensitive Urban Design Policy (2017) 2
2.5 Penrith City Council Water Sensitive Urban Design Technical Guidelines (2020) ... 2
2.6 Australian Rainfall and Runoff (2016) 2
2.7 NSW Music Modelling Guidelines (2015) 3
3 WSUD Objectives 3
3.1 Water Conservation 3
3.2 Stormwater Quality 3
3.3 Stormwater Quantity 4
4 Erosion and Sedimentation Control 5
5 Stormwater Quantity Management 6
5.1 On-Site Detention (OSD) Tank 6
5.2 Water Quantity Modelling 6
5.2.1 DRAINS Catchment Area 6
5.2.2 DRAINS Parameters 6
5.2.3 DRAINS Result 7
6 Stormwater Quality Management 9
6.1 Stormwater Quality Requirements 9
6.2 Proposed Water Quality Treatment System 9
6.2.1 OceanGuard™ 9
6.2.2 StormFilter™ 9
6.2.3 Rainwater Tank 9
6.3 Water Quality Modelling 9
6.3.1 MUSIC Catchment Area 9
6.3.2 MUSIC Parameters 10
6.3.3 MUSIC Results 11
6.4 Monitoring and Maintenance 12
7 Recommendations 13

Appendix A – Civil Plan

Appendix B – DRAINS Catchment Plan
Appendix C – MUSIC Catchment Plan
Appendix D – Checklist

1 Introduction

Van Der Meer Consulting has been commissioned by EMKC Pty Ltd to prepare a Stormwater Management Report for the proposed storage facility at 75-87 Dunheved Circuit, St Marys. This report will be lodged to Penrith City Council for the Development Application for this development. This report contains the stormwater management procedures, modelling and results.

The works consist of the construction of a large storage warehouse with an attached carpark (~5000m^2), in addition to an extensive heavy-duty pavement for the delivery and storage of pipes (~14200m^2). Currently the north-eastern area of the property consists of a paved storage area, which will not be altered in the proposed development. The site currently grades from the south-east to west-northwest at a natural grade of approximately 2% towards a ~1.5m high bank on the western boundary. The location of the site is shown in Figure 1.

Figure 1 Site area

2 Design Control and Guidelines

2.1 Penrith City Council Development Control Plan (2014)

The Development Control Plan (DCP) 2014 provides guidelines, objectives and controls for people who wish to carry out development in the Penrith City LGA.

2.2 Penrith City Council Design Guidelines for Engineering Works for Subdivisions and Developments (2013)

The Penrith City Council Design Guidelines for Engineering Works for Subdivisions and Developments outline the council's general procedures and practices for engineering for the subdivision and development of land within the LGA.

2.3 Penrith City Council Stormwater Drainage Specification for Building Developments (2018)

The Penrith City Council Stormwater Drainage Specification for Building Developments outlines the engineering specification for stormwater drainage requirements in the Penrith City LGA.

2.4 Penrith City Council Water Sensitive Urban Design Policy (2017)

The Penrith City Council Water Sensitive Urban Design Policy clarifies which developments need to achieve the targets for water conservation, quality and quantity in the Penrith City LGA.

2.5 Penrith City Council Water Sensitive Urban Design Technical Guidelines (2020)

The Penrith City Council Water Sensitive Urban Design Technical Guidelines outlines the way in which WSUD should be implemented and documented within the Penrith City LGA.

2.6 Australian Rainfall and Runoff (2016)

Engineers Australia (EA) published the Australian Rainfall and Runoff – A Guide to Flood Estimation which provided the information and approach for hydrology and stormwater management. It contains information to estimate the stormwater runoff, design storm event, and design method for the urban stormwater drainage systems.

2.7 NSW Music Modelling Guidelines (2015)

The NSW Music Modelling Guidelines outline the methodology for using Music by E-water to model Water sensitive urban design principles.

3 WSUD Objectives

In accordance with the *Penrith City Council Water Sensitive Urban Design Policy (2017)*, the proposed development is classified as 'commercial & industrial' landuse and has greater than 2500m^2 total site area. Therefore, the development will need to comply with water conservation, water quality and water quantity objectives and performance criteria.

3.1 Water Conservation

Objectives:

- To reduce consumption of potable water for all development types within the city.
- To use harvested rainwater, treated urban stormwater or treated wastewater for non-potable substitution where appropriate

Performance Criteria

- Water use fittings must demonstrate minimum standards defined by the water efficiency labelling and standards (WELS) scheme.
- Rainwater tanks must be installed which meet 80% of non-potable demand including outdoor use, toilets and laundry.

