



ALDA | ROSE | URBAN VILLAGER

Stormwater Management Report

285-325 Pacific Highway, Lake Munmorah

August 2022

© Copyright Barker Ryan Stewart Pty Ltd
2022 All Rights Reserved

Project No.	CC180099
Author	Scott Brisbin
Checked	Jonathan Terry
Approved	Scott Brisbin

Rev No.	Status	Date	Comments
1	For Planning Proposal Approval	14/4/2022	
2	For Planning Proposal Approval	2/8/2022	Revised for Department of Planning and Environment Comment

COPYRIGHT

Barker Ryan Stewart reserves all copyright of intellectual property in any or all of Barker Ryan Stewart's documents. No permission, licence or authority is granted by Barker Ryan Stewart to any person or organisation to use any of Barker Ryan Stewart's documents for any purpose without the written consent of Barker Ryan Stewart.

REPORT DISCLAIMER

This report has been prepared for the client identified in Section 1.0 only and cannot be relied on or used by any third party. Any representation, statement, opinion or advice, expressed or implied in this report is made in good faith but on the basis that Barker Ryan Stewart are not liable (whether by reason of negligence, lack of care or otherwise) to any person for any damage or loss whatsoever which has occurred or may occur in relation to that person taking or not taking (as the case may be) action in any respect of any representation, statement, or advice referred to above.



SYDNEY
P (02) 9659 0005
E sydney@brs.com.au

CENTRAL COAST
P (02) 4325 5255
E coast@brs.com.au

HUNTER
P (02) 4966 8388
E hunter@brs.com.au

SOUTH EAST QUEENSLAND
P (07) 5582 6555
E seqld@brs.com.au

Table of Contents

1	Introduction.....	4
2	Site Location and Development Proposal	6
2.1	Existing Site & Location	6
2.2	Proposed Development	7
3	Site Flooding.....	8
3.1	Council Flood Mapping.....	8
3.2	Site Specific Flood Impact Assessment.....	8
4	Earthworks and Site Grading.....	9
5	Water Quality Management	10
5.1	Water Quality Targets	10
5.2	Water Quality Modelling – Existing Condition	11
5.3	Water Quality Modelling – Developed Condition.....	13
5.4	Proposed Treatment Train	14
5.5	Water Quality Modelling Results	15
5.5.1	Council Requirements.....	15
5.5.2	Department of Planning and Environment Requirements	16
5.6	Maintenance Requirements	16
6	On-Site Detention (OSD).....	17
6.1	Council's Policy.....	17
6.2	OSD Requirements	17
6.3	OSD Modelling	18
6.4	OSD Configuration	18
6.5	OSD Modelling Results	19
6.6	Maintenance Management.....	19
7	Conclusion and Recommendations.....	21
8	References	22

Attachment A – Proposed Development

Attachment B – MUSIC-Link Report (Existing and Developed Condition)

Attachment C – Department of Planning and Environment Email dated 8 July 2022

1 Introduction

This Stormwater Management Report has been prepared for Alda, Rose Group and Urban Villager to support a Planning Proposal application to the NSW Department of Planning and Central Coast Council for a proposed residential subdivision at 285-325 Pacific Highway, Lake Munmorah.

The planning proposal involves the rezoning of land at 285-325 Pacific Highway, Lake Munmorah to permit a residential development. The proposal is likely to yield in the order of 300 residential lots.

This Stormwater Management Report has been prepared to demonstrate compliance with Council's stormwater requirements, including on-site detention and water quality treatment. The report considers a range of storm events up to and including the 1% AEP storm event.

Figure 1 shows the location of the proposed development site.



Figure 1: Location of Subject Site (source maps.six.maps.nsw.gov.au)

Revision 2 of this report has been updated to address water quality requirements outlined in the Department of Planning and Environment email correspondence dated 8 July 2022 and correspondence dated 2 August 2022. Refer Section 5.1 of this report for further details.

2 Site Location and Development Proposal

2.1 Existing Site & Location

The subject land is in Lake Munmorah within the Central Coast Council Local Government Area. The property addresses are 285-305, 315, 325 and 335 Pacific Highway, Lake Munmorah and include the following lots:

- a. Lot 1 DP 626787;
- b. Lot 2 DP 626787;
- c. Lot 437 DP 755266;
- d. Lot 438 DP 755266;
- e. Lot 27 DP 755266;
- f. Lot 12 DP 771284; and
- g. Lot 83 DP 650114.

The total area of the subject sites is approximately 27.2 ha. The site is currently zoned RU6.

The site includes a natural ridge that approximately follows the boundary of Lot 1 and Lot 438. This divides the site into an Eastern and Western catchment. The site generally falls from north to south.

The site is traversed by two (2) unnamed water courses. A farm dam exists in the eastern water course. A Coastal Wetland as defined by SEPP (Coast Management) 2018, exists to the west of the site.

