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Engineering

Water Cycle Management Plan

Worimi Ecotourism Development

Property:
Lot 227, DP 1097995
Lavis Lane, Williamtown

Applicant:
Worimi LALC

Date:
June 2019

Working Beyond Expectations

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

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Document Control Sheet

Issue No.	Amendment	Date	Prepared By	Checked By
A	Initial Issue	July 2018	JB	MKE
B	Amended	14th August 2018	JB	MKE
C	Council Comments	June 2019	JB	ML

Executive Summary

ADW Johnson was commissioned by Worimi Local Aboriginal Land Council (LALC) to prepare a Water Cycle Management Plan (WCMP) for a proposed carpark and visitor centre within Lot 227 DP1097995 Lavis Lane, Williamtown. The preparation of this management plan has been undertaken to accompany a Development Application required for the proposed development.

This WCMP is required under Port Stephen's Council's Development Control Plan (DCP) 2014 and is to meet the requirements in relation to total water cycle management, erosion and sediment control, water sensitive design and pre to post flow requirements. A concept stormwater layout has been designed to convey flows effectively from the developed site.

MUSIC modelling has been completed adopting water sensitive urban design measures to demonstrate compliance with the performance target objectives of the DCP.

Stormwater runoff has been modelled using XPRAFTS to determine the flows to the low point of the site in the pre-developed and post-developed scenario. The results of the modelling found that, due to extremely high infiltration rates measured, ponding within the low point will not adversely affect the development or any surrounding sites.

The site is situated in a dune region adjacent to the Worimi Conservation Lands and drains to the Stockton Sandbeds. The site was considered to be potentially within the Hunter Water (HWC) drinking catchment. Confirmation on this was sought from HWC and they have confirmed the Stockton Sandbeds are not a water source and there are currently no future plans for its use. Details of correspondence with HWC can be found in Appendix A.

An erosion and sedimentation control plan has been completed for the proposed development to minimise the risk of erosion to disturbed areas and limit the transport of sediments from the site to downstream waterways during the construction period.

Table of Contents

1.0 Introduction

ADW Johnson was commissioned by Worimi LALC to prepare a Water Cycle Management Plan (WCMP) for a proposed carpark and visitor centre within Lot 227 DP1097995 Lavis Lane, Williamtown. The proposed development will incorporate a carpark, a visitor centre and cabins with access via Lavis Lane. The carpark will include vehicle and quad bike access to various existing and proposed dune tracks. The preparation of this management plan has been undertaken to accompany the Development Application required for the proposed development.

This report documents the means of stormwater treatment and disposal from the proposed carpark and related areas in accordance with the latest Port Stephens Council DCP at the time of this report.

2.0 Existing Site & Proposed Development

2.1 SITE DESCRIPTION

The subject site, as depicted in Figure 1 below, is located within Lot 227 DP1097995 Lavis Lane, Williamtown. The site has a developed area of approximately 1ha.

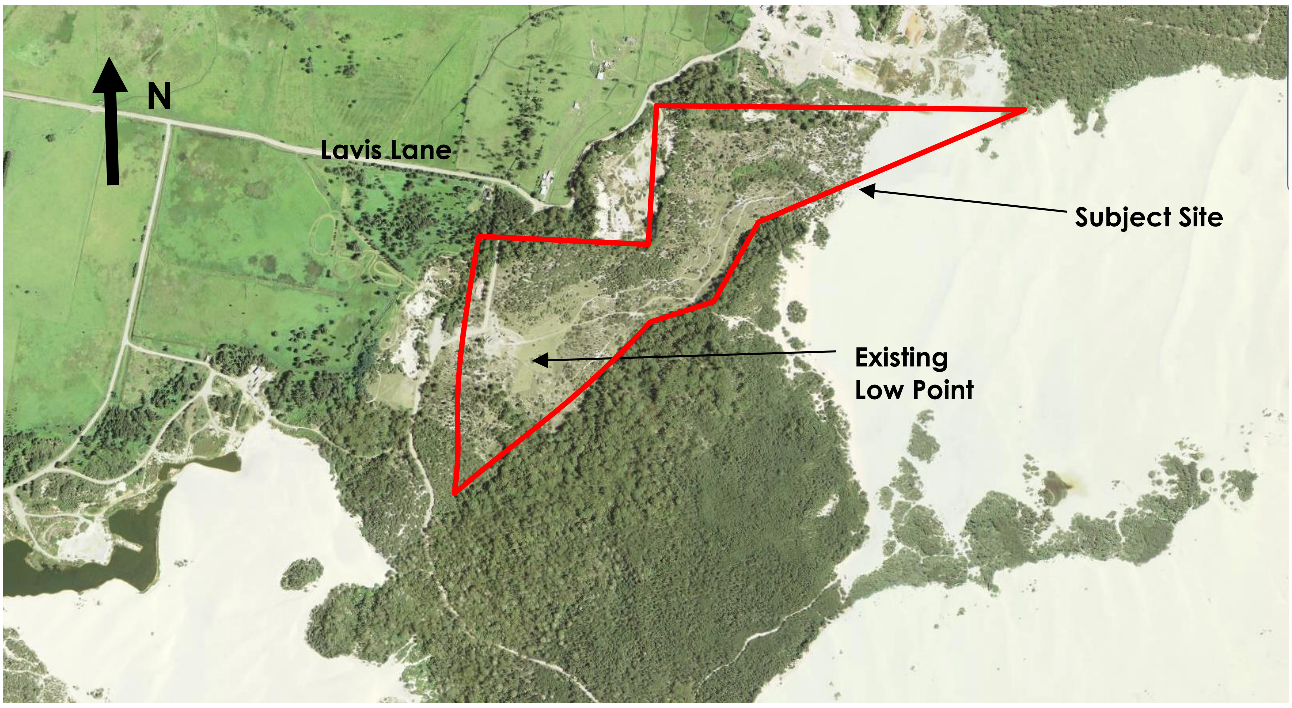


Figure 1: Site Locality (Six Maps Image)

The existing area, as shown in Figure 1, is a sandy site consisting of sand dunes with shrubs adjacent to the Worimi Conservation Lands. The area can be accessed via Lavis Lane and has various tracks throughout leading to Stockton Beach which is approximately 1km away.

