Warren Smith
Consulting Engineers

12 November 2021

CIVIL ENGINEERING SERVICES

723-727 Warringah Road, Forestville

S4.56 Submission Report

DOCUMENT CONTROL

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APPROVALS

Rev #	Author	Reviewer	Approver
02	L. Singh. *Graduate Engineer – Civil and Water Engineering*	L. Shaughnessy *Project Manager – Civil and Water Engineering*	M. Cahalane *Director – Civil and Water Engineering*
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Contents

Schedules

CIVIL ENGINEERING SERVICES

1. INTRODUCTION

Warren Smith Consulting Engineers (WSCE) has been engaged by Mostyn Copper Group (MCG) to prepare a S4.56 report for the proposed works at 723-727 Warringah Road, Forestville. This report will address the following:-

- On-Site Detention (OSD) system and stormwater drainage system;
- Roof drainage system;
- Rainwater Tank Sizing;
- Proposed connections to existing stormwater infrastructure;
- Water Sensitive Urban Design (WSUD) requirements, and;
- Sediment and Erosion Control.

1.1 Background

The existing site is located at 723-727 Warringah Road, Forestville, approximately 1.5km north-east of the Roseville Bridge. The site is bound by Warringah Road to the north, Forestville Public School to the south, and existing residential properties to the east and west of the site. Refer to Figure 1.1 for an aerial view of the development site boundary.

Figure 1.1: Aerial View of Property Boundary (Source: Google Maps)

The site will see the development of a new childcare centre and the construction of a slip lane from Warringah Road.

2. EXISTING STORMWATER DRAINAGE

A desktop review was undertaken to determine the existing drainage infrastructure within the development site. The desktop investigation revealed the following: -

- The existing site grades at approximately 7% from south to north;
- The runoff from the site drains towards Warringah Road where it is captured by the existing Council drainage system, and;
- There are two (2) stormwater kerb inlet pits located immediately downstream of the proposed.

Refer to Figure 2.1 below for an illustration of the site grading and the location of the existing stormwater infrastructure.

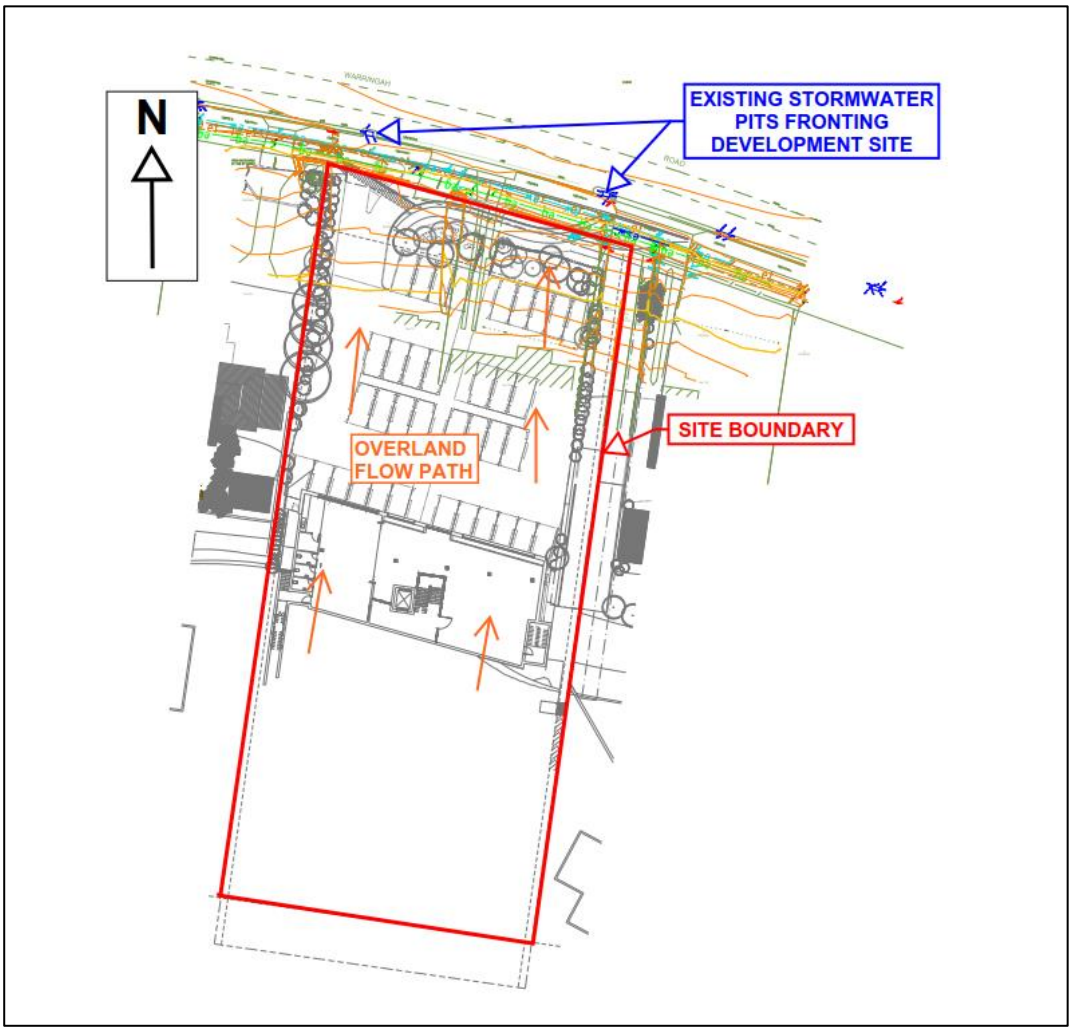


Figure 2.1: Aerial View of Existing Site Conditions

3. AUTHORITY AND REGULATORY REQUIREMENTS

With reference to the Warringah Council's Water Management Policy, 2015, and Warringah Council's On-Site Stormwater Detention Technical Specification, 2012, the council requirements are as presented in the following sub-sections.

3.1 Stormwater Drainage Requirements

- Runoff from the developed site must not exceed the runoff from the total site prior to the development for the 20%, 5% and 1% AEP storm events. The pre-development conditions must be taken with an impervious fraction of 0% when utilising the full computational method.
- Overland flow paths must be capable of carrying stormwater up to, and including, the 1% AEP storm event to account for 100% blockage to the piped system.
- A minimum freeboard of 300mm must be provided between habitable floor levels and the maximum water level.