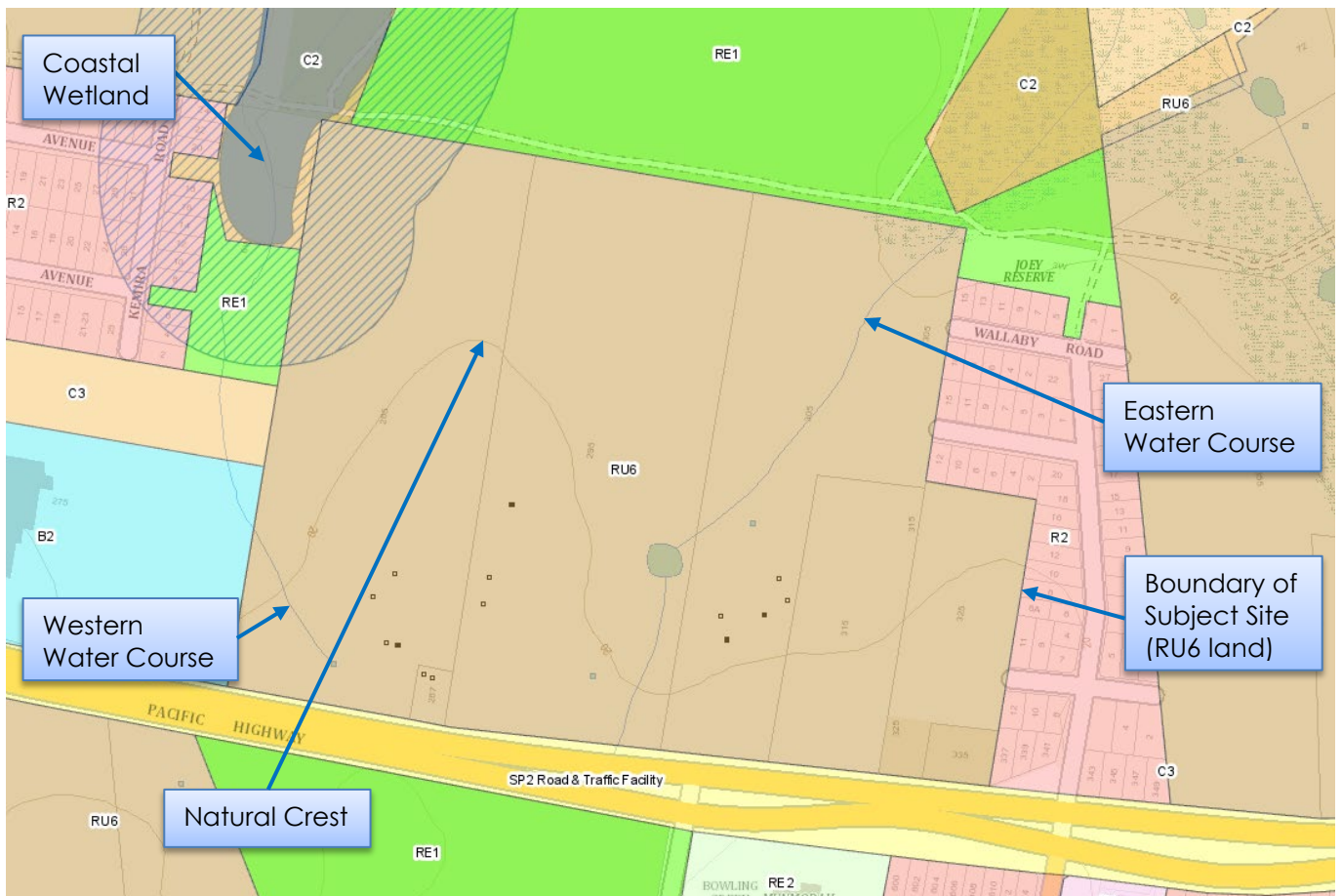


Figure 2: Existing Water Courses and Features (source ePlanning Spatial Viewer)

2.2 Proposed Development

The planning proposal involves the rezoning of land at 285-325 Pacific Highway, Lake Munmorah to permit a residential development. The proposal is likely to yield in the order of 300 residential lots. Primary vehicular access is proposed from the west and east via existing access points from the Pacific Highway. Potential staging of the development will be considered as part of future design stages (ie following Planning Proposal approval).

A Biodiversity Certification Assessment Report (BCAR) has been prepared for the site by Kleinfelder. The report concludes, in part, that:

- a. The western watercourse was determined to be largely historic, with no existing watercourse occurring within the south-western corner of the subject site.
- b. The eastern watercourse was determined to be largely retained within the proposed eastern corridor conservation area, with the southern extent of the mapped watercourse reduced as a result of historic development and earthworks.

Preliminary stormwater management requirements, as presented in this report, have been considered in the preparation of the site’s Masterplan. Two (2) stormwater basins are proposed and will manage water quality and water quantity (ie on-site detention) for the western and eastern catchments.

The proposed DCP Staging Plan by Peter Andrews and Associates has been prepared with consideration to the recommendations of the BCAR report and preliminary stormwater assessment. The DCP Staging Plan is presented below.

It is noted that the layout is indicative only and has been prepared to demonstrate the feasibility of the Planning Proposal. Final layout and lot configuration and yield is subject to further development as part of the next stage of the design after Planning Proposal approval.

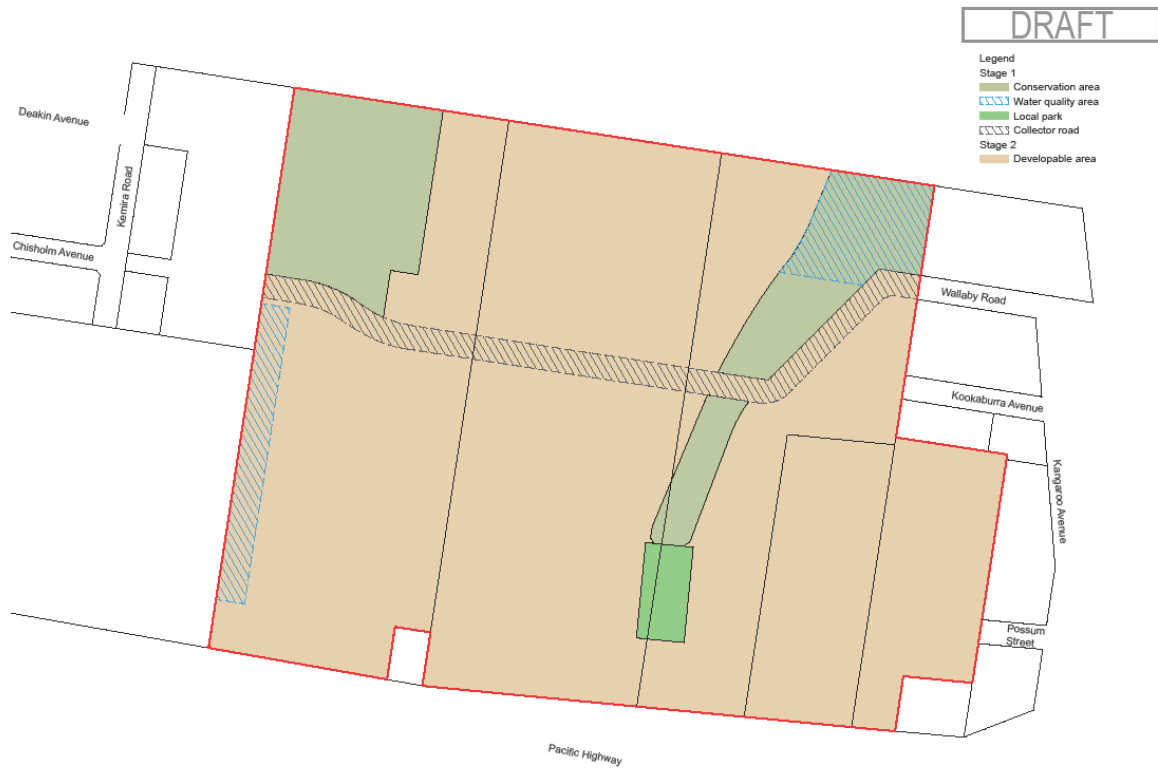










Figure 3: DCP Staging Plan

3 Site Flooding

3.1 Council Flood Mapping

A review of Central Coast Council's Online Mapping Tool shows the whole of the site is free from known flooding during a 1% AEP event as presented in the figure below.