3.2 Stormwater Quality

Objectives:

- To safeguard the environment by improving the quality of stormwater run-off entering receiving waters.

Performance Criteria:

- Pollutant load reductions:
    - 90% reduction in the post development mean annual load of total gross pollutant (greater than 5 mm)
    - 85% reduction in the post development mean annual load of Total Suspended Solids (TSS)
    - 60% reduction in the post development mean annual load of Total Phosphorus (TP)
    - 45% reduction in the post development mean annual load of Total Nitrogen (TN)
- Modelling for the determination of the mean annual loads of land uses must be undertaken in MUSIC and in accordance with the associated WSUD Technical Guidelines

- Changes to the flow rate and duration within receiving watercourses shall be limited as far as practicable. Natural flow paths, discharge point and runoff volumes from the site should also be retained and maintained as far as practicable.
- Impervious areas directly connected to the stormwater system shall be minimised. Runoff from impervious areas such as roofs, driveways and rainwater tank overflows shall be directed onto grass and other landscaped areas designed to accept such flows.

3.3 Stormwater Quantity

Objectives:

- To manage the volume and duration of stormwater flows entering local waterways to protect the geomorphic values of those waterways.

Performance Criteria:

- The post development duration of stream forming flows shall be no greater than 3.5 times the predeveloped duration of stream forming flows. The comparison of post development and pre-development stream forming flows is commonly referred to as the Stream Erosion Index (SEI)

4 Erosion and Sedimentation Control

During construction, water quality control is achieved by deposition and trapping of silts and clays which often have nutrients such as phosphorus and nitrogen attached to their surfaces. Silt fences will be erected prior to construction to control sediment runoff. This will reduce and isolate sediments and particulate matter.

An Erosion and Sediment Control Plan has been provided in accordance with Landcom's "Managing Urban Stormwater – Soils and Construction (2004)". This will ensure that a significant portion of sediments and attached nutrients can be contained on site during construction.
A copy of the preliminary Soil & Water Management Plan included in Appendix A, details:

- The location and extent of proposed sediment & erosion control measures
- The location of the sediment control fence
- The locations and control measures for temporary stockpiles.
- The locations and control measures for vehicle wash down areas.

5 Stormwater Quantity Management

5.1 On-Site Detention (OSD) Tank

The *Penrith City Council Stormwater Drainage Guidelines for Building Developments* deem the proposed development is located in an area in which OSD is mandatory. As such, on Site Detention is to be provided to attenuate peak flows from the site. The requirements for OSD are as follows:

- it will be necessary to demonstrate that there will be no increase in runoff from the site as a result of the development under all durations for all the storms up to and including the 1% AEP event.
- Where the downstream drainage system has limited capacity or may result in increased flooding, the OSD system shall be designed to match the capacity of the downstream system or ensure no increase in flood levels.

5.2 Water Quantity Modelling

DRAINS is a computer modelling program for hydraulic models and commonly used in Australia. DRAINS is capable to model the runoff routing process, pit and pipe hydraulic, and detention basin.

5.2.1 DRAINS Catchment Area

All catchment area in the subject site has been considered in the DRAINS analysis to meet the peak discharge reduction requirements. Catchment breakdown are presented in Table 1 below and also shown in Appendix B.

Table 1 DRAINS catchment areas

Condition	Paved Area (m^2)	Supplementary Area (m^2)	Grassed Area (m^2)	Bypass (m^2)	Total Area (m^2)
Post development	17,266	0	2,672	253	3,096

The proposed drainage system has then been modelled and provided with an OSD to attenuate flows such that there is no increase in runoff from the site as a result of the development under all durations for all the storms up to and including the 1% AEP event.

5.2.2 DRAINS Parameters

Following are the input parameters that were used in the DRAINS analysis:

Hydrological model

- Soil Type: 4

- Paved (impervious) area depression storage = 1 mm
- Supplementary area depression storage = 1 mm
- Grass (pervious) area depression storage = 5 mm

Rainfall Data and Temporal Pattern

Rainfall data and Temporal Pattern from AR&R Data Hub and Bureau of Meteorology (BoM) for the Dunheved, St Marys area has been adopted for the DRAINS analysis.

Tailwater Level

The proposed drainage system will discharge into the drainage swale in Links Road. Mainstream flooding is shown to extend to a level of 21.5m at the North-East corner of the site and has been used as the Tailwater level.