3.2 On Site Detention Requirements

- A maximum of 50% of the total site area will be allowed to bypass the on site detention (OSD) system;
- For above ground storage, depths of ponding on driveways and carparks must not exceed 200mm. Paving slopes within storage areas must not be less than 0.7%.
- OSD will not be required where the site of the development is located within a Council established 1% AEP storm event flood plain, and that it can be identified that lesser storm events will also flood the site. Otherwise it will be necessary to provide OSD to control the runoff for the minor storm events.

4. PROPOSED STORMWATER DRAINAGE SYSTEM

The development site has a total development area of approximately 0.4116 Ha. A breakdown of the proposed development area is presented in Table 4.1 below.

Table 4.1: Breakdown of Proposed Development Site Catchment

Catchment	Impervious (Ha)	Pervious (Ha)	Total Area (Ha)
Roof to RWT	0.0766	-	0.0766
Roof to OSD	0.0342	0.0080	0.0422
To OSD Tank (excl. Roof)	0.1010	0.1526	0.2536
Bypass	0.0348	0.0044	0.0392
Total	**0.2466**	**0.1650**	**0.4116**

The maximum area of the development site bypassing the OSD system shall not be greater than 50%. For this development, a total area of 0.0392 Ha will bypass the OSD tank, which equates to 9.5% of the development area, therefore satisfying Council's requirements.

Refer to Figure 4.1 for an illustration of the stormwater and OSD systems proposed for the development and the WSCE DA drawing package for further details.

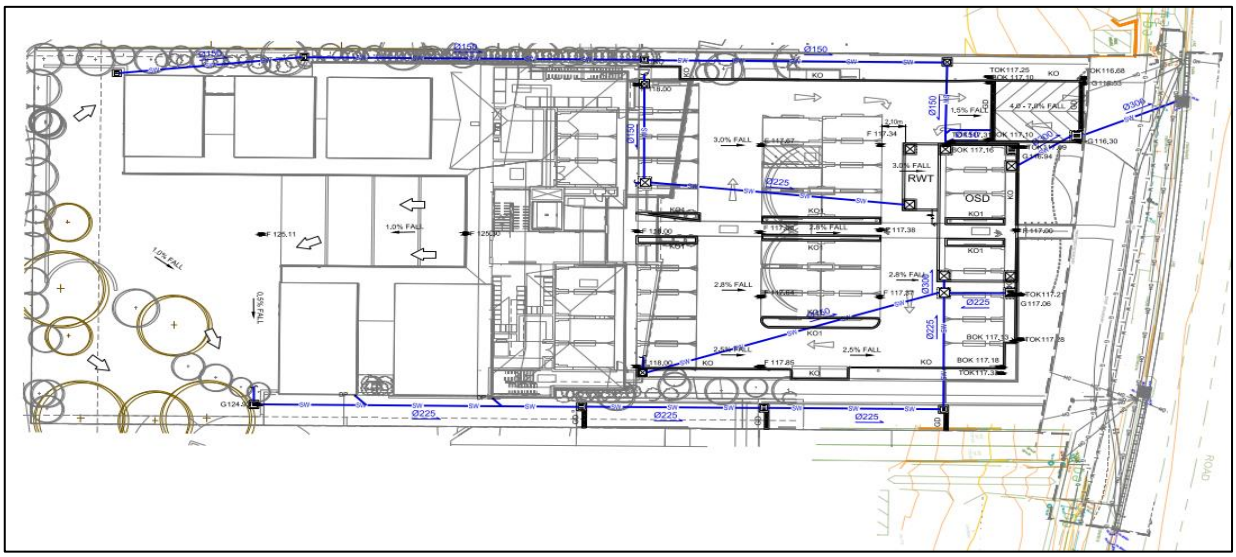


Figure 4.1: Proposed Stormwater Layout Plan

4.1 Stormwater and OSD Systems

Warringah Council requires that the runoff from the developed site must not exceed the runoff from the total site area prior to development for the 20%, 5% and 1% AEP storm events.

To satisfy the above condition, it is proposed that one (1) OSD tank be installed within the development area which will provide sufficient storage to limit the discharge from the development as required. Refer to Schedule 1 for the completed Warringah Council On-Site Stormwater Checklist. It is proposed that a pit and pipe system be installed throughout the proposed development to capture the majority of the surface runoff and roof runoff and reticulate it to the OSD tank.

Refer to Figure 4.2 for an illustration of the stormwater catchment plan.

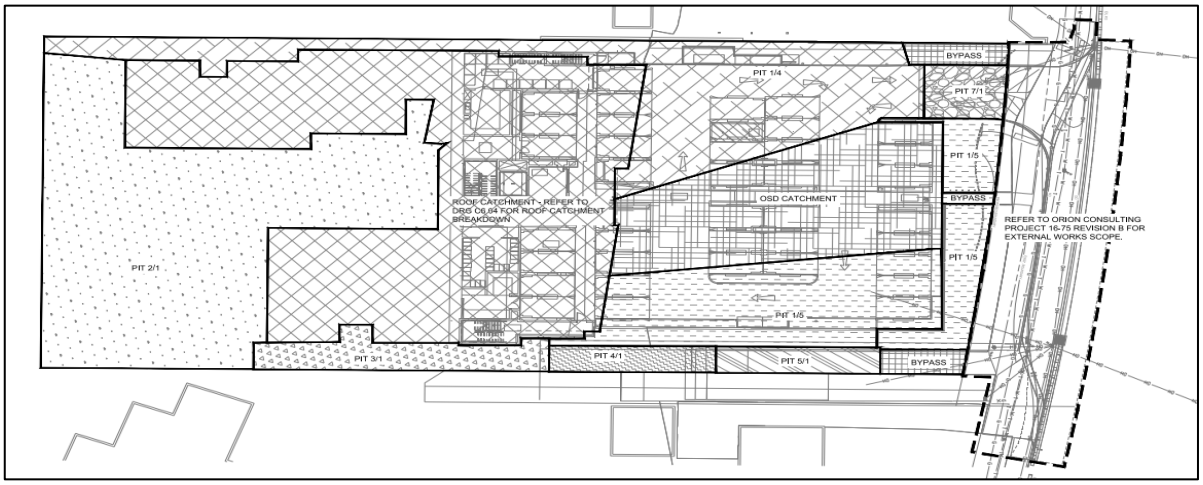


Figure 4.2: Proposed Stormwater Catchment Plan

4.2 DRAINS Model Parameters

The OSD storage volumes and site discharges have been calculated using a DRAINS Model. DRAINS is a stormwater drainage system design and analysis program which performs hydraulic grade line analysis and generates flows that occur in a drainage system for a particular AEP storm event.