The site consists of a ridgeline of varying height between RL 25-35m which loops around an existing low point. The low point has a base RL 3.6m and is located adjacent to the proposed amphitheater area. The developed area consisting of the carpark and visitors centre is located on the western portion of the ridgeline and is connected to the amphitheater via various vehicle/quad bike accessible tracks. Figure 2 shows the proposed development, which can also be seen in Exhibit 001.

The site area contains no watercourses or dams. The distinctive low point does not hold water due to extremely high infiltration into the sandy ground and low-lying water table.

Figure 2: Proposed Development

2.2 GEOTECHNICAL INVESTIGATION

A geotechnical investigation was undertaken by Cardno on the existing site to determine the subsurface conditions including infiltration capacity and water table. The report found the existing soils to be sand with fine to medium grain size.

Infiltration testing was performed within the natural low point of the site to determine the in-situ permeability. The geotechnical report states "The infiltration testing undertaken in the natural dry to moist SAND profile was unable to be performed in accordance with

AS1547-2012, due to the excessive infiltration. Therefore, it is likely that the subsurface infiltration will be greater than 1080mm/hr, however in the absence of test results adoption of this upper bound value is recommended." As per council comments, a factor of safety of 5 has been adopted for this infiltration rate for the given as it is greater than 1000m^2 and would be of minor inconvenience in the event of failure to drain (i.e. minor flooding of access track and amphitheatre). As such, for the purposes of this report an infiltration rate of 216mm/hr has been used (i.e. 1080mm/hr divided by 5).

3.0 Council Requirements

The proposed development is to comply with the following Port Stephens Council documents:

- Port Stephens Council – Development Control Plan (DCP);
- Port Stephens Council – Infrastructure Specification – Design.

All documents have been reviewed and there are several objectives and requirements relating to stormwater management. These objectives are outlined in Section 4.0 and are addressed within this Water Cycle Management Plan.

In addition to the requirements above, Port Stephens Council has issued further information request which details the following requirements to be met for the development:

1. Water Quantity
    a) Amended water quality modelling, achieving the greater of the requirements between NorBE and Port Stephens Council stripping rates as the subject site is located within a Hunter Water Corporation Drinking Water Catchment. – Addressed in Sections 4.3, 7.0 and Appendix A
    b) A copy of the MUSIC Model file and Music Link report including any justification as to any parameters outside required ranges. – See Appendix B for Music Link report.
    c) Justification as to the use of a forest source node despite zoning being contrary. – See Appendix B, forest node has been removed.
    d) Details of the type of GPT proposed and demonstrate how the GPT can achieve the specified targets proposed. – Addressed in Section 7.0.
2. Water Quantity
    a) Detailed hydrological analysis (including model data/results) for internal drainage system to determine flows, velocities, ponding level, erodibility etc. and should include stormwater catchments and subcatchments. – Addressed in Sections 4.2 and 6.0, see Exhibit 001 for further information.
    b) Details to quantify flows reaching the swale, and how the swale is proposed to function as an infiltration system, including retention and storage capacity and any discharged flows to demonstrate what impact this has on surrounding development. – Addressed in Section 7.0.

4.0 Objectives

4.1 CONCEPT STORMWATER DESIGN

A concept stormwater design is required to demonstrate that stormwater runoff can be effectively captured and conveyed off the proposed development and ensure no nuisance runoff occurs onto the existing properties.

4.2 STORMWATER QUANTITY

The aim of stormwater quantity management is to restrict post-developed flows to that of or less than the pre-developed flows up to and including the 1% AEP storm event. A recognised runoff routing method (XPRAFTS) was used for the computation of any detention requirements and site discharge rates.

Stormwater conveyance will be via a pit and pipe network. This network is intended to be privately owned and thus will be designed to AS3600 plumbing and drainage code.

4.3 STORMWATER QUALITY / WATER SENSITIVE URBAN DESIGN

The stormwater drainage system must effectively remove nutrients and gross pollutants from the site.

The stormwater design for the proposed development must adopt Water Sensitive Urban Design (WSUD) principles throughout the development to promote sustainable and integrated land and water resource management.

The guidelines for stormwater quality treatment objectives are dictated by whether the development is within a Hunter Water Drinking Water Catchment or has any impact on such catchment. Appendix A is an email obtained from Hunter Water Corporation confirming that the development is not within a Drinking Water Catchment, nor is there any plans for future use of the area as a Drinking Water Catchment. As such, as outlined in Section B4 of Council's DCP, the requirement for stormwater drainage is to reach Council's water quality stripping targets. Council's water quality stripping targets are expressed as mean annual reductions of pollutant loads. The target objectives were obtained through MUSIC-Link and are shown in Table 1.

