STORMWATER MANAGEMENT REPORT

Proposed Aged Care Facility

181 Forest Way, Belrose

September 2018

Rev A

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ISSUE AND REVISION RECORD

Issue	Date	Purpose	Prepared By	Checked By	Approved By
A	20/06/2017	Issue for DA	KL	JRH	JRH
B	10/09/2018	Re-Issue for DA	JH	GL	GL

1 INTRODUCTION

1.1 Project Description

ACOR Consultants have been engaged to prepare the stormwater design, including an On-Site Stormwater Management Plan for the proposed development at 181 Forest Way, Belrose. The proposed development comprises the establishment of new aged care facility catering for 138 beds and 51 car parking spaces.

This report documents the methodology involved in determining the design of the proposed stormwater drainage system for the proposed development, including the stormwater quantity and quality management.

1.2 Guidelines and Standards

The stormwater system and Water Sensitive Urban Design (WSUD) design is based on notes taken from the pre-lodgement meeting (PLM/2016/0097) held on 13 October 2016 – in particular, Clause 76 – Management of Stormwater and Clause 78 – Erosion and sedimentation.

To that end, it satisfies the following local authority and water authority requirements:

- Warringah Council PL 850 Water Management Policy
- Warringah Council On-site Stormwater Detention Technical Specification
- Warringah Council Creek Management Study (March 2004)
- NSW MUSIC Modelling Guidelines (August 2015)

2 EXISTING SITE

The site occupies approximately 2.1 hectares. It falls to the east, at between 5 to 25%. Most of the site has been cleared of trees. There is a large brick residence, semi-detached garage, two detached sheds and a pool on the western side of the site.

Adjacent to the western site boundary is Forest Way. Existing road pit and pipe system commences on the median strip and continues along the kerb and gutter on the western side of the roadway. There is no existing underground drainage on the eastern side of the roadway bordering the site.

Approximately 200m east (downstream) of the site is Snake Creek. This creek is situated within an Endangered Ecological Community, under both the Threated Species Act 1995 and Environment Protection and Biodiversity Conservation Act 1999.

Water quality parameters for Snake creek can be found in the Warringah Creek Management Study, Table 3.3. The values are summarised in Table 1 for convenience:

Table 1 – Pollutant Concentrations for Snake Creek

Pollutant	Concentration
Suspended Solids (mg/L)	1
Total Nitrogen (mg/L)	0.3
Nitrate and Nitrite (mg/L)	0.1
Total Phosphorous (mg/L)	< 0.01
Ortho-Phosphorus (FRP) (mg/L)	< 0.01
Biological Oxygen Demand (mg/L)	< 2
Faecal Coliforms	---

These values were taken from a single monitoring program, during fine weather conditions (low flow). During larger storm events, the values would increase substantially (p10. of Creek Management Study).

3 PROPOSED STORMWATER DRAINAGE

3.1 Proposed Layout

Stormwater from the proposed development is to be directed into an underground pit and pipe system and discharged via sheet flow through the eastern (downstream) end of the site. We note that On-site Detention is required for site to attenuate post-development flows.

3.2 Proposed Post-Development Flow

The proposed stormwater system is to store and release stormwater so that the post-development flows do not exceed pre-development flows from the site for the 20%, 5% and 1% AEP storm events (in accordance with Warringah Council On-site Stormwater Detention Technical Specification – 4.3 Pre and Post Development Runoff for Full Computation Method). Flows were modelled in the computer software package Drains (see attached Drains file), and the tank configuration and orifice sizing were obtained correspondingly.

The parameters used are summarised in Table 2, with results given in Table 3. Screenshots of the Drains model is shown in Appendix C, with outputs for the 20%, 5% and 1% AEP flows.