The catchment characteristic factor values used in the DRAINS model are listed below:-

- Soil Type – Normal 2.5
- Paved (Impervious) Area Depression Storage 1mm
- Supplementary Area Depression Storage 1mm
- Grassed (Pervious) Area Depression Storage 5mm
- Antecedent Moisture Condition 3.0
- Minimum Pit Freeboard 300mm
- Blockage Factor for On-Grade Pits 20%
- Blockage Factor for Sag Pits 50%

The rainfall data has been taken from the Bureau of Meteorology Rainfall IFD Data System using local coordinates.

4.3 OSD Catchment

The OSD tank will be a combined rainwater reuse and OSD tank located in the northern-western section of the car parking area. It is proposed that a pit and pipe system shall reticulate to the rainwater tank which shall capture non-trafficable roof area only. The rainwater reuse tank will have a total capacity of 15kL which will be drawn from for irrigation. Any overflow from the rainwater tank shall be directed into the OSD tank through an overflow pipe. A separate pit and pipe system shall capture stormwater runoff from the rear of the property and the car parking area and reticulate it to the OSD tank. The OSD tank will discharge to a proposed pit within the driveway which will ultimately connect into the proposed stormwater pit (by others) on Warringah Road. The future proposed pit (by others) to which the proposed stormwater network will connect into will be owned by the Roads and Maritime Services (RMS).

A breakdown of the OSD catchment area is presented in Table 4.2 below.

Table 4.2: Breakdown of OSD Catchment

Catchment	Total Area (Ha)
Roof to OSD	0.0572
Roof to RWT	0.0591
Impervious	0.1486
Pervious	0.1
Total	**0.365 (Note this total excludes areas bypassing the OSD)**

Details of the OSD tank are presented in Table 4.3 below.

Table 4.3: OSD Tank Details

Item	Value
Total catchment area discharging to OSD Tank	0.3724 Ha
Average Base IL of OSD Tank (RL mAHD)	115.14
Orifice Diameter	188mm
Orifice IL	51.06
Required OSD Tank Volume	108 kL
Top Water Level – 1% AEP Storm Event (RL mAHD)	116.22

4.4 Results

The development area's OSD tank has been designed to ensure that the post development stormwater runoff from the site does not exceed the pre-development runoff which emanates from the site during the 20%, 5% and 1% AEP storm events. The pre-development case was modelled assuming an impervious fraction of 0%, in line with Warringah Council's On-Site Detention Technical Specification.

Refer to Table 4.4 below for the development area's discharge results.

Table 4.4: DRAINS Discharge Results

Scenario	20% AEP Storm Event (L/Sec)	5% AEP Storm Event (L/Sec)	1% AEP Storm Event (L/Sec)
Pre-Development Discharge	65	110	167
Post Development Discharge	56	72	88

4.5 Freeboard and Overland Flow Path

In accordance with the Warringah Council's On-Site Detention Technical Specification, a minimum freeboard of 300mm has been provided between habitable floor levels and the maximum water level adjacent to the properties throughout the development site.

Warringah Council's On-Site Detention Technical Specification states that overland flow paths must be capable of carrying stormwater up to, and including, the 1% AEP storm event, accounting of 100% blockage to the piped system. An overland flow path has been established along the southern section of the site, grading in a north-easterly direction.

The DRAINS model has been used to estimate overland flows across the development site, which determined that the overland flow path was adequately able to convey storm events in the 1% AEP event with 100% pipe blockage. It was also confirmed that the top water level of the overland flow was below the finished floor level of adjacent properties.

5. ROOF DRAINAGE SYSTEM

The total roof catchment of the proposed development site is 0.1163 Ha, with 0.0591 Ha reticulating to the RWT and the remaining 0.0572 Ha reticulating through the proposed pit and pipe system to the OSD tank, bypassing the RWT. The roof has been split into several sub-catchments – these sub-catchments are captured by a series of box gutter, eaves gutter and rainwater outlet systems which are directed to the combination below ground tank to the north-western carpark. The box gutter, eaves gutter and downpipe system has been sized in accordance with AS3500.3-2015. Refer to Figure 5.1 for an illustration of the roof sub-catchment areas and location of downpipes.

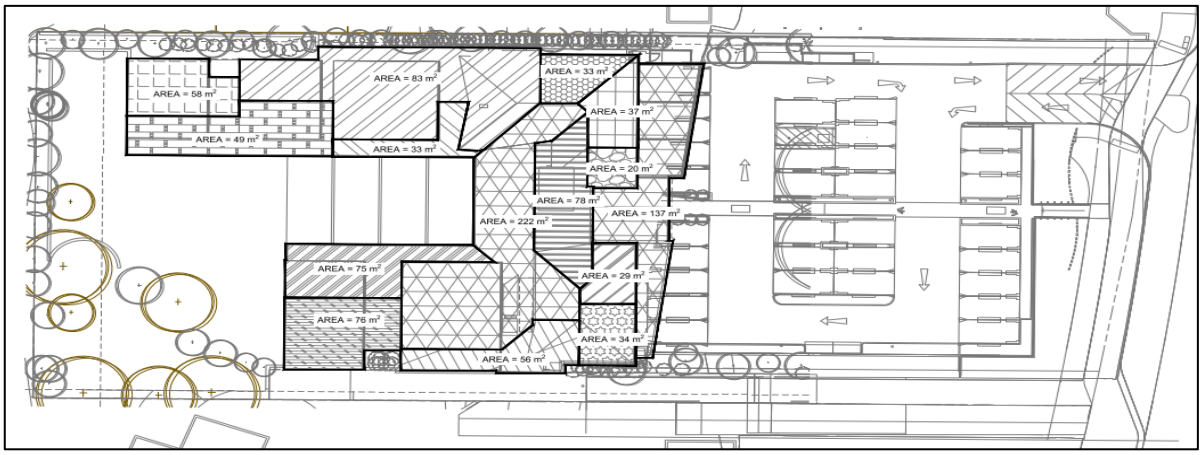


Figure 5.1: Roof Catchments

The box gutters and downpipes for Roof Areas have been sized to cater for the 1% AEP storm event. The eaves gutters and downpipes for the Roof areas have been sized to cater for the 5% AEP storm event. Appendix I of AS3500.3-2015 sets out the minimum dimensions for box gutters based on the total flow reticulating through each downpipe. Refer to Figure 5.2 for the required size of box gutters.