Table 1 – Stormwater Treatment Objectives

Pollutant	Stormwater Treatment Objectives
Gross Pollutants	90% retention of the average annual load
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

4.4 EROSION AND SEDIMENTATION CONTROL

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

5.0 Concept Stormwater Design

5.1 CONCEPT STORMWATER DESIGN

The concept stormwater layout has been designed to effectively capture water from both developed and undeveloped areas and convey them away from the site.

The concept design utilises mostly 1-way crossfall within the carpark and accessways leading to a grass lined swale. Stormwater pits and pipes convey flows from the swale to the natural low point. Another grass-lined swale has been designed to direct undeveloped flows away from the developed area (refer to concept engineering plans).

The grass-lined swales will act as a flow path for the stormwater to reach its designated point of discharge. They will also act as a quality control measure for reduction of nutrient and pollutant loads given the high infiltration rates expected. Swales are proposed to have a maximum slope of 3.5%. A GPT will also be installed to collect gross pollutants and litter before discharge.

Due to the sandy ground within the site verified by a geotechnical investigation (inclusive of infiltration testing), stormwater will infiltrate before reaching the low point within the centre of the site. A level spreader has been provided for any excess flows that do not infiltrate during high intensity storm events. XPRAFTS modelling has been used to determine the quantity of flows reaching the low point and any ponding that occurs.

The development also includes singular cabins. It is not proposed to connect these cabins into a formal stormwater network as the small roof catchments will drain onto the surrounding land surface where flow will infiltrate through sandy loam. Small level spreaders may be utilised at the outlets to ensure any minor scour is avoided.

6.0 Stormwater Quantity

The proposed development is required to limit post-development critical peak flows to less than or equal to existing flows for all design storms up to the 100yr ARI design storm event leaving the site.

The pre-developed and post-developed catchments have been determined for the development and are summarised in Table 2 and are shown in Exhibit 001. The catchment considered is all areas draining towards the existing low point as this is where the proposed development will drain to.

Table 2 – Catchments Details

Catch-ment	Subcatchment	Total Area (ha)	% Impervious	Impervious Area (ha)	Pervious Area (ha)	% Slope	Manning's 'n'
Pre-developed	Pre-developed	17.354	0%	0	17.354	15%	0.05
	Carpark	1.091	100%	1.091	0	5%	0.014
Post-developed	Roofs & Access Track	1.190	100	1.190	0	5%	0.014
	Undeveloped Land	15.480	0%	0	16.671	15%	0.05

The site is free draining, as a site inspection and geotechnical investigation (outlined in Section 2.2) revealed the sandy nature of the soils with high infiltration rate. The site can be seen in Figure 3. In addition to this, due to the close proximity to the beach, the water table is expected to reside close to sea level. There is an existing low point within the site that does not reside within an any water course and does not retain water.

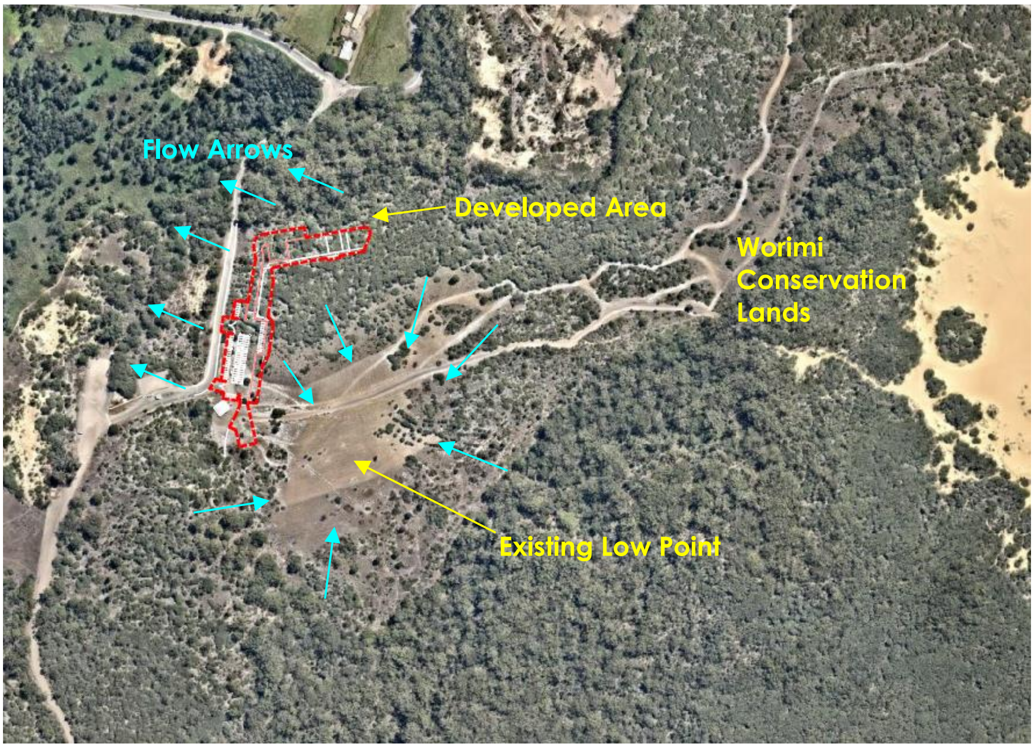


Figure 3: Extents of Developed Area (Shown by Red Boundary) and Existing Site

XPRAFTS modelling was used to determine the flows and ponding within the natural low point to confirm there are no adverse effects to the immediate development (i.e. flooding of the accommodation area) or surrounding properties (i.e. overflowing from the low point). Parameters used within the modelling can be found in Appendix C.