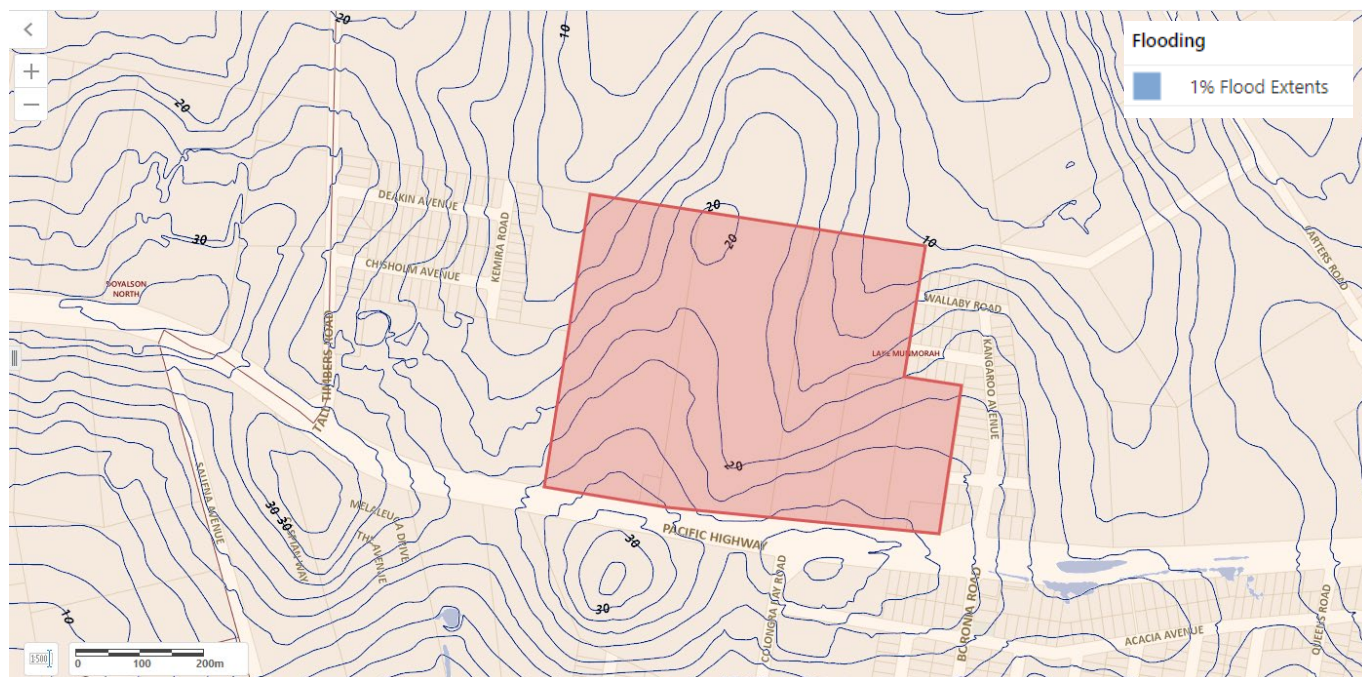


Figure 4: 1% AEP Flood Extents (Central Coast Council)

3.2 Site Specific Flood Impact Assessment

There has been no known assessment of flood behaviour on the site.

Barker Ryan Stewart have undertaken a flood assessment of existing condition and development condition flood extents on the site as reported in BRS's 'Flood Impact Assessment Report'.

4 Earthworks and Site Grading

As part of the Flood Impact Assessment report discussed in Section 3.2 above, BRS undertook a preliminary grading of the proposed internal development roads. The preliminary grading of these roads was set with consideration to:

- a. Proposed development layout as presented in Figure 3;
- b. Existing terrain, to limit cut and fill depths and maintain existing points of discharge;
- c. Minimum and maximum road grades as defined by Council's Civil Works Specification; and
- d. Site Flood Planning Levels, defined as the 1% AEP flood level plus 500mm freeboard.

5 Water Quality Management

5.1 Water Quality Targets

The following Central Coast Council documents were used in determining the requirements for water quality management for the proposed development site.

- a. Wyong Development Control Plan 2013
- b. Central Coast Council Civil Works Specification Design Guideline 2020

Central Coast Council's water quality treatment requirements are specified in Section 11 of Council's Civil Works Specification – Design Guideline 2020 and is summarised below.

**Table 11.1 Minimum Pollutant Removal Performance Targets
(Australian Runoff Quality 2006)**

Pollutant	Performance Requirements (Targets)
Total Suspended Solids (TSS)	80% reduction in the post-development mean annual load
Total Nitrogen (TN)	45% reduction in the post-development mean annual load
Total Phosphorous (TP)	45% reduction in the post-development mean annual load
Gross Pollutants	90% reduction in the post-development mean annual load (for pollutants greater than 5mm in diameter)
Hydrology	The post-development peak discharge must not exceed the pre-development peak discharge for flows for the 5, 20 and 100% AEP event

Figure 5: Minimum Pollutant Removal Performance Targets (CCC Civil Works Specification)

Revision 1 of this report was reviewed by the Department of Planning and Environment's Water, Floodplains and Coast team. Email correspondence containing their comments was received on 8 July 2022 and a subsequent letter dated 2 August 2022 is included in Appendix C.

The Department of Planning and Environment's comments recommend the following:

- a. Modelling of the existing-case scenario to determine background hydrology and water quality
- b. Remodelling of hydrology and water quality models to incorporate rainwater tanks being installed at residential properties (we are assuming this is already required under BASIX or Council requirements).
- c. Adoption of neutral or beneficial water quality targets and revision of the water treatment system as required in order to achieve this.

The site's water quality targets have therefore been adopted as the more stringent of:

- a. Council requirements as outlined in Figure 5; and
- b. Neutral or beneficial water quality targets as required by Department of Planning and Environment.

5.2 Water Quality Modelling – Existing Condition

Stormwater runoff quality from the site under existing conditions was modelled in the MUSIC software package.

The water quality modelling utilised Central Coast Council's MUSICLink data that is built into the MUSIC software program. MUSIC software Version 6.3.0 was utilised with MUSICLink data Version 6.34 for 'Upland' area.

Separate discharge points for the Eastern and the Western catchment have been considered.

With reference to detailed site survey and aerial photography, the existing site was separated into the following land uses:

- a. Roof;
- b. Sealed road/driveway;
- c. Unsealed road/driveway;
- d. Retained vegetation (north-west corner of site);
- e. Rural residential development.

A summary of the land use areas and modelling parameters is presented below.

Table 1 – Summary of Existing Condition Land Use Areas and Modelling Parameters

LAND USE DESCRIPTION	MODEL LAND USE	MODELLED IMPERVIOUSNESS	LAND USE AREA (ha)		
			WEST	EAST	TOTAL
Roof	Urban [Roof]	100%	0.017	0.287	0.304
Sealed Road (Driveway)	Urban [Sealedroad]	100%	0.047	0.335	0.382
Unsealed Road (Driveway)	Urban [Unsealedroad]	50%	0	0.094	0.094
Retained Ecological Area	Urban [Ruralresidential]	0%	2.115	0	2.115
Remainder of Site	Urban [Ruralresidential]	5%	5.441	19.098	24.539
Total			7.620	19.814	27.434
Future Road (RuralResi)	Urban [Ruralresidential]	5%	0.216		
Total			7.836	19.814	27.650

An image of the existing condition MUSIC model layout is presented below.