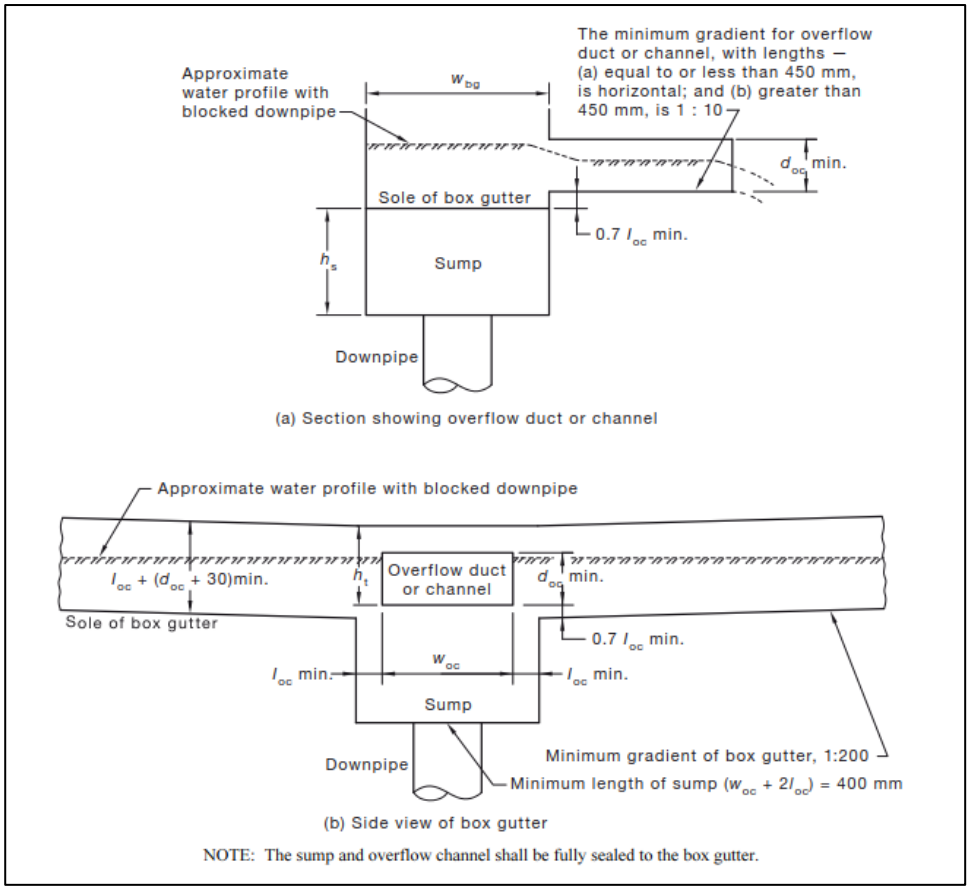


Figure 5.2: Sump/Side Overflow Device Dimensions (Source AS3500.3-2015)

The flow was calculated using a rainfall intensity of 273.6mm/hr for a 100 year ARI, 5 minute rainfall event. The rainfall data was taken from the Bureau of Meteorology Rainfall IFD Data System using local coordinates. In accordance with AS3500.3, the maximum allowable flow in a box gutter is 16L/s. Resultantly, the maximum area that can reticulate to a downpipe is 211m^2.

A maximum area of 147.6m^2 was adopted to account for blockages in the downpipes, which would generate a flow of 11.2L/s. The box gutter for each roof area was sized in accordance with the maximum flow reticulating through any of its downpipes. The graphs in Figures 14 and 16 within AS3500.3-2015 were utilised to determine the minimum size of the box gutters based on the flow in the downpipes. Refer to Table 5.1 for the sizing of the box gutters and downpipes for the roof areas.

Table 5.1: Downpipe and Box Gutter Sizing

Parameter	Value
Total Flow Generated (L/s) for 1% AEP storm event	72.2
Flow Generated from Largest Roof Catchment (L/s)	11.2
Total No. of Downpipes	9
Diameter of Downpipes (mm)	150
Width of box gutter - w_{bg} (mm)	450
Height of box gutter (mm)	175
Depth of sump - h_s (mm)	110
Overflow Duct/Channel Details	
Width of overflow channel	300
Depth of channel - d_{oc} (mm)	100
Length of channel - l_{oc} (mm)	45
Height of overflow channel above sump – 0.7 l_{oc} (mm)	35

6. WATER QUALITY MANAGEMENT

6.1 Potential Pollutants Generated

The pollutants that could be potentially generated as a result of the development use are as follows:

- Gross pollutants, e.g. Litter;
- Sediment;
- Nutrients (Nitrogen and Phosphorus), and;
- Hydrocarbons.

The development area will be modelled to demonstrate the performance of the stormwater treatment system utilising a program called MUSIC (Model for Urban Stormwater Improvements Conceptualisation). MUSIC models the proposed stormwater treatment devices and estimates their respective performance against the performance targets of the project. The pollutants modelled in MUSIC are Gross Pollutants, Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN).

6.2 Regulatory Requirements

With reference to the *Northern Beaches Council PL850 Water Management Policy, 2017, Section 8.1 Table* 4, the water quality requirements are presented in Table 6.1 below and have been incorporated into the design to ensure adequate water quality treatment is provided to the system.

Table 6.1: Warringah Council Pollutant Reduction Requirements

Pollutant	Reduction Percentage (%)
Gross pollutants	90%
Total suspended solids	85%
Total Phosphorus	65%
Total Nitrogen	45%

6.3 Rainfall

The rainfall data to be used in the MUSIC model will be based on the Bureau of Meteorology data from a Sydney rainfall station.