Rainfall data was obtained from the Bureau of Meteorology. Initial losses were set to 5mm and continuing losses were set to their model maximum of 100mm/hr for any pre-developed and undeveloped pervious catchments. This is considered conservative, due to the real infiltration rates being much higher as outlined in Section 2.2. Impervious area losses were set to 1mm and 0mm/hr for initial and continuing losses respectively. The existing low point has been modelled as a basin with no outlet and using an infiltration rate of 216mm/hr as outlined in the geotechnical report. The storage for the basins can be found in Appendix C and differs between pre-developed and post-developed cases due to the amphitheatre. Groundwater beneath the basin (low point) was approximated as RL 1m (2.6m depth from surface), due to the close proximity to the ocean. It is noted that no groundwater was encountered in the boreholes.

Within the XPRAFTS model the carpark is assumed to discharge directly into the low point, and the use of bio-infiltration swales has not been considered. This is considered conservative, as in the real scenario flows will experience more infiltration over the swales and land between the carpark and low point.

The following results below in Table 3 were collated from the model.

Table 3 – Catchments Details

AEP %	Pre-developed Flows to Low Point (m^3/s)	Pre-developed Max. Ponding Level (Depth) (m)	Post-developed Flows to Low Point (m^3/s)	Post-developed Max. Ponding Level (Depth) (m)
63	0	0	0.507	4.246 (0.636)
50	0.019	3.87 (0.26)	0.674	4.317 (0.707)
20	0.173	4.156 (0.546)	0.986	4.462 (0.852)
10	0.38	4.33 (0.72)	1.245	4.558 (0.948)
5	0.744	4.47 (0.86)	1.723	4.708 (1.098)
2	1.031	4.546 (0.936)	1.93	4.827 (1.217)
1	1.502	4.658 (1.048)	2.455	4.964 (1.354)

Flows leaving the site in the pre-developed and post-developed cases are nil. In order for any flows to leave the site, the ponding level at the existing low point would have to exceed RL 25-30m. This would never occur, due to the high infiltration rate as well as no possibility that the water table could rise enough to get close to the current surface level of the low point.

As shown in Exhibit 001 the proposed amphitheater is situated at RL 5m and the adjacent accommodation starts from as low as RL 7-8m. As shown by the results of the model, the highest level of ponding occurs in the 1% AEP storm at RL 4.964m. Hence there is no adverse effects to the amphitheater, accommodation or surrounding properties (ponding must be over RL 25-30m to overflow). The access track is expected to be inundated by approximately 1.3m in such a storm for a short period of time, though emergency access is still possible at all times via the high-side of the track adjacent to the accommodation.

7.0 Water Quality / Water Sensitive Urban Design

The proposed stormwater system, as detailed in Section 5.0, uses a combination of pit, pipe and swale networks and water sensitive urban design elements 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.

7.1 TREATMENT DEVICES

The stormwater design for the development proposes to use conveyance controls to treat runoff from the site. The treatment train will be modelled for demonstration of compliance with Port Stephens Council's key performance objectives.

Conveyance Swales

Flows from developed portions of the site will primarily sheet flow to grass-lined swales. These swales will act as a primary nutrient and suspended solid control device in the treatment train. The swales will utilise a filter media layer to capture nutrients and suspended solids. An example of a typical cross-section can be seen in Figure 4. The swales are proposed to have maximum grades of 3.5%.

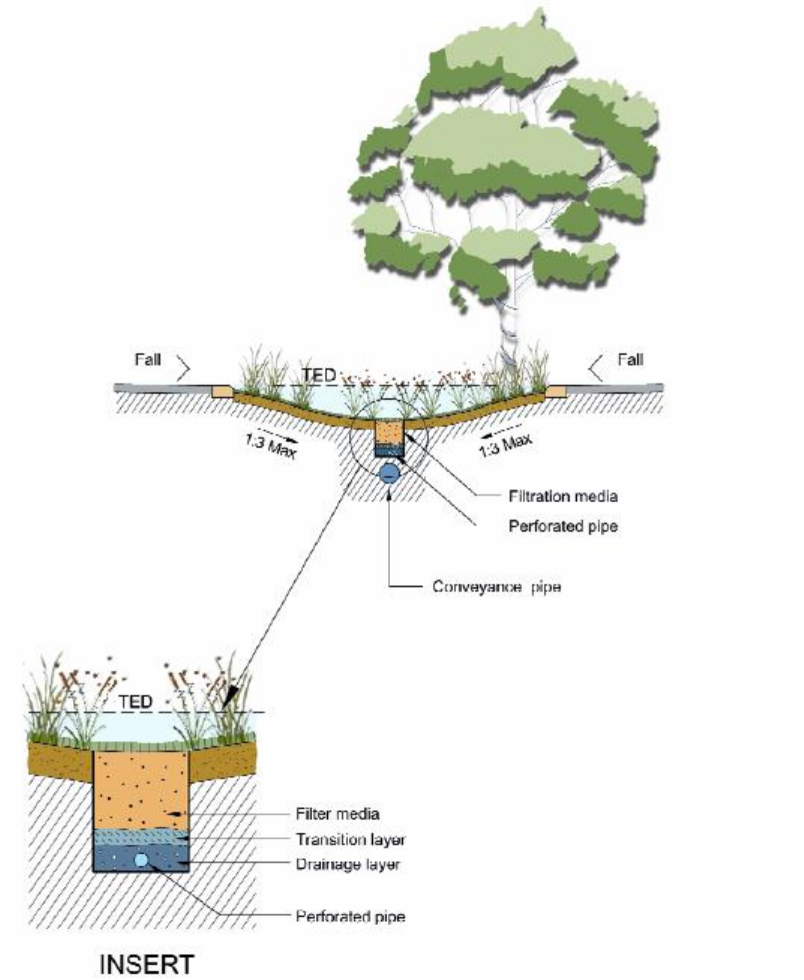


Figure 4: Example of biofiltration swale. Excerpt from WSUD Engineering Procedures for Stormwater Management in Southern Tasmania 2005.