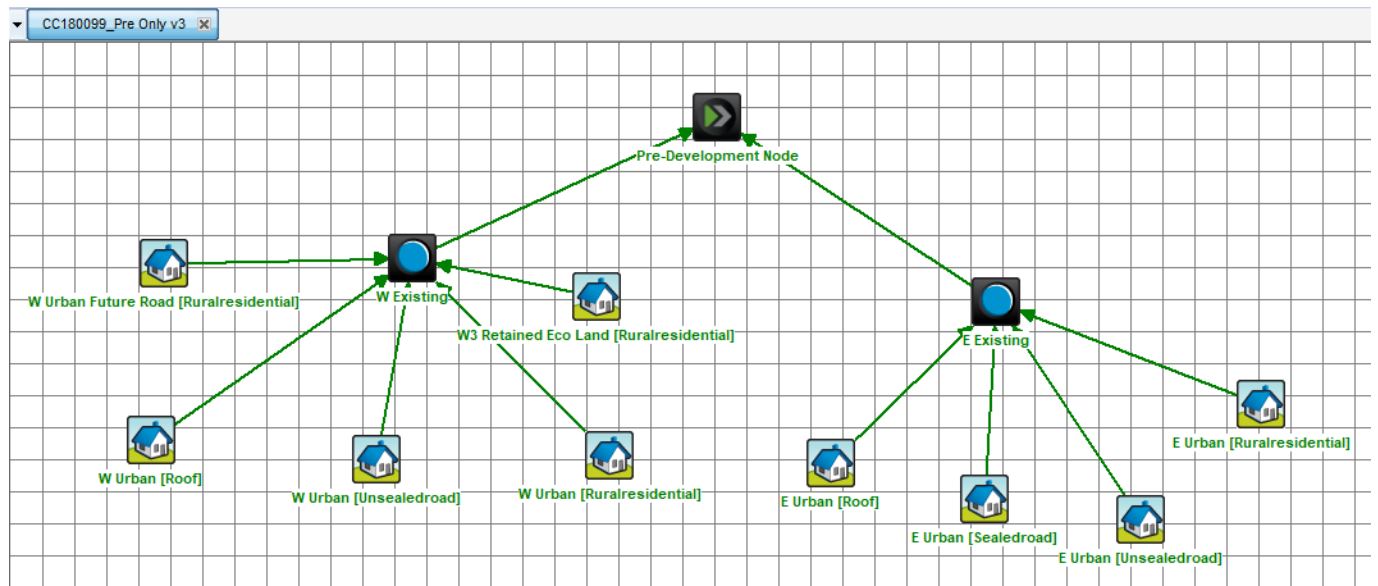


Figure 6: Existing Condition MUSIC Model Layout

5.3 Water Quality Modelling – Developed Condition

Water quality treatment for the development site has been designed and modelled in the MUSIC software package using the same model parameters outlined in Section 5.2.

The evaluation considered the use of the following devices to improve the quality of stormwater discharge leaving the site:

- a. Rainwater tanks to future residential buildings;
- b. Infiltration area for each lot accepting overflow from the rainwater tanks;
- c. Proprietary gross pollutant traps (GPTs);
- d. Bioretention treatment areas; and
- e. Infiltration areas.

Separate treatment trains for the Eastern and the Western catchment have been considered.

An image of the developed condition MUSIC model layout is presented below.

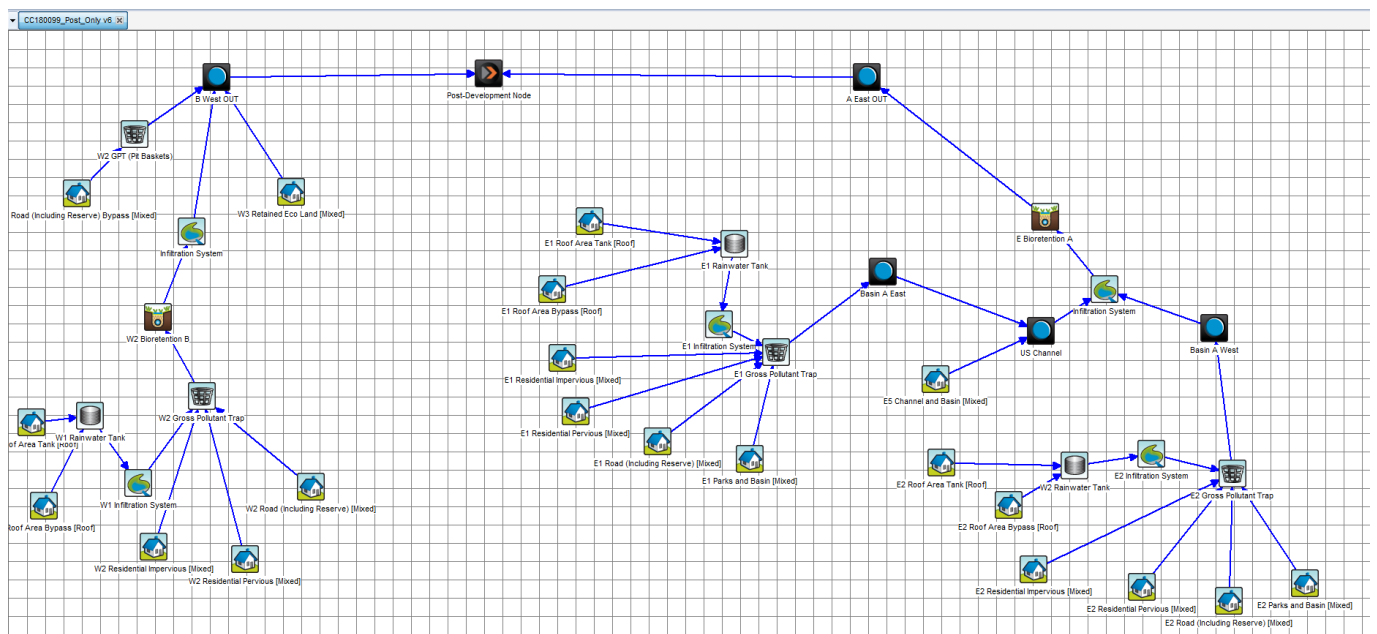


Figure 7: Developed Condition MUSIC Model Layout

5.4 Proposed Treatment Train

The proposed water quality treatment train has been designed to exceed the minimum requirements specified in Section 5.1 of this report.

The proposed treatment train proposes the elements as presented in Table 1.

Table 2 – Summary of Water Quality Treatment Train

Catchment	Treatment Type	Treatment Details
Eastern	Residential Rainwater Tanks	5kL tanks to each future lot connected to outdoor taps and toilets
	Residential Infiltration Areas	25m ² of infiltration area for each lot accepting overflow from the rainwater tanks
	Gross Pollutant Trap Type 1	OceanSave GPT Model 'Twin OS-2324' (or equivalent) Treatable flow = 970L/s
	Gross Pollutant Trap Type 2	OceanSave GPT Model 'OS-2324' (or equivalent) Treatable flow = 655L/s
	Bioretention	Filter Area = 800m ² Filter Depth = 0.5m EDD Depth = 0.3m High Flow Bypass = 1,625L/s
	Infiltration Area	Additional 600m ² infiltration area to the eastern creek line, upstream of the bioretention area.
Western	Residential Rainwater Tanks	5kL tanks to each future lot connected to outdoor taps and toilets
	Residential Infiltration Areas	25m ² of infiltration area for each lot accepting overflow from the rainwater tanks
	Gross Pollutant Trap Type 2	OceanSave GPT Model 'OS-23-2324' (or equivalent) Treatable flow = 680L/s
	Bioretention	Filter Area = 500m ² Filter Depth = 0.5m EDD Depth = 0.3m High Flow Bypass = 680L/s
	Infiltration Area	Additional 800m ² infiltration area to the eastern creek line, upstream of the bioretention area.

The bioretention areas will include a 100mm transition layer and 200mm drainage layer under the filter material.

5.5 Water Quality Modelling Results

A summary of the water quality modelling results against Council and the Department of Planning and Environment’s requirements is presented in the Sections below.

5.5.1 Council Requirements

Council's water quality targets are presented in Figure 5 in Section 5.1 of this report.

A summary of the water quality treatment results for the Eastern and Western catchments with the treatment train nominated in Table 1 are presented in Figure 8 and Figure 9, respectively.

	Sources	Residual Load	% Reduction
Flow (ML/yr)	183	95.3	48
Total Suspended Solids (kg/yr)	20400	3030	85.1
Total Phosphorus (kg/yr)	42.1	12.4	70.5
Total Nitrogen (kg/yr)	402	124	69.2
Gross Pollutants (kg/yr)	4370	0	100

Figure 8: MUSIC model results – Eastern Catchment

	Sources	Residual Load	% Reduction
Flow (ML/yr)	65.4	25.4	61.2
Total Suspended Solids (kg/yr)	7620	1960	74.3
Total Phosphorus (kg/yr)	15.4	4.44	71.1
Total Nitrogen (kg/yr)	143	38.4	73.2
Gross Pollutants (kg/yr)	1440	52.2	96.4

Figure 9: MUSIC model results – Western Catchment

The results show that in the post development case the pollutant reduction targets exceed Council's requirements for both the Eastern and the Western catchments.