Table 6.2: Rainfall Data for MUSIC Modelling

Rainfall Station	Rainfall Period	Rainfall Period Dates	Time Step
066062 Sydney Observatory	5 years	1 Jan 1981 – 31 Dec 1985	6 minutes

Table 6.3: Monthly Evapotranspiration Data for MUSIC Modelling

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PET (mm)	180	135	128	85	58	43	43	58	88	127	152	163

6.4 Rainfall Runoff Properties

In accordance with the NSW MUSIC Modelling Guidelines, August 2010, Table 6.4 and Table 6.5 present the rainfall runoff properties which have been used in the MUSIC model.

Table 6.4: Soil Properties for MUSIC Source Nodes

Parameter	Units	Urban
Impervious Area Parameters		
Rainfall Threshold	mm	1.0 (for roads/paths etc.) 0.3 (for roofs) & 1.5 (for driveways)
Pervious Area Parameters		
Soil Capacity	mm	120
Initial Storage	%	30
Field Capacity	mm	80
Infiltration Capacity Coefficient – a		200
Infiltration Capacity Coefficient – b		1.0
Groundwater Properties		
Initial depth	m	10
Daily Recharge Rate	%	25
Daily Baseflow Rate	%	5
Deep Seepage	%	0

Table 6.5: Stormwater Water Quality Parameters for MUSIC Source Nodes

Land-Use Category		Log_{10}TSS (mg/L)		Log_{10}TP (mg/L)		Log_{10}TN (mg/L)	
		Storm Flow	Base Flow	Storm Flow	Base Flow	Storm Flow	Base Flow
General Urban	Mean Std Dev	2.43 0.32	1.20 0.17	-0.30 0.25	-0.85 0.19	0.34 0.19	0.11 0.12
Roof Areas	Mean Std Dev	1.30 0.32	* *	-0.89 0.25	* *	0.30 0.19	* *

*Base flows are only generated from pervious areas; therefore these parameters are not relevant to impervious areas

6.5 MUSIC Model Catchment Area and Treatment Plan

The MUSIC model's total catchment area to be treated is 0.374 Ha. Refer to Table 6.6 for a breakdown of the MUSIC model catchment areas and Figure 6.1 for an illustration of the MUSIC model catchment plan.

Table 6.6: Breakdown of MUSIC Model Catchment

Catchment	Total Area (Ha)
To Stormfilters	
Roof Catchment to OSD	0.0572
Roof Catchment to RWT	0.0591
Road Surfaces	0.154
Landscaped Areas	0.104
Total	**0.374**
To Enviropods	
Road Surfaces	0.154
Landscaped Areas	0.104
Bypass	
Road Surfaces	0.006

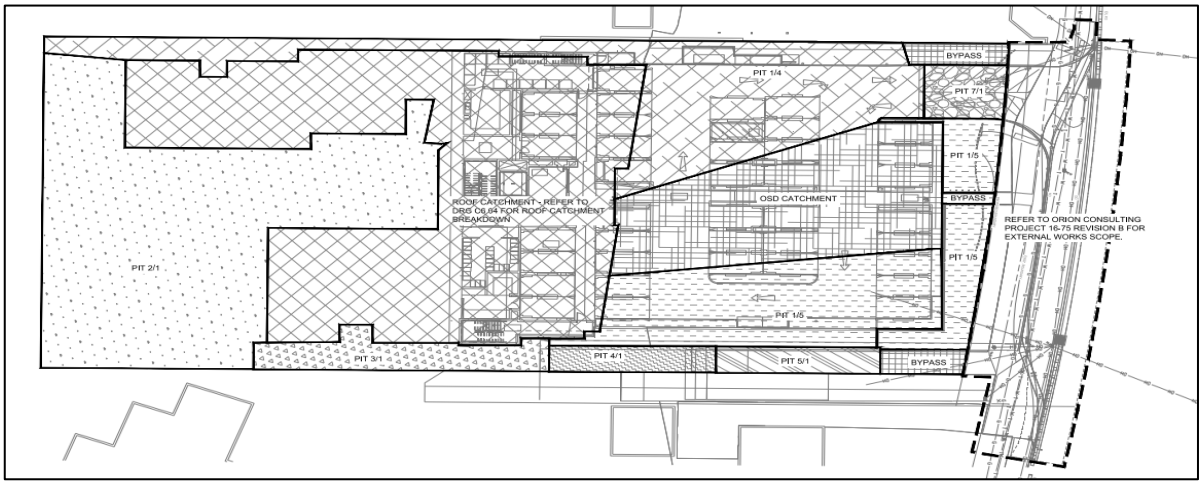


Figure 6.1: MUSIC Model Catchment Plan

The proposed site treatment will utilise two products by Stormwater 360. The first level of treatment will include Enviropods, which intercept surface runoff at the pit grates and filter the runoff prior to entering the piped stormwater system. It is proposed that all nine (9) proposed grated stormwater pits on site will be fitted with enviropod filter baskets. The Enviropod is fitted with a monofilament 200 micron pore size filter bag that removes gross pollutants such as sediment, trash and debris as well as suspended solids; Refer to Figure 6.2 below for an illustration of a typical Enviropod.

Figure 6.2: Typical Enviropod Filter

The second treatment device which will be incorporated into the system is a stormfilter system that will be contained within a sectioned area of the OSD storage tank. To achieve the reduction targets, eighteen (18) Stormwater360 690mm phosphorous absorption cartridges will need to be installed into the OSD tank. A Psorb Stormfilter cartridge system is provided to remove any remaining suspended sediments and nutrients which have entered the stormwater system, Refer to Figure 6.3 below for an illustration of a typical Psorb Stormfilter.

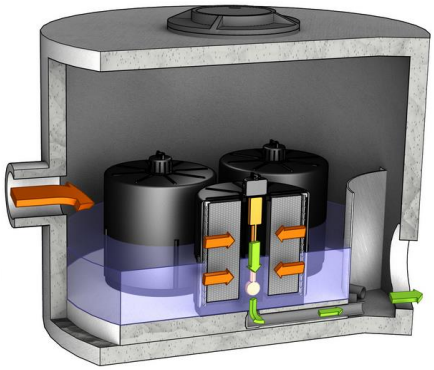


Figure 6.3: Typical PSorb Stormfilter

6.6 Rainwater Tank Reuse

The rainwater reuse demand for irrigation has been calculated based on an average water demand assumption, which is presented below in Table 6.7. It has been assumed that rainwater shall be reused for irrigation only.