The flows will then be conveyed through a GPT at the end of the line. The GPT will remove litter and large debris prior to infiltration. An Ecosol GPT is proposed. Capture efficiency for the GPT can be found in Figure 5.

ECOSOL GPT CAPTURE EFFICIENCY PERFORMANCE SUMMARY		
Pollutants	Capture Efficiency	Details
Gross Pollutants (GP)	98%	Particulate >2000 micron
Total Suspended Solids (TSS)	61%	Particulate 20-2000 micron (mean averages)
Total Phosphorous (TP)	29%	Particulate and dissolved mean average efficiency less standard deviation
Total Nitrogen (TN)	1%	Particulate and dissolved mean average efficiency less standard deviation
Total Petroleum/Hydrocarbon (TPH)	99%	In dry weather emergency oil spill solutions
	23%	In a high flow event

Figure 5: Except from Ecosol Gross Pollutant Trap Technical Specification

Scour protection is intended for use after the GPT as an outlet erosion protection measure.

7.2 MODELLING

The software used for the water quality modelling is MUSIC Version 6.2. This program 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.

MUSIC-link for Port Stephens Council has been used for the modelling for this site. Port Stephens Council's MUSIC-link enables the simplification of the development and assessment of MUSIC models by adopting all of the preferred parameters such as rainfall, evapotranspiration data, soil characteristics and pollutant generation rates.

The template model chosen for the MUSIC analysis was Williamtown – Default Catchment Sandy Soils – Williamtown Raaf – Zone B.mlb. The template was chosen based on the site location and soil type. Details of the MUSIC model including MUSIC-Link report can be found in Appendix B.

Swales used within the model have infiltration rates of 180mm/hr. This is considered conservative given the geotechnical report recommendations as per Section 2.2. The existing low point has been modelled as a pond with infiltration of 216mm/hr. A "Buffer" node has been used for the "Roof & Track" catchment (i.e. roofs of accommodation and access track) to represent water flowing onto undeveloped surfaces. This buffer node also uses and infiltration rate of 216mm/hr as it represents the soils in the area of the access track and roof.

7.2.1 Catchment Data

The post-development catchment boundaries have been determined from the concept layout and architectural plans. The catchment breakdown is as seen previously in Table 2.

7.3 RESULTS

In accordance with Council requirements, modelling has been undertaken to demonstrate compliance with water quality objectives for stormwater runoff from the proposed development prior to discharge. The results of the modelling are shown in Table 3.

Table 3 – Pollutant Loads and Reductions

Pollutant	Without Treatment (kg/yr)	With Treatment (kg/yr)	Modelled Reduction (%)	Target Reduction (%)
GP	580	0	100	90
TSS	5970	0	99.9	90
TP	9.83	0	99.7	60
TN	51.9	0	99.5	45

As shown in Table 3, MUSIC modelling indicates compliance with Council's target reduction objectives for the proposed development through the use of stormwater treatment devices as per the concept design.

The high reduction in pollutant loads can be attributed to the exfiltration rates of the swales at 180mm/hr. This value was chosen as the lower-bound for sand exfiltration rates.

7.4 SWALE DESIGN

A manning's calculation has been performed on the swale cross-section to determine the flow capacity. The dimensions of the swales is:

- Base width – 0.5m
- Side slopes – 1 in 4
- Swale depth – 0.5m
- Top width – 4.5m

Using manning's equation:

$$Q = \frac{kAR^{\frac{2}{3}}S^{\frac{1}{2}}}{2}$$

With parameters:

- K = 1
- N = 0.035
- S = 0.035 m/m (maximum)
- Depth of water = 0.266m
- A = 0.416
- R = 0.154

The flowrate capacity for the given scenario, Q = 0.640 m^3/s. XPRAFTS modelling of the carpark catchment yielded a maximum runoff through the swales during the 1% AEP of 0.638m^3/s. Hence this swale has suitable capacity to convey flows to the low point.

8.0 Erosion and Sedimentation Control

Erosion and sedimentation control measures need to be implemented during any construction on the proposed development 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 002. The attached Erosion and Sedimentation Control Plan is only an indicative plan as another Erosion and Sedimentation Control Plan will be provided as part of the Construction Certificate drawings and a further plan will be provided by the contractor before construction takes place.

9.0 Conclusion

The concept stormwater layout has been designed to convey flows effectively from the developed site. The design includes the use of a pit, pipe and swale network, as well as a GPT and level spreader in order to improve water quality before discharge. MUSIC modelling has been completed adopting water sensitive urban design measures to demonstrate compliance with the performance target objectives of the DCP.