A copy of the MUSICLink report is presented in Appendix B.

5.5.2 Department of Planning and Environment Requirements

The Department of Planning and Environment requirements are presented in Section 5.1 of this report.

A summary of the water quality treatment results for the Eastern and Western catchments with the treatment train nominated in Table 1 are presented in the table below.

Table 3 – Summary of Water Quality Treatment Results

	PRE-DEVELOPED			POST DEVELOPED (WITH TREATMENT)			DIFFERENCE		
	WEST	EAST	TOTAL	WEST	EAST	TOTAL	WEST	EAST	TOTAL
Flow (ML/yr)	25.8	97.2	123	25.4	95.3	120.7	-0.4	-1.9	-2.3
Total Suspens. Solids (kg/yr)	3390	12300	15690	1960	3030	4990	-1430	-9270	-10700
Total Phosphor. (kg/yr)	6.71	26	32.71	4.44	12.4	16.84	-2.27	-13.6	-15.87
Total Nitrogen (kg/yr)	56.4	213	269.4	38.4	124	162.4	-18	-89	-107
Gross Pollutants (kg/yr)	163	879	1042	52.2	0	52.2	-110.8	-879	-989.8

The results show that in the post development case the pollutant loads are less than those under existing site conditions and therefore meet the Department of Planning and Environment requirements.

5.6 Maintenance Requirements

Maintenance requirements are discussed in Section 6.6 of this report.

6 On-Site Detention (OSD)

6.1 Council’s Policy

The following documents from Central Coast Council were used in determining the requirements for stormwater drainage and storage for the sites proposed development.

- a. Wyong Development Control Plan 2013
- b. Central Coast Council Civil Works Specification Design Guideline 2020

In considering the stormwater management at the site, this report will consider the following:

- a. The existing site conditions and stormwater quality.
- b. The design and installation of an on-site detention storage to control discharge from the 20% AEP, 5% AEP and 1% AEP storm events.
- c. Stormwater management and maintenance issues associated with the proposed infrastructure.

6.2 OSD Requirements

Central Coast Council's water quality treatment requirements are specified in Section 11 of Council's Civil Works Specification – Design Guideline 2020 and is summarised below.

Table 11.1 Minimum Pollutant Removal Performance Targets (Australian Runoff Quality 2006)

Pollutant	Performance Requirements (Targets)
Total Suspended Solids (TSS)	80% reduction in the post-development mean annual load
Total Nitrogen (TN)	45% reduction in the post-development mean annual load
Total Phosphorous (TP)	45% reduction in the post-development mean annual load
Gross Pollutants	90% reduction in the post-development mean annual load (for pollutants greater than 5mm in diameter)
Hydrology	The post-development peak discharge must not exceed the pre-development peak discharge for flows for the 5, 20 and 100% AEP event

Figure 10: On-Site Detention Requirements (CCC Civil Works Specification)

6.3 OSD Modelling

On-site detention has been provided to the development's Eastern and Western catchments to limit the post development flows to match predevelopment flows for the 20% AEP, 5% AEP and 1% AEP storm events in accordance with Section 11 of Council's Civil Works Specification – Design Guideline 2020.

The stormwater modelling for the site was undertaken in the DRAINS software package (Software Version 2022.012) to determine the OSD storage sizes and outlet configurations. Design rainfall data has been utilised in accordance with Australian Rainfall and Runoff, 2019.

Separate online OSD basins for the Eastern and the Western catchment have been considered.

An image of the DRAINS model layout is presented below.

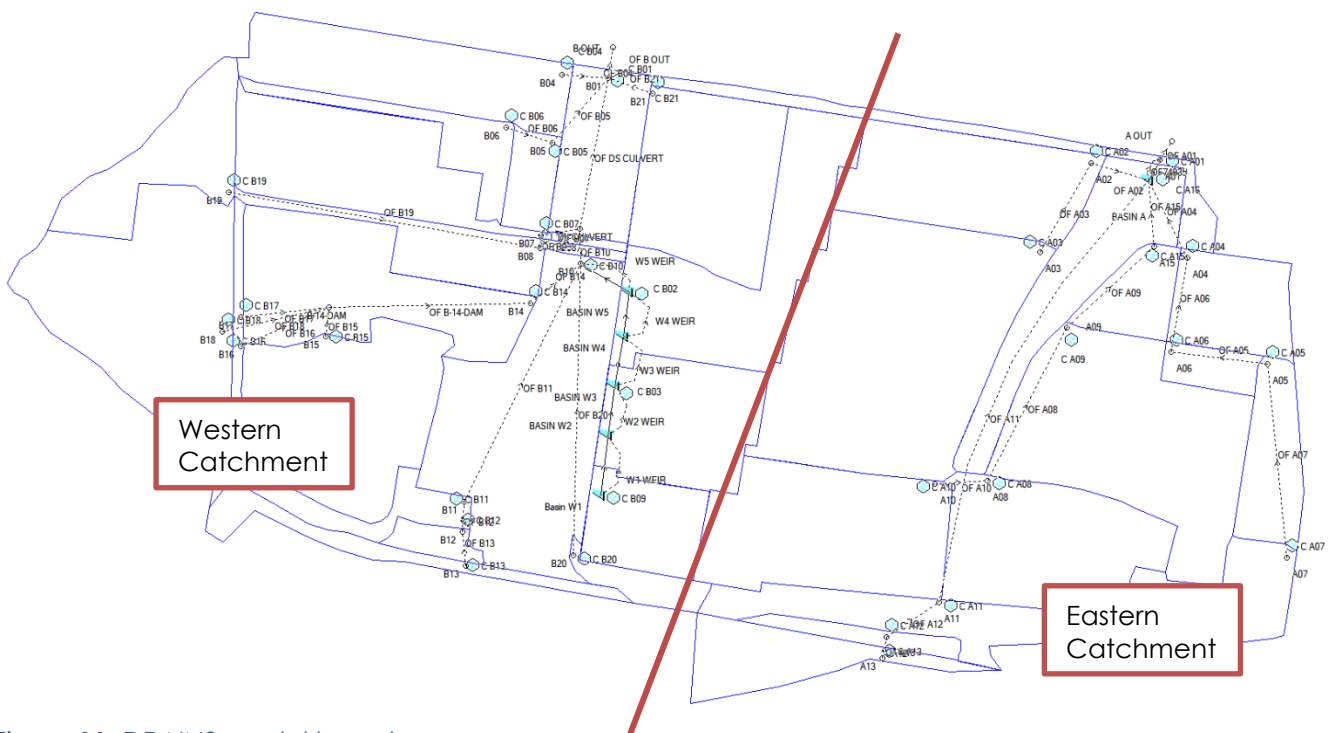


Figure 11: DRAINS model layout

6.4 OSD Configuration

The proposed OSD basins have been designed to exceed the requirements specified in Figure 10.

The proposed basin configurations and outlet arrangements are presented in Table 4 and Table 5, respectively. Note that the western basin consists of 5 terraced inline basins that flow from W1 to W5, prior to discharging upstream of the proposed culvert crossings over the western water course.