Table 2 – Parameters used in Drains model

Parameter	Pre-dev value	Post-dev value
Total catchment area (ha)	0.7932	0.7932
Paved area (%)	0	65.4
Supplementary area (%)	0	0
Grassed area (%)	100	34.6
Flow path length (m)	100	100
Flow path slope (%)	12	12
Paved Retardance coefficient *	0.012	0.012
Grassed Retardance coefficient *	0.33	0.33

* Values taken from Appendix 6 of On-site Stormwater Detention Technical Specification.

Table 3 – Pre and Post-Development Flows

Storm events	Flows (L/s)
Q5 Pre-development	132
Q5 Post-development	125
Q20 Pre-development	222
Q20 Post-development	157
Q100 Pre-development	330
Q100 Post-development	300

It was found that 240m^3 of storage was sufficient.

Based off these figures, we have decided to provide 240m^3 of storage for the proposed development.

The details of the proposed layout will be as shown in Appendix A.

4 STORMWATER QUALITY MANAGEMENT

The proposed stormwater quality treatment system has been designed in accordance with Warringah Council Water Management Policy, Section 8.1 Table 3. In particular the policy notes ‘stormwater quality shall not impact receiving waters’ and ‘reference shall be made to local data if available, including the Warringah Creek Management Study.’

Refer to Table 1 in Section 2 of this report for the existing pollutant concentrations in Snake Creek. It should be noted that the majority of these concentrations are below those of ANZECC trigger levels, which are already very low.

The treatment measures necessary to achieve such a level of pollutant removal are significant; they are described in the following section.

4.1 Stormwater Quality Treatment Train

Primary treatment is provided via pit inserts – these will capture the litter, debris and other gross pollutants as water collects from the roof, hardstand and landscaped areas. It is proposed that the Stormwater360 Enviropod (1600 micron), be installed in all pits on the site.

Once the first pass of treatment has been complete, water flows into the OSD tank, where sediments further settle. Trash screens are installed before the two orifice plates, not only to prevent blockage but to also prevent rubbish from entering downstream.

Discharge from the OSD then flows into a bio-retention basin for secondary treatment. A large reduction in phosphorus and nitrogen removal was achieved by establishing a bio-retention basin with surface area 150 m^2. Refer to the MUSIC model attached for parameters used to model this basin. Even so, it was insufficient to bring the levels down to that shown in Table 1, Section 2 of this report.

To achieve the removal levels required to meet the targets, further tertiary treatment is provided downstream of the bio-retention basin. To that end, two Stormwater360 Jellyfish filters (JF1800) will be connected in series to provide the necessary reduction.

The MUSIC model of the setup is shown in Appendix B, and is also attached.

Table 4 – MUSIC Output – Post-development pollutant concentrations

Parameter	Existing Concentrations in Snake Creek (under optimal weather conditions)	Post-development discharge concentrations from site (mean concentrations)
Total Suspended Solids (mg/L)	1.0	0.0264
Total Nitrogen (mg/L)	0.3	0.147
Total Phosphorous (mg/L)	<0.01	0.00979

As can be seen in Table 4 above, the mean concentrations of TSS, TN and TP from the post development stormwater runoff are lower than the sample values taken from Snake Creek during a fine day. These results exceed the requirements set by Warringah Council's stormwater management policy.

5 CONCLUSION

As can be seen from the report, a variety of measures have been taken to address both the stormwater quantity and quality requirements pertaining to the aged care development at 181 Forest Way, Belrose.

In particular:

- Stormwater discharge from the proposed development is not greater than the existing flows for the 20%, 5% and 1% AEP events
- Site stormwater has lower pollutant concentrations than that existing in Snake Creek during a fine day.