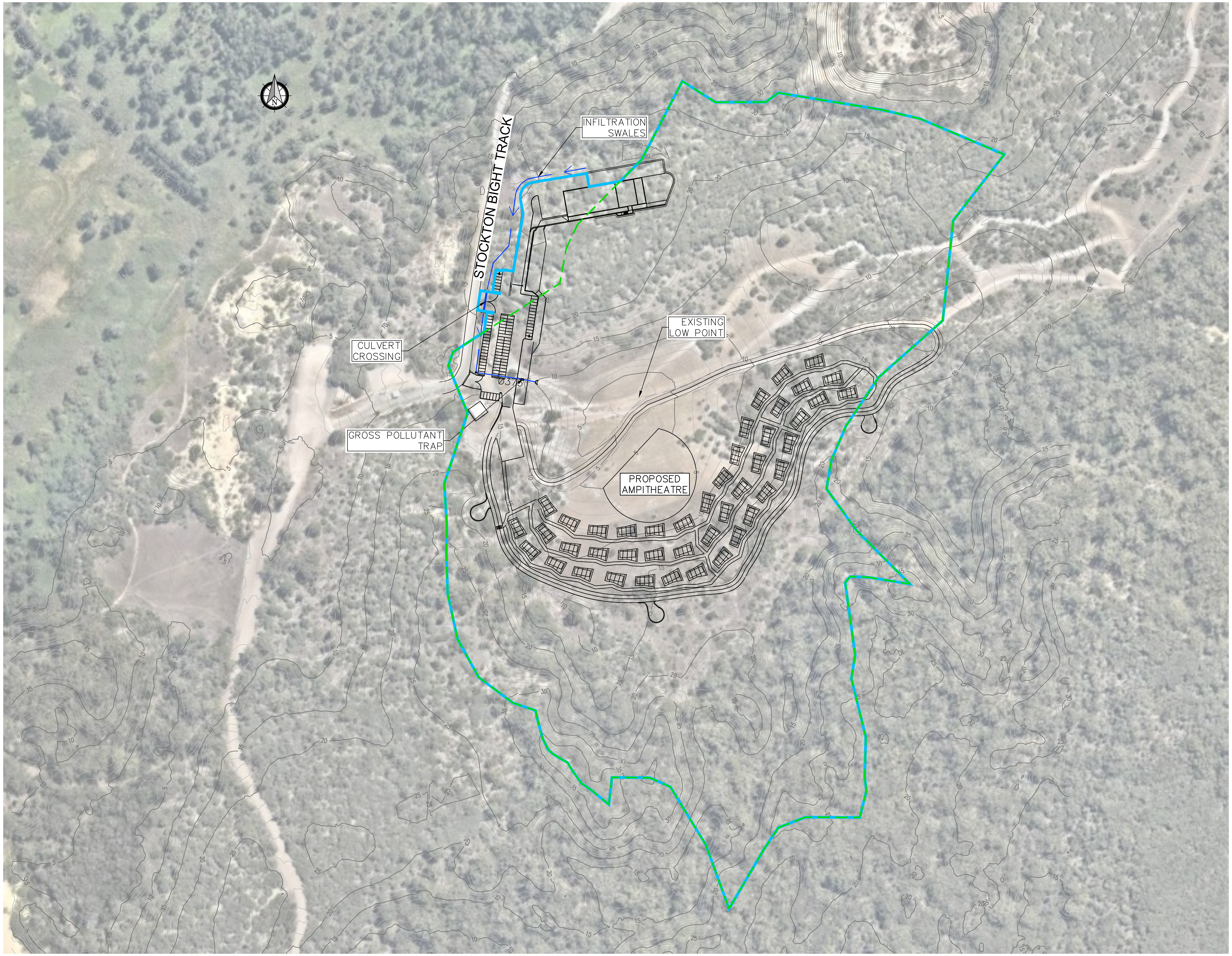
Stormwater runoff has been modelled using XPRAFTS to determine the flows to the low point of the site in the pre-developed and post-developed scenario. The results of the modelling found that ponding within the low point will not adversely affect the development or any surrounding sites due to the high rates of infiltration of the sand.

Hunter Water state that the Stockton Sandbeds are not a water source and there are currently no future plans for its use. A letter of notice of formal requirements from Hunter Water is attached in Appendix A.

An Erosion and Sedimentation Control Plan has also been prepared for construction of the proposed development also complying with Council's requirement.

Exhibits

EXHIBIT 001 STORMWATER CATCHMENT PLAN
EXHIBIT 002 EROSION AND SEDIMENTATION CONTROL PLAN



LEGEND

- PRE-DEVELOPED CATCHMENT
- POST-DEVELOPED CATCHMENT
- INFILTRATION SWALE
- MAJOR CONTOURS
- MINOR CONTOURS

CONTOUR INTERVAL = 1.0m

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
C	19.06.19	CATCHMENTS UPDATED	J.B.	M.K.	DATUM: A.H.D. CONTOUR INTERVAL: 1m	0 30 60 75m SCALE: 1:1500 (FULL)	

drawing title:

EXHIBIT 001 - STORMWATER CATCHMENT PLAN

location: WORIMI VISITOR DEVELOPMENT LAVIS LANE, WILLIAMTOWN

council: PORT STEPHENS COUNCIL

dwg ref: 190415-WCMP-001

client:

adw johnson

central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100
sydney office ph: (02) 8046 7411
www.adwjohnson.com.au

190415-WCMP-001

Plotted By: Joshua Bagus Plot Date: 21/06/19 9:44:26AM Cad File: S:\190415\DRAWINGS\ENGINEERING\WCMP\190415-WCMP-001.DWG

This plan includes coloured information. If you have a black and white copy you do not have all of the information. This note is coloured RED.