Table 4 – Basin Configuration Summary

Basin	Top of Media/Infiltration Zone	EDD Depth/Level	TWL Depth/Level	Weir RL	Storage Vol in 1% AEP Event
Eastern	RL9.40	0.3m / RL9.70	1.6m / RL10.90	RL10.70	6,200m ³
Western					Total = 1,966m ³
W1	RL21.50	0.6m / RL22.10	0.9m / RL23.00	RL23.00	489m ³
W2	RL20.00	0.6m / RL20.60	0.6m / RL21.20	RL21.50	241m ³
W3	RL18.90	0.3m / RL19.20	0.95m / RL20.15	RL20.10	425m ³
W4	RL17.30	0.6m / RL17.70	0.8m / RL18.50	RL18.50	403m ³
W5	RL16.40	0.3m / RL16.70	1.1m / RL17.80	RL17.70	408m ³

Table 5 – Basin Outlet Configuration

Culvert	Discharge Control Pit Size	Configuration	U/S IL	D/S IL
Eastern Basin Outlet	1.2x2.6m	4 x DN900 RCPs	RL8.65	RL8.40
Western Basin Outlets				
W1	N/A	1 x DN675 RCP	RL20.80	RL20.60
W2	N/A	1 x DN450 RCP	RL19.30	RL19.10
W3	N/A	1 x DN450 RCP	RL17.80	RL17.60
W4	N/A	1 x DN225 uPVC	RL16.70	RL16.50
W5	N/A	1 x DN225 uPVC	RL15.50	RL15.30

6.5 OSD Modelling Results

Results of the on-site detention Drains modelling for pre-development and post-development flows are presented below.

Table 6 – Pre and Post Development Flows from the Development

Catchment	Storm Event (AEP)	Pre-Development Flow (m ³ /s)	Post-Development Flow (m ³ /s)
Eastern	20%	5.11	5.11
	5%	7.95	5.79
	1%	12.3	11.0
Western	20%	7.54	7.50
	5%	11.5	11.0
	1%	17.6	16.6

Note that the above Pre and Post-Development flows are total catchment flows which include adjacent catchments contributing to a total flow prior to entering the downstream catchment.

The above table confirms that the proposed OSD measures reduce flows from the development for both the Eastern Catchment and the Western Catchment to no greater than pre-development conditions for the 20%, 5% and 1% AEP storm events in accordance with Council's requirements.

6.6 Maintenance Management

To ensure the system functions efficiently over the long term, it will be necessary to carry out regular maintenance on the stormwater system and the water quality devices.

The maintenance of the on-site detention systems and bioretention areas will be undertaken during regular inspections. A maintenance schedule will have to be prepared as part of future stages of the design. This schedule will set out the frequency of maintenance inspections and who should undertake them.

A similar maintenance schedule will be provided by the manufacturer of the proprietary gross pollutant traps.

In addition, during construction, temporary erosion sediment control devices will have to be put in place to protect the downstream drainage system from silt and sediment generated by the works. These temporary measures shall comply with the requirements of the Council and the 'Blue Book'.

The installation of permanent water quality treatment devices, such as gross pollutant traps and bioretention areas, shall not be undertaken until the development site is suitably developed and stabilised, typically at 80% complete development.

7 Conclusion and Recommendations

This Stormwater Management Report has been prepared for Alda, Rose Group and Urban Villager to support a Planning Proposal to NSW Department of Planning and Central Coast Council for a proposed residential subdivision at 285-325 Pacific Highway, Lake Munmorah.

The purpose of this Report is to demonstrate compliance with on-site detention and water quality requirements of Central Coast Council and the requirements of the Department of Planning and Environment.

The site's stormwater management has been prepared with consideration to:

- a. Wyong Development Control Plan 2013;
- b. Central Coast Council Civil Works Specification Design Guideline 2020;
- c. Australian Rainfall and Runoff, 2019; and
- d. Department of Planning and Environment dated 8 July 2022.

Water quality modelling was carried out using the MUSIC software program and Central Coast Council's MUSIC-Link data. The proposed treatment train comprises exceeds the minimum pollutant reduction targets specified by Council and meets the requirements specified by Department of Planning and Environment.

On-site detention (OSD) modelling was carried out using the DRAINS software program and rainfall data adopted from Australian Rainfall and Runoff, 2019. Two (2) OSD basins are proposed with the outlet configuration designed to restrict peak discharges from the site to no more than under existing conditions for the 5%, 20% and 1% AEP storm events.

It is therefore concluded that the proposed development meets the requirements of Central Coast Council and the Department of Planning and Environment with respect to on-site detention and water quality.

8 References

Argue, J, 2007, "Basic Procedures for 'source control' of stormwater", Engineering Education Australia, Melbourne.

Central Coast Council (2020). Civil Works Specification Design Guideline 2018, Australia, Central Coast Council, <http://search.gosford.nsw.gov.au/documents/00/24/22/91/0024229145.pdf>

Duncan, H.P. (1999), "Urban Stormwater Quality: A Statistical Overview", Report 99/3, Cooperative Research Centre for Catchment Hydrology.

Facility for Advancing Water Biofiltration (FAWB), 2008, "Bioretention Filter Media Guidelines", version 2.01, March 2008.

Fletcher, T, Duncan, H, Poelsma, P. & Lloyd, S., 2004, "Stormwater Flow and Quality, and the effectiveness of non-proprietary stormwater treatment measures – a review and gap analysis", Technical Report 04/8, December 2004.

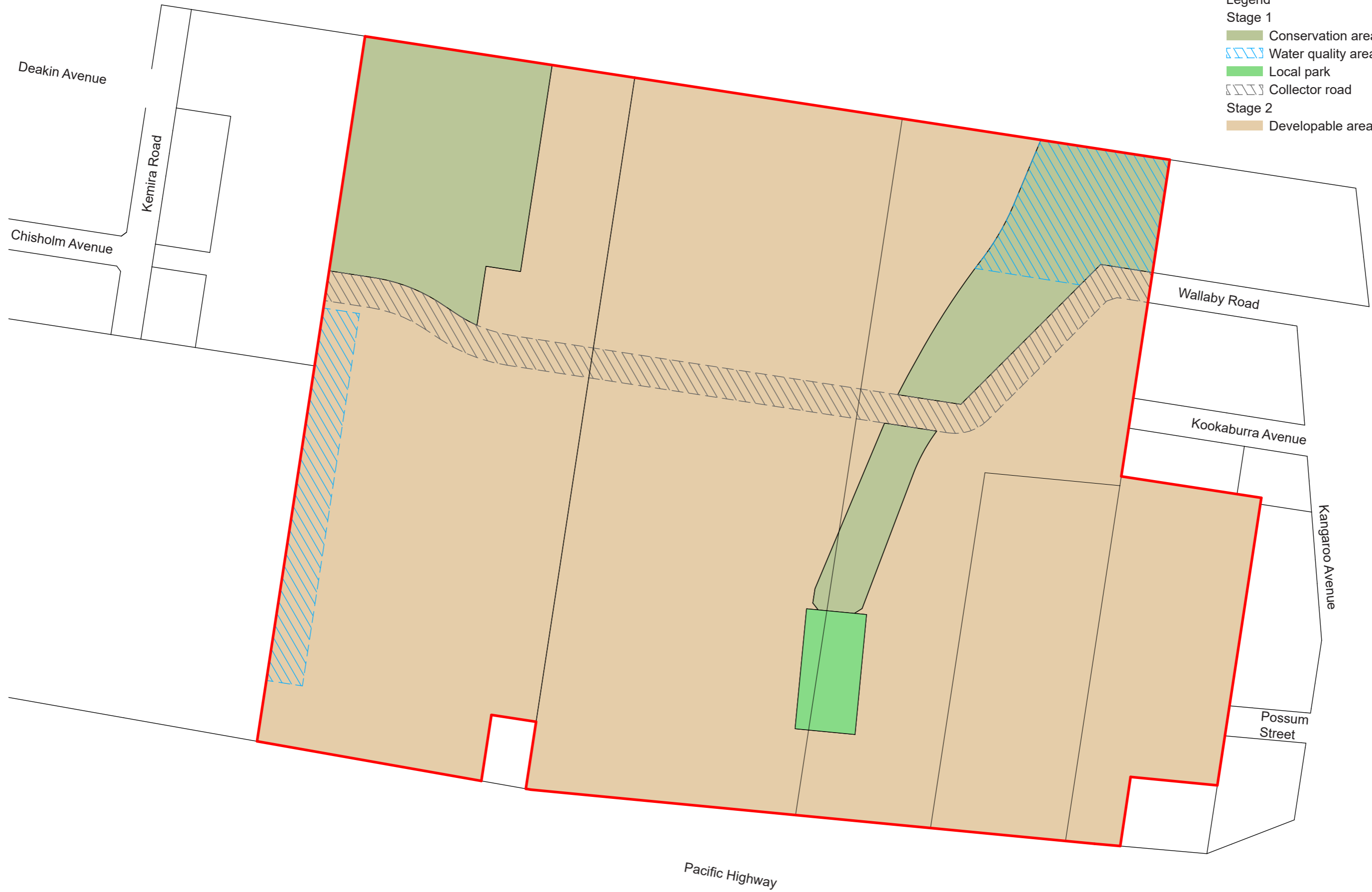
Music Development Team CRC for Catchment Hydrology, 2005, "Music User Guide", CRC for Catchment Hydrology, Australia, www.toolkit.net.au/music