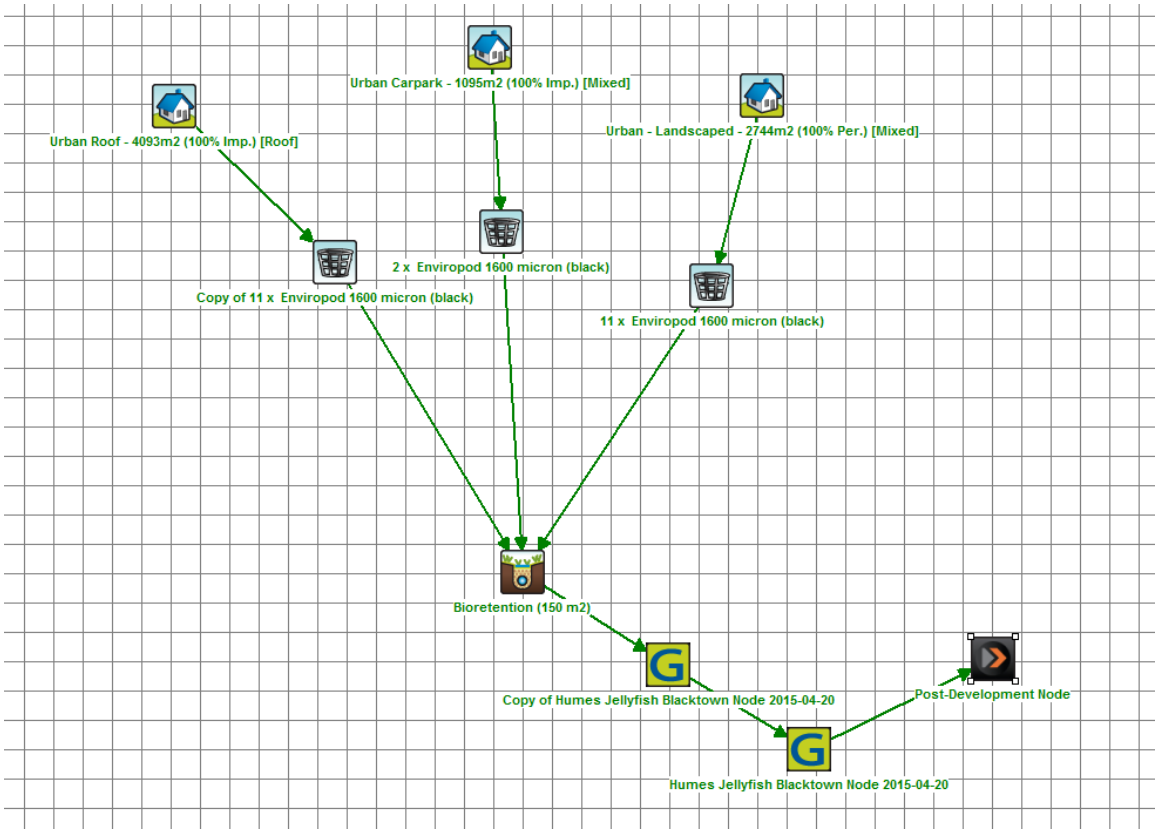
APPENDIX A – ACOR Consultants Drawings

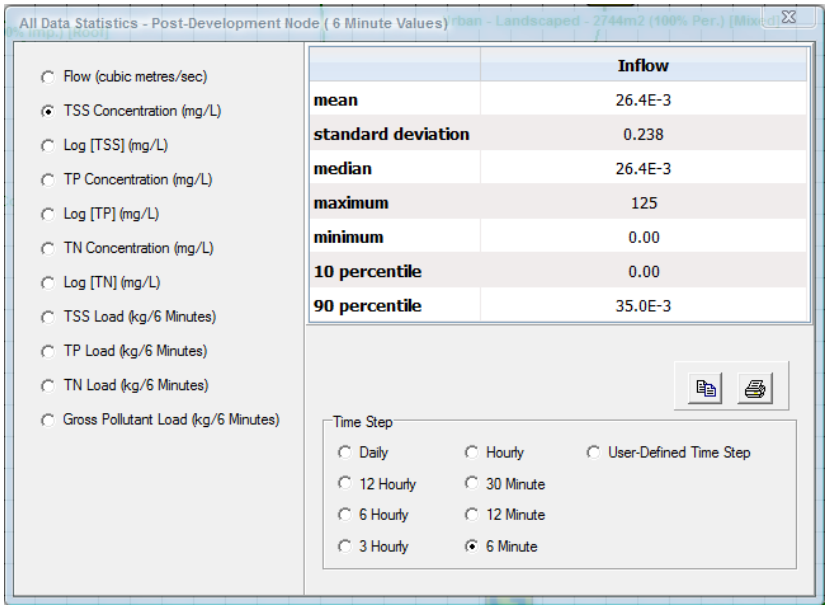
ACOR Consultants Drawings:

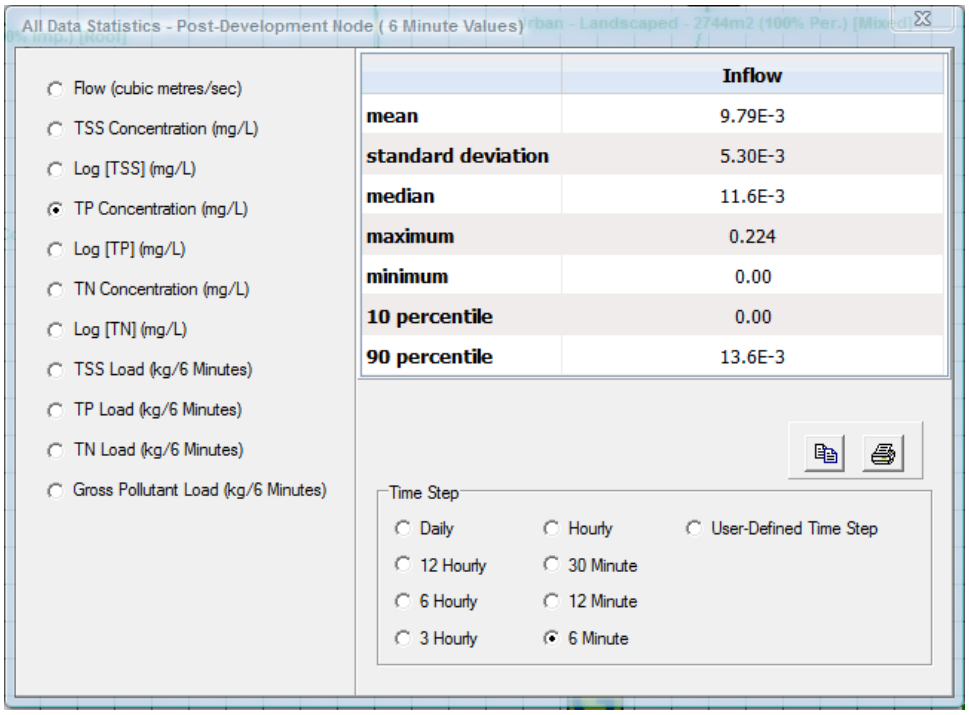
- C1.01 – Cover Sheet, Notes and Legends
- C1.05 – Details Sheet 1
- C1.06 – Details Sheet 2
- C1.07 – Details Sheet 3
- C3.01 – Storm Water Management Plan
- C4.01 – Soil Erosion and Sediment Control Plan