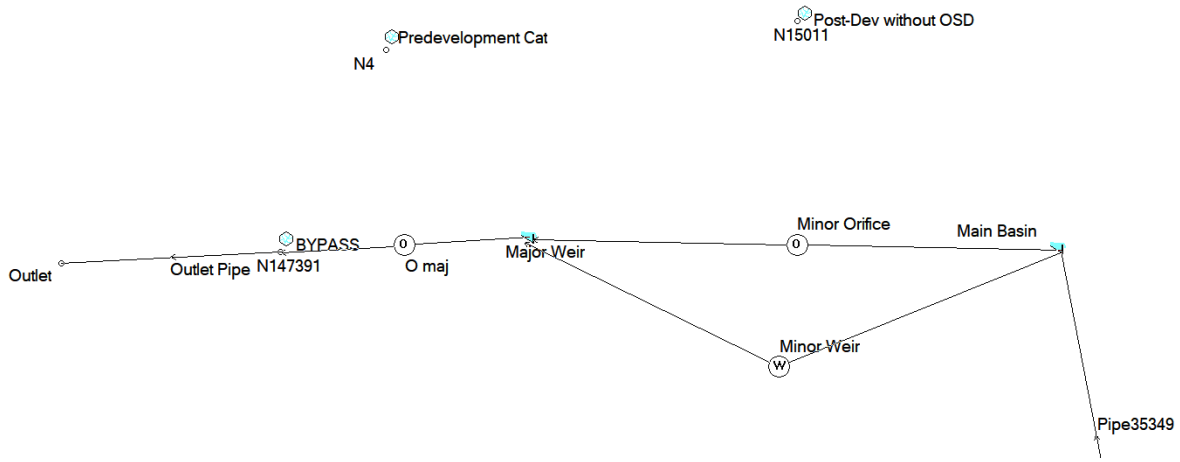

Figure 2 DRAINS model

5.2.3 DRAINS Result

The OSD tank has been designed with a 500mm major orifice, and a 200mm minor orifice with overflow over an internal weir. Following are the summary of the DRAINS OSD analysis:

Table 2 DRAINS OSD comparison

AEP Event (%)	Pre-Development Site Discharge (m^3/s)	Post Development Peak Discharge with OSD Tank (m^3/s)
50%	0.112	0.081
20%	0.208	0.096
10%	0.276	0.107
5%	0.355	0.170
2%	0.471	0.380
1%	0.567	0.496

Results indicate that during 50% AEP to 1% AEP storms, the proposed stormwater drainage system and OSD tank satisfy with Penrith City Council requirements.