Melbourne Water, 2005, "Stormwater WSUD Engineering Procedures", CSIRO Publishing, Melbourne.

Wong, T.H.F. (Ed.) (2005), "Australian Runoff Quality – A Guide to Water Sensitive Urban Design", Engineers Australia, Sydney.

Attachment A – Proposed Development

DRAFT



- Legend
- Stage 1
- Conservation area
 - Water quality area
 - Local park
 - Collector road
- Stage 2
- Developable area

Attachment B – MUSIC-Link Report (Existing and Developed Condition)



MUSIC-*link* Report

Project Details		Company Details	
Project:	CC180099 285-325 Pacific Highway, Lake Munmorah	Company:	Barker Ryan Stewart Pty Ltd
Report Export Date:	2/08/2022	Contact:	Scott Brisbin
Catchment Name:	CC180099_Pre Only v3	Address:	Suite 5, 78 York Street, East Gosford
Catchment Area:	35.131ha	Phone:	0409 667 913
Impervious Area*:	6.267%	Email:	scottb@brs.com.au
Rainfall Station:	66062 SYDNEY		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1974 - 31/12/1993 11:54:00 PM		
Mean Annual Rainfall:	1297mm		
Evapotranspiration:	1261mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.34		
Study Area:	Upland		
Scenario:	Central Coast Development		

* 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: Pre-Development Node	Reduction	Node Type	Number	Node Type	Number
Flow	0%			Urban Source Node	9
TSS	0%				
TP	0%				
TN	0%				
GP	0%				

Comments

This MUSICLink report has been prepared to support a Planning Proposal submission for 285-325 Pacific Highway, Lake Munmorah and should be read in conjunction with the 'Stormwater Management Report' prepared by Barker Ryan Stewart.

Note that this model represents existing site conditions and thus does not include a treatment train.

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Pre	Pre-Development Node	% Load Reduction	None	None	0
Urban	E Urban	Baseflow Total Nitrogen Mean (log mg/L)	-0.05	-0.05	-0.05
Urban	E Urban	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	E Urban	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.32
Urban	E Urban	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	E Urban	Baseflow Total Phosphorus Mean (log mg/L)	-1.22	-1.22	-1.22
Urban	E Urban	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	E Urban	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.82
Urban	E Urban	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	E Urban	Baseflow Total Suspended Solids Mean (log mg/L)	1.15	1.15	1.15
Urban	E Urban	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	E Urban	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.1
Urban	E Urban	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	E Urban	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	E Urban	Stormflow Total Nitrogen Mean (log mg/L)	0.34	0.34	0.34
Urban	E Urban	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	E Urban	Stormflow Total Nitrogen Mean (log mg/L)	0.34	0.34	0.34
Urban	E Urban	Stormflow Total Phosphorus Mean (log mg/L)	-0.66	-0.66	-0.66
Urban	E Urban	Stormflow Total Phosphorus Mean (log mg/L)	-0.3	-0.3	-0.3
Urban	E Urban	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.89	-0.89
Urban	E Urban	Stormflow Total Phosphorus Mean (log mg/L)	-0.3	-0.3	-0.3
Urban	E Urban	Stormflow Total Suspended Solids Mean (log mg/L)	1.95	1.95	1.95
Urban	E Urban	Stormflow Total Suspended Solids Mean (log mg/L)	3	3	3
Urban	E Urban	Stormflow Total Suspended Solids Mean (log mg/L)	1.3	1.3	1.3
Urban	E Urban	Stormflow Total Suspended Solids Mean (log mg/L)	2.43	2.43	2.43
Urban	W Urban	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.32
Urban	W Urban	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	W Urban	Baseflow Total Nitrogen Mean (log mg/L)	-0.05	-0.05	-0.05
Urban	W Urban	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.82
Urban	W Urban	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	W Urban	Baseflow Total Phosphorus Mean (log mg/L)	-1.22	-1.22	-1.22
Urban	W Urban	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.1
Urban	W Urban	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	W Urban	Baseflow Total Suspended Solids Mean (log mg/L)	1.15	1.15	1.15
Urban	W Urban	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	W Urban	Stormflow Total Nitrogen Mean (log mg/L)	0.34	0.34	0.34
Urban	W Urban	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	W Urban	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.89	-0.89
Urban	W Urban	Stormflow Total Phosphorus Mean (log mg/L)	-0.3	-0.3	-0.3
Urban	W Urban	Stormflow Total Phosphorus Mean (log mg/L)	-0.66	-0.66	-0.66

Only certain parameters are reported when they pass validation



Node Type	Node Name	Parameter	Min	Max	Actual
Urban	WUrban	Stormflow Total Suspended Solids Mean (log mg/L)	1.3	1.3	1.3
Urban	WUrban	Stormflow Total Suspended Solids Mean (log mg/L)	3	3	3
Urban	WUrban	Stormflow Total Suspended Solids Mean (log mg/L)	1.95	1.95	1.95
Urban	WUrban Future Road	Baseflow Total Nitrogen Mean (log mg/L)	-0.05	-0.05	-0.05
Urban	WUrban Future Road	Baseflow Total Phosphorus Mean (log mg/L)	-1.22	-1.22	-1.22
Urban	WUrban Future Road	Baseflow Total Suspended Solids Mean (log mg/L)	1.15	1.15	1.15
Urban	WUrban Future Road	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	WUrban Future Road	Stormflow Total Phosphorus Mean (log mg/L)	-0.66	-0.66	-0.66
Urban	WUrban Future Road	Stormflow Total Suspended Solids Mean (log mg/L)	1.95	1.95	1.95
Urban	W3 Retained Eco Land	Baseflow Total Nitrogen Mean (log mg/L)	-0.05	-0.05	-0.05
Urban	W3 Retained Eco Land	Baseflow Total Phosphorus Mean (log mg/L)	-1.22	-1.22	-1.22
Urban	W3 Retained Eco Land	Baseflow Total Suspended Solids Mean (log mg/L)	1.15	1.15	1.15
Urban	W3 Retained Eco Land	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	W3 Retained Eco Land	Stormflow Total Phosphorus Mean (log mg/L)	-0.66	-0.66	-0.66
Urban	W3 Retained Eco Land	Stormflow Total Suspended Solids Mean (log mg/L)	1.95	1.95	1.95