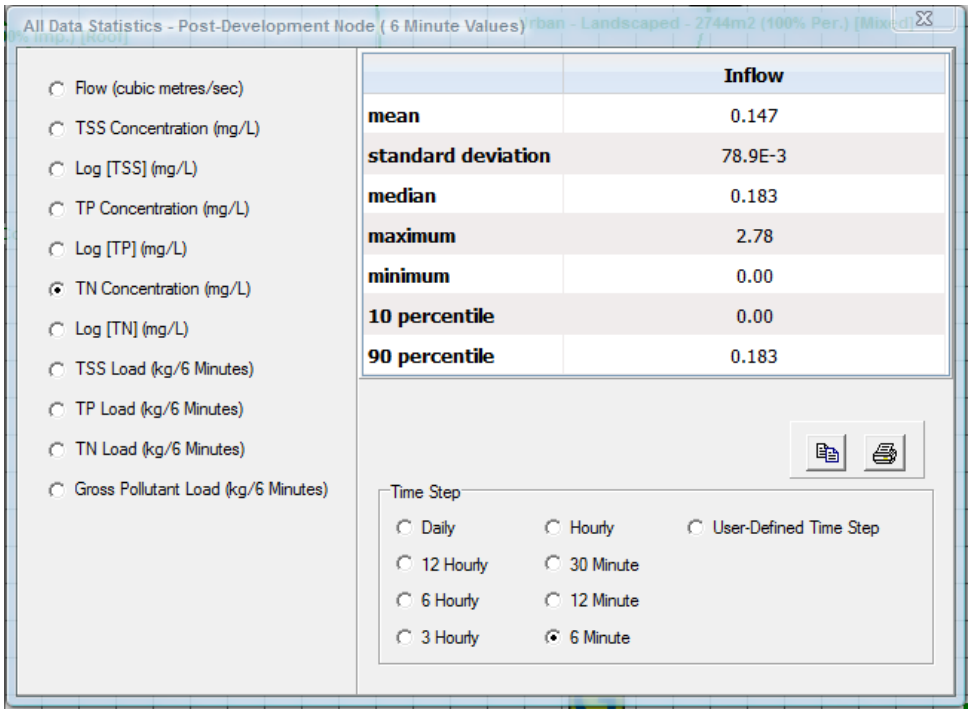
APPENDIX B – MUSIC Model

Figure 1 - MUSIC Model Layout and Results for the proposed development






All Data Statistics - Post-Development Node (6 Minute Values)
Flow (cubic metres/sec)
TSS Concentration (mg/L)
Log [TSS] (mg/L)
TP Concentration (mg/L)
Log [TP] (mg/L)
TN Concentration (mg/L)
Log [TN] (mg/L)
TSS Load (kg/6 Minutes)
TP Load (kg/6 Minutes)
TN Load (kg/6 Minutes)
Gross Pollutant Load (kg/6 Minutes)
Inflow
mean 9.79E-3
standard deviation 5.30E-3
median 11.6E-3
maximum 0.224
minimum 0.00
10 percentile 0.00
90 percentile 13.6E-3
Time Step
Daily
Hourly
User-Defined Time Step
12 Hourly
30 Minute
6 Hourly
12 Minute
3 Hourly
6 Minute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Log [TSS] (mg/L)
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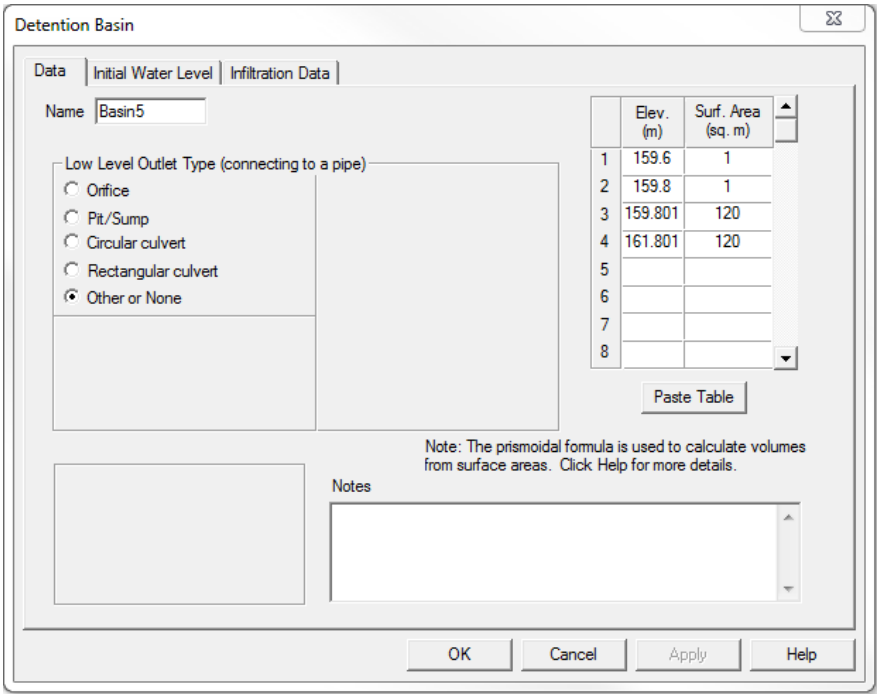
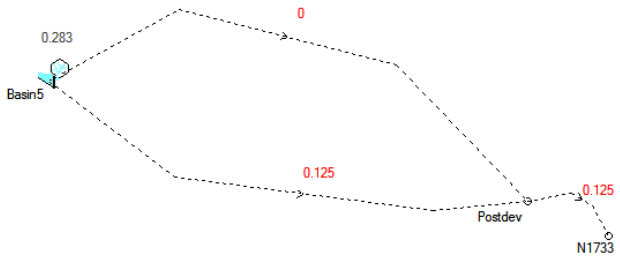
Log [TP] (mg/L)
TN Concentration (mg/L)
Log [TN] (mg/L)
TSS Load (kg/6 Minutes)
TP Load (kg/6 Minutes)
TN Load (kg/6 Minutes)
Gross Pollutant Load (kg/6 Minutes)
Inflow
mean 0.147
standard deviation 78.9E-3
median 0.183
maximum 2.78
minimum 0.00
10 percentile 0.00
90 percentile 0.183
Time Step
Daily
Hourly
User-Defined Time Step
12 Hourly
30 Minute
6 Hourly
12 Minute
3 Hourly
6 Minute