Table 6.7: Average Yearly Water Demand

Use	Average Water Demand
Turf & Garden Irrigation	0.4 kL/Year/m²

Refer to Table 6.8 for the irrigation demand calculation.

Table 6.8: Average Daily Irrigation Water Demand

Use	Average Water Demand	Area to be Irrigated (m²)	Average Daily Demand (kL/Day)
Turf & Garden Irrigation	0.4 kL/Year/m²	1204	1.32

Therefore, the estimated total daily water demand for the rainwater reuse tank is 1.32 kL/Day.

6.7 MUSIC Modelling Results

The stormwater quality treatment system has been modelled using the MUSIC software. Refer to Figure 6.4 for the stormwater treatment plan and Table 6.9 for the MUSIC modelling results.

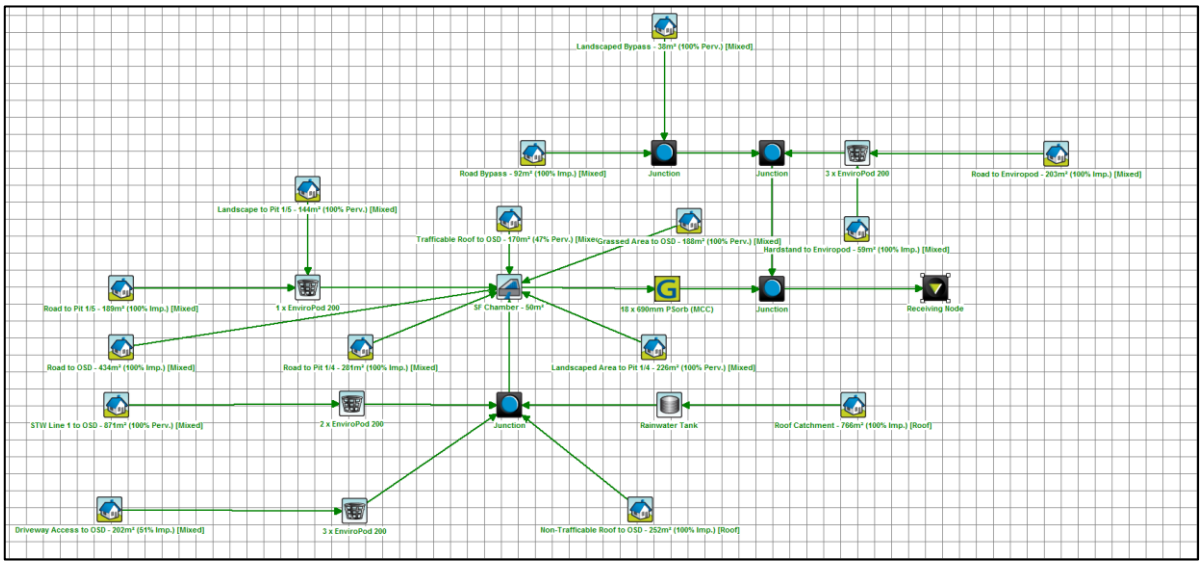


Figure 6.4: Stormwater Treatment Plan

Table 6.9: MUSIC Model Results

Pollutant	Sources	Residual Load	% Reduction	Target %
Gross Pollutants (GP)	70.1	2.31	96.7	90
Total Suspended Solids (TSS)	629	93.9	85.1	85
Total Phosphorus (TP)	1.22	0.324	73.5	65
Total Nitrogen (TN)	7.57	3.37	55.5	45

7. SEDIMENT AND EROSION CONTROL

7.1 Site Protection Measures

It is proposed to provide the following in order to inhibit the movement of sediment off the site during the demolition and construction phases.

7.1.1 Site Access

Construction vehicles leaving the site shall be required to pass over a Temporary Construction Vehicle Entry consisting of a 1.5m long by 3m wide ‘cattle rack’.

7.1.2 Sediment Control

All exposed earth areas where it may be possible for runoff to transport silt down slope shall be protected with a sediment and erosion control silt fence generally installed along the boundaries of the site.

The fence will be constructed in accordance with details provided by the Department of Conservation and Land Management incorporating geotextile fabric which will not allow suspended particles greater than 50mg/L non-filterable solids to pass through, and as such comply with the appropriate provisions of the Clean Waters Act 1970.

The construction of the silt fence will include the following: -

- Geotextile fabric buried to a maximum of 100mm below the surface;
- Overlapping any joins in the fabric;
- Turning up on the ends for a length of 1 metre in order to prevent volumes of suspended solids escaping in a storm event;
- Any Council owned road kerb entry and or gully pits will be protected by Atlantis Filter Bales and EcoSock. Additional protection will be provided by inserting Water Clean Filter Cartridges into the gully opening, and;
- Internal site drainage pits shall be protected by Sediment Traps consisting of hay bales.

7.2 Temporary Stormwater System (where required)

Site runoff within the zones of the excavation will be drained into a central holding well within the excavation. Runoff will be allowed to settle out suspended particles and debris and an acceptable water of 50mg per litre of Non Filterable Residues (NFR) is required to be achieved prior to discharge.

7.2.1 Dust Control

The following dust control procedures will be adhered to:

- Loose loads entering or leaving the site will be securely covered by a tarpaulin or like material in accordance with RMS and local Council Guidelines.
- Soil transport vehicles will use the single main access to the site.
- There will be no burning of any materials on site.
- Water sprays will be used across the site to suppress dust. The water will be applied either by water sprinklers or water carts across ground surfaces whenever the surface has dried out and

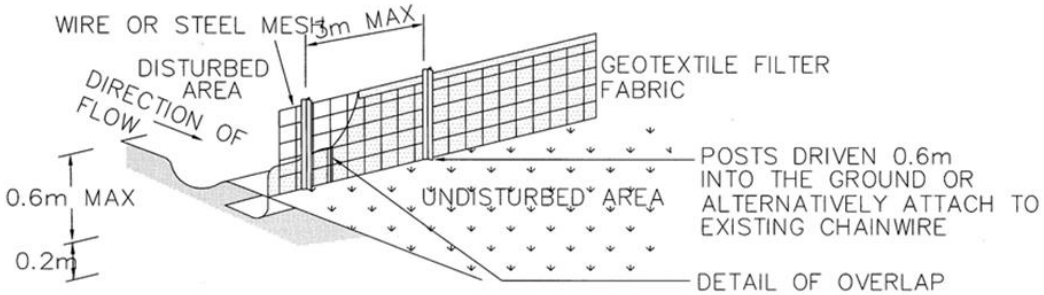
has the potential to generate visible levels of dust either by the operation of equipment over the surface or by wind. The watercraft will be equipped with a pump and sprays.