LEGEND

- NO-GO FENCE
- SEDIMENT FENCE
- MAJOR CONTOURS
- MINOR CONTOURS
- SHAKER RAMP/SITE ACCESS

CONTOUR INTERVAL = 0.5m

ver.	date	comment	drawn	pm	level information	scale (A1 original size)	notes
B	14/08/2018	REFERENCES UPDATED	K.T.	M.K.	DATUM: A.H.D. CONTOUR INTERVAL: 0.5m	0 12.5 25.0m SCALE: 1:500 (FULL)	

drawing title:

EXHIBIT 002 - EROSION AND SEDIMENT PLAN

location: WORIMI VISITOR DEVELOPMENT LAVIS LANE, WILLIAMTOWN

council: PORT STEPHENS COUNCIL

dwg ref: 190415-WCMP-002

client:

adw johnson

central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100
sydney office ph: (02) 8046 7411

www.adwjohnson.com.au

Plotted By: Kurt Tillett Plot Date: 14/08/18 10:54:10AM Cad File: S:\190415\DRAWINGS\ENGINEERING\WCMP\190415-WCMP-002.DWG

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Appendix A

CORRESPONDENCE WITH HUNTER WATER

Malcolm Withers <malcolm.withers@hunterwater.com.au> | Mark Kelly

Hunter Water to ADWJ - Query regarding development adjacent to Stockton Sandbeds catchment : 2017-210/1.001

You replied to this message on 8/03/2017 3:49 PM.

Good afternoon Mark,

The Stockton Sandbeds are not currently a water source for Hunter Water, and there are no current plans to use it in the future. Consequently, we have no issue with the proposed development provided it is undertaken to the satisfaction of Council, DPI Water and NPWS.

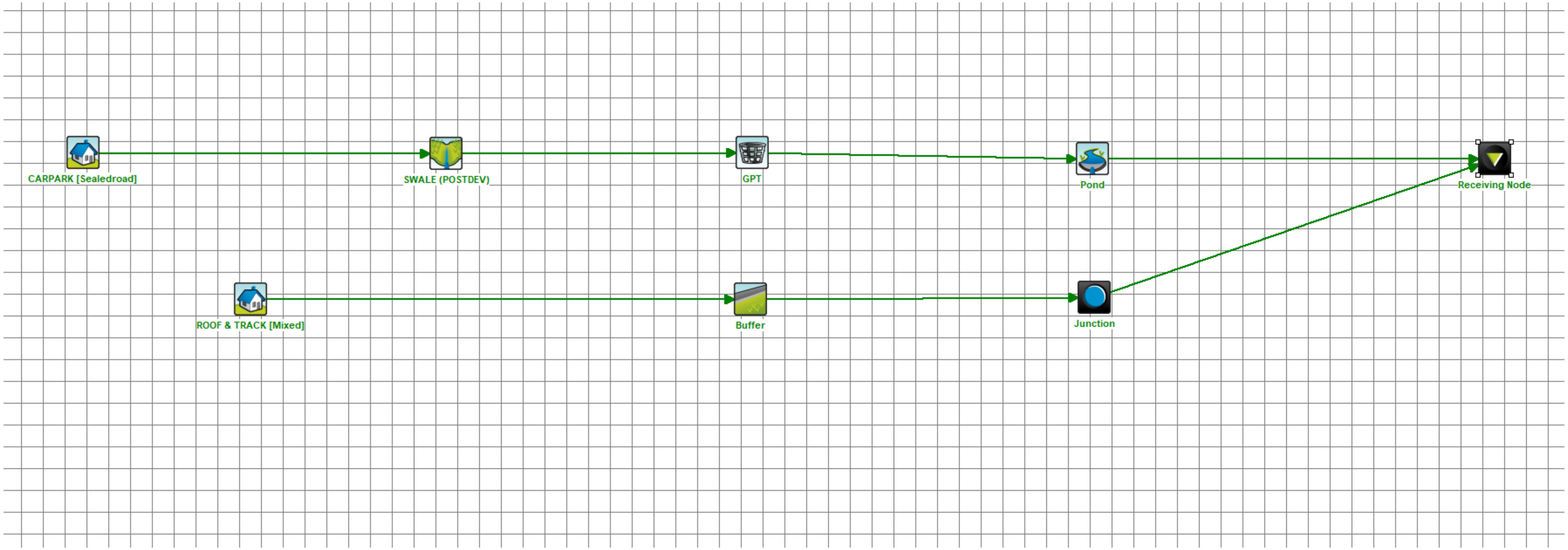
Please let met me know if you need any further information.

Regards

Malcolm Withers
Senior Developer Services Engineer | Hunter Water Corporation
36 Honeysuckle Drive Newcastle NSW 2300 | PO BOX 5171 HRMC NSW 2310
T 02 4979 9545 | **M** 0429 372 449 | Twitter: @hunterwater
malcolm.withers@hunterwater.com.au | hunterwater.com.au

Appendix B

MUSIC DETAILS



MUSIC-*link* Report

Project Details		Company Details	
Project:	Worimi Visitor Centre Carpark	**Company:**	ADW Johnson
Report Export Date:	21/06/2019	**Contact:**	
Catchment Name:	WORIM VISITOR CENTRE rev B	**Address:**	
Catchment Area:	2.281ha	**Phone:**	
Impervious Area*:	100%	**Email:**	
Rainfall Station:	WILLIAMTOWN RAAF - Station 061078 - Zone B		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1998 - 31/12/2007 11:54:00 PM		
Mean Annual Rainfall:	1125mm		
Evapotranspiration:	1394mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.31		
Study Area:	Williamtown		
Scenario:	Default Catchment - Sandy soils		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Receiving Node	**Reduction**	**Node Type**	**Number**	**Node Type**	**Number**
Flow	99.5%	Swale Node	1	Urban Source Node	2
TSS	99.9%	Pond Node	1		
TP	99.7%	Buffer Node	1		
TN	99.6%	GPT Node	1		
GP	100%				