APPENDIX C – Drains Model

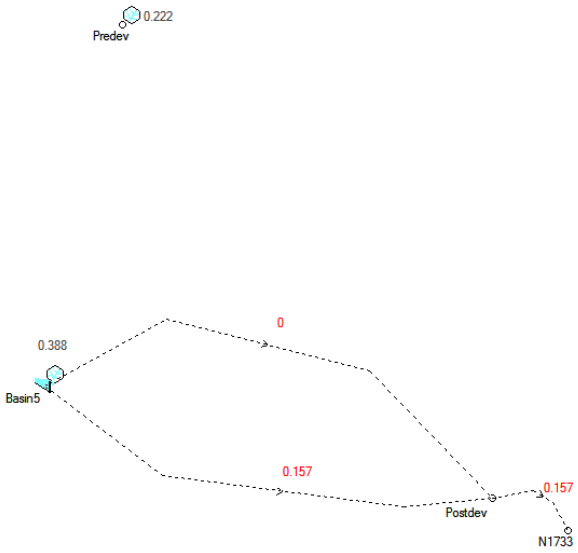
The staged discharge relationship was inputted into an overflow path to model two orifices.

Figure 2 – Drains model

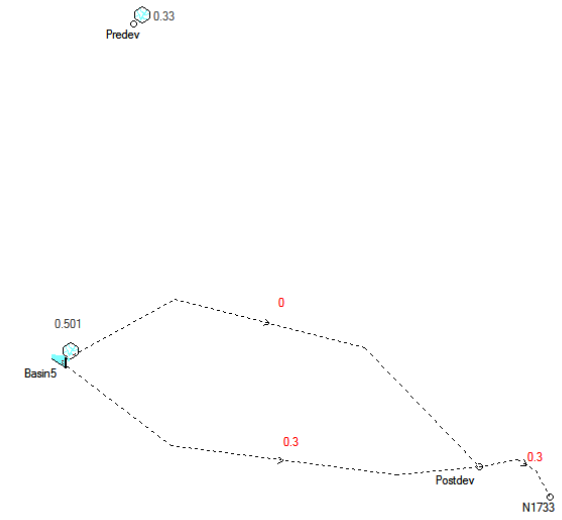




5 year ARI pre vs post-development flows



20 year ARI pre vs post-development flows



100 year ARI pre vs post-development flows