- Spraying water at the rate of not less than three (3) L/s and not less than 700kPa pressure. The area covered will be small enough that surfaces are maintained in a damp condition and large enough that runoff is not generated. The water spray equipment will be kept on site during the construction of the works.
- During excavation all trucks/machinery leaving the site will have their wheels washed and/or agitated prior to travelling on Council Roads.
- Fences will have shade cloth or similar fabric fixed to the inside of the fence.

7.2.2 Maintenance

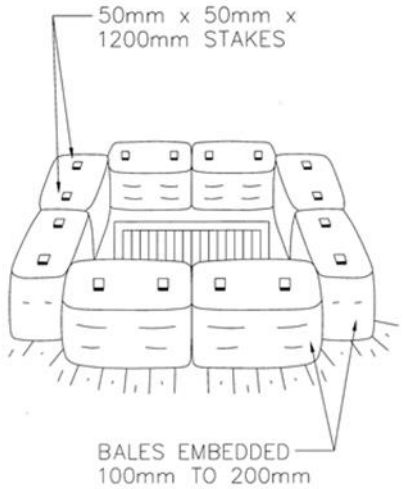
- It will be the responsibility of the site foreman for the building contractor to ensure sediment and erosion control devices on site are maintained. The devices shall be checked daily and the appropriate maintenance undertaken as necessary.
- Prior to the closing of the site each day, the road shall be swept and materials deposited back onto the site.
- Gutters and roadways will be kept clean regularly to maintain them free of sediment.
- Appropriate covering techniques, such as the use of plastic sheeting will be used to cover excavation faces, stockpiles and any unsealed surfaces;
- If dust is being generated from a given surface, and water sprays fail;
- If fugitive emissions have the potential to cause the ambient as quality to foul the ambient air quality;
- The area of soils exposed at any one time will be minimised wherever possible by excavating in a localised progressive manner over the site; and,
- Materials processing equipment suitable comply with regulatory requirements. The protection will include the covering of feed openings with rubber curtains or socks.

It is considered that by complying with the above, appropriate levels of protection are afforded to the site and the adjacent public roads, footpaths and environment.



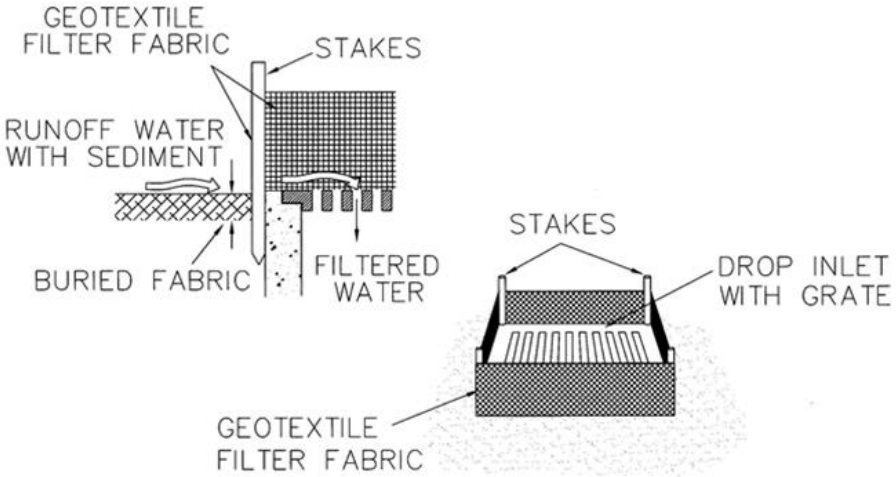
SEDIMENT CONTROL FENCE

NTS



STORMWATER PIT
SEDIMENT TRAP

NTS



GEOTEXTILE FILTER FABRIC DROP INLET
SEDIMENT TRAP

NTS

Atlantis Sediment Control Filter Bales

What are FilterBales?

Water Clean FilterBales are a unique new patented 7 stage sediment filter device developed to substantially reduce the migration of sediment and contaminants into drainage systems while allowing filtered water to easily pass through. FilterBales reduce customers' time and money by providing solutions to comply witht environmental and regulatory requirements.

Durable, Dependable, Reusable.
Replacing hay bales and other inadequate attempts to stop sediment run-off, FilterBales are durable and re-useable, effectively stopping your money from "pouring down the drain". They are also lightweight and easy to handle. Replaceable Water Clean Filter Cartridges guarantee peak performance is maintained.

Ask your local FilterBales stockist about replacement frequencies in your area. Cartridges and filter covers should be changed when the infiltration rate decreases. Water Clean FilterBales are suitable for a wide range of sediment and water management situations and can be easily secured in place for long term use. The unique multi-directional filter system allows you to position Water Clean FilterBales in any direction without reducing performance.
Water Clean FilterBales can be fixed to concrete or bitumen surfaces using an epoxy mortar-binder or fixed to earth surfaces using 6-10 mm pegs or stakes. When positioning, the side with the red reflective marker should be facing traffic.

www.atlantiscorp.com.au

1. FilterBales frames are a perforated plastic structure made from recycled wheelie bins, battery cases, milk bottles etc.

2. Filter medium (bio engineered soil media) used in the filter cartridges is made from a special blend of recycled organic (RO) materials from kerbside and vegetation drop off centres. The RO hosts enhanced naturally occurring micro-organisms. The blend also contains natural minerals to capture nutrients. The filter medium is as safe as normal soil.