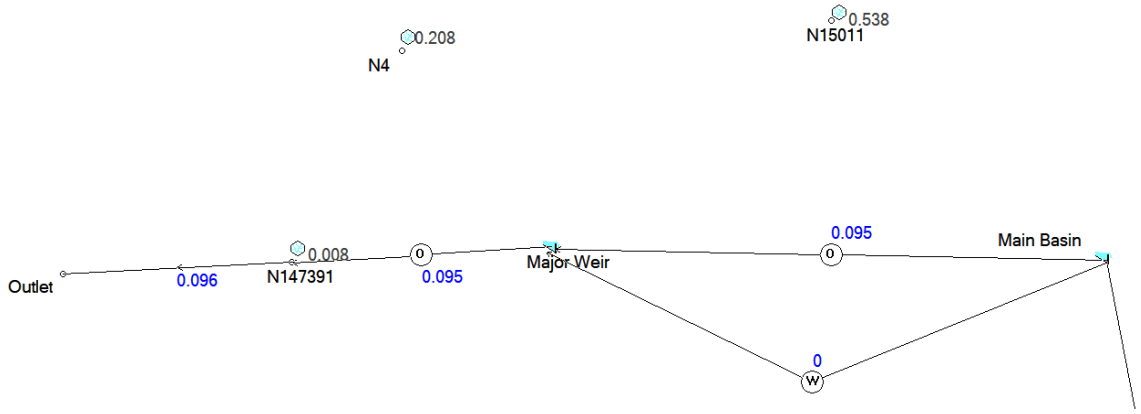

Figure 3 DRAINS 20% AEP Results

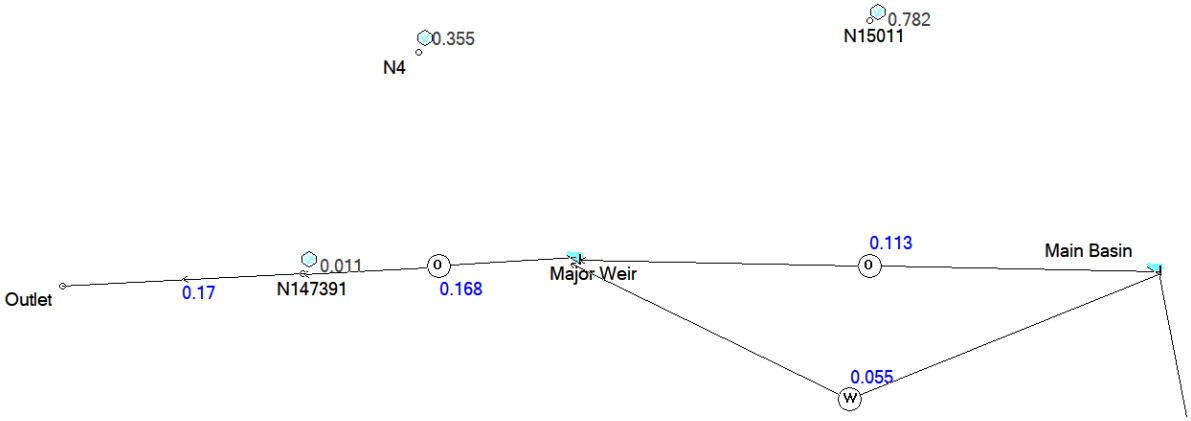

Figure 4 DRAINS 5% AEP Results

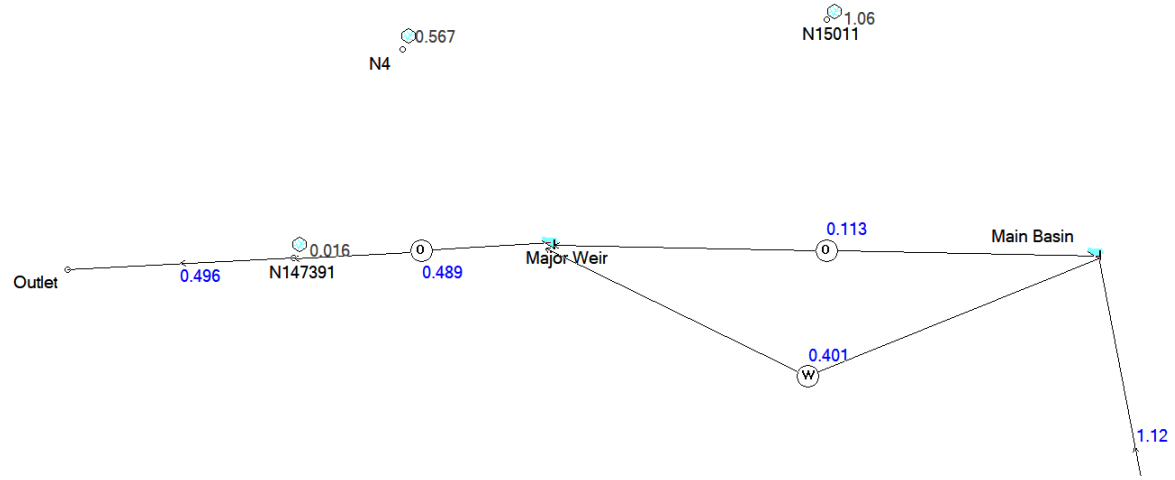

Figure 5 DRAINS 1% AEP Result

6 Stormwater Quality Management

6.1 Stormwater Quality Requirements

According to *Penrith City Council Water Sensitive Urban Design Policy*, the stormwater quality requirements are as follows:

- 90% reduction in the post development mean annual load of total gross pollutant (greater than 5 mm)
- 85% reduction in the post development mean annual load of Total Suspended Solids (TSS)
- 60% reduction in the post development mean annual load of Total Phosphorus (TP)
- 45% reduction in the post development mean annual load of Total Nitrogen (TN)

6.2 Proposed Water Quality Treatment System

6.2.1 OceanGuard™

OceanGuard™ is one of the stormwater treatment device design to capture pollutant the run into the stormwater drains. It can be installed in the new or existing pits. It is effective to remove gross pollutant, total suspended solids, and attached pollutant. 24 OceanGuard™ are to be provided in the nominated pit inlets.

6.2.2 StormFilter™

StormFilter™ is to be provided to be used as the primary stormwater treatment for the subject site. 18 StormFilter™ are to be placed inside the proposed OSD tank. StormFilter™ are effective to reduce a high level of stormwater pollutant including total suspended solids, total phosphorus, and total nitrogen.

6.2.3 Rainwater Tank

A 100kL rainwater reuse tank is proposed for Irrigation purposes to assist with treatment and reduce overall runoff.

6.3 Water Quality Modelling

MUSIC was used to analyse the performance of the stormwater quality treatment devices.