Comments

Exfiltration rate for the swale has been used as 180mm/hr, as the proposed filter media will be sand. The underlying and surrounding soils will also have high infiltration rates. Geotechnical investigation found the soil in the area to be sand. Infiltration testing was conducted and the geotechnical report recommends using 1080mm/hr as the infiltration rate. A factor of safety of 5 has been applied, and for the Pond node (low point) and Buffer node (adjacent land) an infiltration rate of 216mm/hr to represent this rate. The extended detention depth of the Pond node was taken as the minimum value of 0.01 (an extended detention depth of 0 is not allowed by MUSIC). In reality the low point will have no extended detention as it is free draining.

PORT STEPHENS COUNCIL

music@link

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Buffer	Buffer	Proportion of upstream impervious area treated	None	None	1
GPT	GPT	Hi-flow bypass rate (cum/sec)	None	99	0.192
Pond	Pond	% Reuse Demand Met	None	None	0
Receiving	Receiving Node	% Load Reduction	None	None	99.5
Receiving	Receiving Node	GP % Load Reduction	90	None	100
Receiving	Receiving Node	TN % Load Reduction	45	None	99.6
Receiving	Receiving Node	TP % Load Reduction	60	None	99.7
Receiving	Receiving Node	TSS % Load Reduction	90	None	99.9
Swale	SWALE (POSTDEV)	Bed slope	0.01	0.05	0.035
Urban	CARPARK	Area Impervious (ha)	None	None	1.091
Urban	CARPARK	Area Pervious (ha)	None	None	0
Urban	CARPARK	Total Area (ha)	None	None	1.091
Urban	ROOF & TRACK	Area Impervious (ha)	None	None	1.19
Urban	ROOF & TRACK	Area Pervious (ha)	None	None	0
Urban	ROOF & TRACK	Total Area (ha)	None	None	1.19

Only certain parameters are reported when they pass validation

PORT STEPHENS COUNCIL

music@link

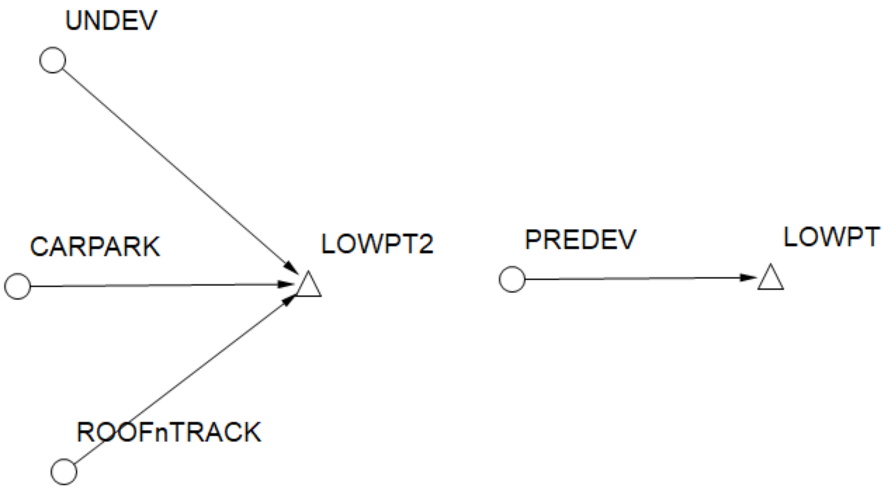
Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Pond	Pond	Extended detention depth (m)	0.25	1	0.01
Swale	SWALE (POSTDEV)	Exfiltration Rate (mm/hr)	0	0	180

Only certain parameters are reported when they pass validation

Appendix C

XPRAFTS DETAILS



Pre-developed Low Point	
Stage	**Storage**
3.61	0
3.7	0.93
3.8	8.33
3.9	30.965
4	79.082
4.1	165.595
4.2	290.523
4.3	456.029
4.4	682.84
4.5	993.74
4.6	1389.495
4.7	1850.044
4.8	2365.322
4.9	2932.323
5	3549.001
5.1	4206.7
5.2	4902.545
5.3	5633.827
5.4	6399.357
5.5	7198.549
5.6	8030.859
5.7	8895.545
5.8	9792.028
5.9	10719.92
6	11679.09

Post-developed Low Point	
Stage	**Storage**
3.61	0
3.7	0.904
3.8	7.417
3.9	26.131
4	67.415
4.1	148.484
4.2	272.905
4.3	440.816
4.4	654.482
4.5	912.564
4.6	1224.612
4.7	1581.767
4.8	1973.297
4.9	2394.906
5	2844.159
5.1	3691.082
5.2	4563.929
5.3	5461.801
5.4	6384.481
5.5	7331.946
5.6	8304.09
5.7	9300.688
5.8	10321.45
5.9	11366.12
6	12434.76

Impervious	
Initial Loss (mm)	Continuing Loss (mm/hr)
1	0

Pervious	
Initial Loss (mm)	Continuing Loss (mm/hr)
5	100*

*Continuing loss for pervious areas in reality is higher (as outlined in Section 2.2). 100mm/hr is the highest allowable rate for XPRAFTS.