3. FilterBales have a seven (7) stage filtration system:

1. In through the filter bag
2. Through the perforated plastic structure wall
3. In through the filter cartridge bag
4. Through the bio engineered filter medium
5. Out through the filter cartridge bag
6. Out through the perforated plastic structure wall
7. Out through the filter bag

4. The filter bag is made from 300-micron (one third of a millimetre) pore size geotextile. This is the first stage that filters much of the sediment and other suspended solids from the run-off water. The geotextile is designed to stop sediment and reduce clogging but allow water to pass through easily. The filter cartridge bags are made from a similar geotextile.

5. FilterBales work effectively up to "a one-in-one-year 48 hours, 100 mm "storm events". This is the largest storm event experienced since the commercialisation of FilterBales. Having handled this easily, Filter Bales are considered capable of handling much greater "storm events". During these storm events FilterBales were used inside gully pits in one application and on the ground surrounding the gully pit in another application.

6. EcoSocks are made from a similar geotextile to the filter cartridge bags and contain the same bio engineered soil media as the FilterBales. They appear able to stand up to as much wear and tear as a sandbag.

7. FilterBales are much lighter (at around 15 kgs dry weight) than hay bales. This reduces exposure to Occupational Health and Safety problems

Product Range

Item No.	Description	
HFB001	**High FilterBale,** suitable for high flow situations and higher retention time applications. Contains two standard size WaterClean Filter Cartridges in upright formation to treat contaminated waters. (605mm x 485mm x 460mm)	
LFB002	**Low FilterBale,** suitable for low flow situations and kerb & gutter applications. Multi-directional module containing two standard size WaterClean Filter Cartridges. (605mm x 485mm x 220mm)	
ESF004	**Directional EcoSock,** can be used in conjunction with FilterBales to direct water. Will also provide some sediment filtration from seepage through bio-remediating media contained within the EcoSock (1135mm x 160mm x 30mm)	

Accessories

Item No.	Description	
FCR004	**WaterClean Filter Cartridges** contain a unique blend of fixating and bio-remediating products that treat common pollutants. To achieve maximum performance, each FilterBale uses two WaterClean Filter Cartridges. (440mm x 400mm x 100mm)	
HBC005 (High bale)	**Replaceable FilterBale covers,** made from specially designed geotextile. FilterBale covers have a standard aperture of 300 microns.	
HBC006 (Low bale)	**Replaceable FilterBale covers,** made from specially designed geotextile. FilterBale covers have a standard aperture of 300 microns.	

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Atlantis Water Management

V3-20/06/01

SCHEDULE 1 OSD CHECKLIST

SCHEDULE 2 MUSIC RESULTS

APPENDIX 8 – OSD Checklist

Warringah Council

On-site Stormwater Detention (OSD) Checklist

For Single Dwelling Residential Developments

This form is to be used to determine if OSD will be required for demolition and reconstruction, or construction of new single dwelling residential developments and **must be completed and included with the submission of any development application for these works**. Please read both sides of this form carefully for its applications, guidelines and definitions.

For assistance and support, please contact Council's Customer Service Centre on (02) 9942 2111.

Address of Proposed Development	
Address of proposed development	Lot: 1-3 DP (if applicable): 25050 No.: 723-727 Street: Warringah Road Suburb: Forestville
PART 1 Exemption for properties that drain naturally away from the street	
Tick one only	Does the site fall naturally away from the street? Yes ☐ No ☒ If yes, stormwater drainage must be in accordance with Council's Policy No. PDS-POL 136 'Stormwater Drainage from Low Level Properties'. If no, proceed to the next part.
PART 2 Is the site area less than 450m^2	
Tick one only	Yes ☐ No ☒ If yes, OSD is not required. If no, proceed to next part.
PART 3 Exemption for Direct Discharge to Ocean	
Tick one only	Does the site of the development drain directly to the ocean without the need to pass through a drainage control structure such as a pipe, bridge, culvert, kerb and gutter or natural drainage system? Yes ☐ No ☒ If yes, OSD is not required. If no, proceed to the next part.

PART 4 Exemption for Flood Affected Areas

Tick one only	Is the site of the development located within an established Flood Prone Land as referred to in the Warringah Local Environmental Plan? Refer to section 2.6 of Council's OSD Technical Specification. Yes ☐ No ☒ If yes, OSD is not required. If no, proceed to the next part.

PART 5 Determination of OSD Requirements

3.1 Calculations Please view below examples	(a) Site area 4118 m^2 x 0.40 = 1647 m^2 (b) Proposed and remaining impervious area 2468 m^2 **OSD will not be required when (a) is greater than (b)** Is OSD required for this development (tick one only) Yes ☒ No ☐ If yes, then a design in accordance with the Streamlined Method in Council's OSD Technical Specification is to be provided with the Development Application (refer to Clause 3.1.1) If no, OSD is not required.
3.2 Example	If the proposed combined impervious area is greater than 40% of the site area, then OSD is required. *Example 1*: Site Area = 600m^2 Total proposed & remaining impervious area = 290m^2 600 x 0.4 = 240m^2 (290 > 240) OSD required *Example 2*: Site Area = 800m^2 Total proposed & remaining impervious area = 290m^2 800 x 0.4 = 320m^2 (290 < 320) OSD is **not** required

DEFINITIONS

Designed to help you fill out this application	**Site area:** This refers to the area of the land bounded by its existing or proposed boundaries. **Impervious areas:** This refers to driveways, pathways, paved areas, hardstand areas, roofed areas, garages and outbuildings that are proposed and to be retained. Where an existing structure is to be demolished to make way for a new dwelling, only the proposed impervious areas and remaining impervious areas are to be used in the calculations. No credit is given for existing impervious areas that are not retained.

NOTES

Please read before filling out this form	1. Other works, ancillary buildings, commercial, industrial, subdivisions and multiple occupancy developments are to comply with Council's **OSD Technical Specification**. 2. A reduction in the OSD volume required may be permitted. Refer to Council's "OSD Rainwater Re-use Policy for Single Residential Dwellings". If OSD is required, then a design for OSD in accordance with Council's "OSD Technical Specifications" is to be provided with the development application.

Receiving Node

1/05/2018 10:22:33 AM

Treatment Train Effectiveness

	Flow (ML/yr)	TSS (kg/yr)	TP (kg/yr)	TN (kg/yr)	Gross Pollutants (kg/yr)
Sources	3.46	629	1.22	7.57	70.1
Residual Load	3.09	93.9	0.324	3.37	2.31
% Reduction	10.7	85.1	73.5	55.5	96.7