6.3.1 MUSIC Catchment Area

All catchment area in the subject site has been considered in the MUSIC analysis to meet the stormwater quality requirement. Catchment breakdowns are presented in Table 3 below and shown in Appendix C.

Table 3 MUSIC catchment area

Node	Total Area (m^2)	Impervious (%)	MUSIC Source Node
Hardstand	10,331	100	Industrial
Landscape	2,200	0	Industrial
Roof	7,327	100	Roof
Bypass	342	0	Industrial

6.3.2 MUSIC Parameters

Rainfall data and Pollutant concentrations were defined using the latest version of Music-Link for Penrith Council.

Stormwater Treatment Parameters

Various stormwater treatment devices are proposed in the subject site. Table 4 shows the stormwater pollutant removal efficiency in the proposed devices.

Table 4 Stormwater treatment nodes parameters

Parameters	Adopted Values
StormFilter™	
Concentration based capture efficiency	
TSS input/output value	1000/66
TP input/output value	10/1.39
TN input/output value	100/44.1
GP input/output value	14.9393/0
OceanGuard™	
Concentration based capture efficiency	
TSS input/output value	121/30
TP input/output value	10/7
TN input/output value	50/39.5
GP input/output value	14.7808/0

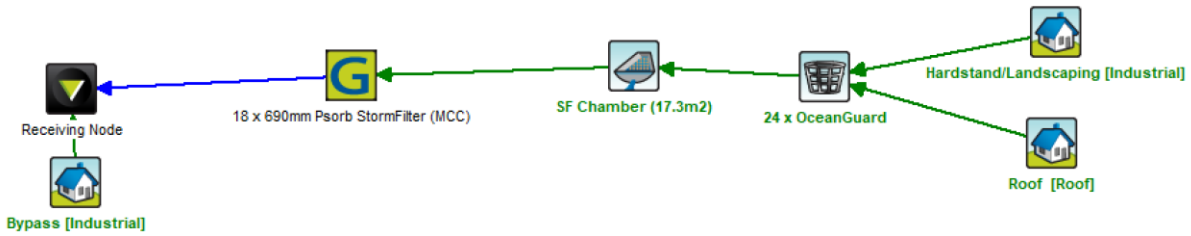

Figure 6 MUSIC model

6.3.3 MUSIC Results

The result of the MUSIC analysis is shown on Table 5. The values summarise the stormwater pollutant reduction for the entire treatment train.

Table 5 Stormwater pollutant reduction results

Pollutant	Development Proposal			Pollutant Reduction Target
	Source Load (kg/yr)	Residual Load (kg/yr)	% Reduction	% Reduction
TSS	1300	140	89.2	85%
TP	2.53	0.841	66.7	60%
TN	23.3	12.1	47.9	45%
Gross Pollutant	292	0	100	90%

MUSIC analysis result indicated the proposed stormwater treatment device is able to satisfy Penrith City Council stormwater quality reduction objectives for TSS, TP, TN, and gross pollutants.

6.4 Monitoring and Maintenance

Monitoring and maintenance are required to make sure the stormwater treatment devices work properly on the daily basis. Table 6 shows the monitoring and maintenance requirements for subject site stormwater systems

Table 6 Stormwater devices monitoring and maintenance schedules

Stormwater Devices	Monitoring Schedule	Maintenance Schedule
OSD Tank	6 months	12 months
OceanGuard™	As per manufacturer specification	As per manufacturer specification
StormFilter™	As per manufacturer specification	As per manufacturer specification

7 Recommendations

The proposed development of the site could potentially lead to significant changes in water quantity and quality if a water sensitive urban design approach is not adopted as part of the development strategy.

The key strategies to be adopted for this development include the following:

1. A pit and pipe network to collect minor storm runoff from surface areas which will minimise nuisance flooding.
2. Overland flow paths to carry major storms through and around the site without causing damage to property from flooding.
3. OceanGuard™ at nominated inlet pits will form part of the water quality treatment train, removing pollutants and nutrients that are detrimental to downstream waterways;
4. Rainwater reuse tank to reduce runoff and assist in achieving water quality targets.
5. An on-site stormwater detention tank to maintain existing peak flows will be constructed. The tank will be fitted with 18 x 690 StormFilter™ to treat the water prior to it leaving the site.

The results from the investigations and modelling for this project, which have been summarised in this report, indicate that the development with the proposed WSUD strategy and management can provide a safe and ecologically sustainable environment.

Appendix A – Civil Plan

Appendix B – DRAINS Catchment Plan

Appendix C – MUSIC Catchment Plan