Only certain parameters are reported when they pass validation



Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Pre	Pre-Development Node	GP % Load Reduction	90	None	0
Pre	Pre-Development Node	TN % Load Reduction	45	None	0
Pre	Pre-Development Node	TP % Load Reduction	45	None	0
Pre	Pre-Development Node	TSS % Load Reduction	80	None	0

Only certain parameters are reported when they pass validation



MUSIC-*link* Report

Project Details		Company Details	
Project:	CC180099 285-325 Pacific Highway, Lake Munmorah	Company:	Barker Ryan Stewart Pty Ltd
Report Export Date:	2/08/2022	Contact:	Scott Brisbin
Catchment Name:	CC180099_Post_Only v6	Address:	Suite 5, 78 York Street, East Gosford
Catchment Area:	27.695ha	Phone:	0409 667 913
Impervious Area*:	68.63%	Email:	scottb@brs.com.au
Rainfall Station:	66062 SYDNEY		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1974 - 31/12/1993 11:54:00 PM		
Mean Annual Rainfall:	1297mm		
Evapotranspiration:	1261mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.34		
Study Area:	Upland		
Scenario:	Central Coast Development		

* 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: Post-Development Node	Reduction	Node Type	Number	Node Type	Number
Flow	51.5%	Bio Retention Node	2	Urban Source Node	20
TSS	82.5%	Rain Water Tank Node	3		
TP	70.6%	Infiltration System Node	5		
TN	70.2%	GPT Node	4		
GP	99.1%				

Comments

This MUSICLink report has been prepared to support a Planning Proposal submission for 285-325 Pacific Highway, Lake Munmorah and should be read in conjunction with the 'Stormwater Management Report' prepared by Barker Ryan Stewart.

It is noted that exfiltration from the proposed bioretention areas has been included in the MUSIC model to assist in managing overall stormwater flow volumes discharged from the site. The adopted exfiltration rate is 1.98mm/hr which equates to the average exfiltration rate for 'heavy clay' soil recommended by MUSIC (representative range 0.36 to 3.6mm/hr). The adopted exfiltration rate is considered to be conservative and may be confirmed through field testing, if required, as part of the next stage of the design (ie after Planning Proposal approval).

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	E Bioretention A	Extended detention depth (m)	0.1	0.3	0.3
Bio	E Bioretention A	Filter depth (m)	0.5	1	0.5
Bio	E Bioretention A	Orthophosphate Content in Filter (mg/kg)	40	50	40
Bio	E Bioretention A	PET Scaling Factor	2.1	2.1	2.1
Bio	E Bioretention A	Saturated Hydraulic Conductivity (mm/hr)	100	180	125
Bio	E Bioretention A	Total Nitrogen Content in Filter (mg/kg)	750	950	800
Bio	W2 Bioretention B	Extended detention depth (m)	0.1	0.3	0.3
Bio	W2 Bioretention B	Filter depth (m)	0.5	1	0.5
Bio	W2 Bioretention B	Orthophosphate Content in Filter (mg/kg)	40	50	40
Bio	W2 Bioretention B	PET Scaling Factor	2.1	2.1	2.1
Bio	W2 Bioretention B	Saturated Hydraulic Conductivity (mm/hr)	100	180	125
Bio	W2 Bioretention B	Total Nitrogen Content in Filter (mg/kg)	750	950	800
GPT	E1 Gross Pollutant Trap	Hi-flow bypass rate (cum/sec)	None	99	0.97
GPT	E2 Gross Pollutant Trap	Hi-flow bypass rate (cum/sec)	None	99	0.655
GPT	W2 GPT (Pit Baskets)	Hi-flow bypass rate (cum/sec)	None	99	0.12
GPT	W2 Gross Pollutant Trap	Hi-flow bypass rate (cum/sec)	None	99	0.68
Infiltration	E1 Infiltration System	Area (sqm)	None	None	2193
Infiltration	E1 Infiltration System	Filter area (sqm)	None	None	2193
Infiltration	E1 Infiltration System	Hi-flow bypass rate (cum/sec)	None	None	100
Infiltration	E2 Infiltration System	Area (sqm)	None	None	3437
Infiltration	E2 Infiltration System	Filter area (sqm)	None	None	3437
Infiltration	E2 Infiltration System	Hi-flow bypass rate (cum/sec)	None	None	100
Infiltration	Infiltration System	Area (sqm)	None	None	600
Infiltration	Infiltration System	Area (sqm)	None	None	800
Infiltration	Infiltration System	Filter area (sqm)	None	None	600
Infiltration	Infiltration System	Filter area (sqm)	None	None	800
Infiltration	Infiltration System	Hi-flow bypass rate (cum/sec)	None	None	100
Infiltration	Infiltration System	Hi-flow bypass rate (cum/sec)	None	None	100
Infiltration	W1 Infiltration System	Area (sqm)	None	None	1869
Infiltration	W1 Infiltration System	Filter area (sqm)	None	None	1869
Infiltration	W1 Infiltration System	Hi-flow bypass rate (cum/sec)	None	None	100
Post	Post-Development Node	% Load Reduction	None	None	51.5
Post	Post-Development Node	GP % Load Reduction	90	None	99.1
Post	Post-Development Node	TN % Load Reduction	45	None	70.2
Post	Post-Development Node	TP % Load Reduction	45	None	70.6
Post	Post-Development Node	TSS % Load Reduction	80	None	82.5
Urban	E1 Parks and Basin	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	E1 Parks and Basin	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	E1 Parks and Basin	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	E1 Parks and Basin	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	E1 Parks and Basin	Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6
Urban	E1 Parks and Basin	Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15
Urban	E1 Residential Impervious	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	E1 Residential Impervious	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	E1 Residential Impervious	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	E1 Residential Impervious	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	E1 Residential Impervious	Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6
Urban	E1 Residential Impervious	Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15
Urban	E1 Residential Pervious	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	E1 Residential Pervious	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	E1 Residential Pervious	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	E1 Residential Pervious	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	E1 Residential Pervious	Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6
Urban	E1 Residential Pervious	Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15
Urban	E1 Road (Including Reserve)	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	E1 Road (Including Reserve)	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	E1 Road (Including Reserve)	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	E1 Road (Including Reserve)	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	E1 Road (Including Reserve)	Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6
Urban	E1 Road (Including Reserve)	Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15
Urban	E1 Roof Area Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.32
Urban	E1 Roof Area Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.82
Urban	E1 Roof Area Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.1
Urban	E1 Roof Area Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	E1 Roof Area Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.89	-0.89
Urban	E1 Roof Area Bypass	Stormflow Total Suspended Solids Mean (log mg/L)	1.3	1.3	1.3
Urban	E1 Roof Area Tank	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.32
Urban	E1 Roof Area Tank	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.82
Urban	E1 Roof Area Tank	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.1
Urban	E1 Roof Area Tank	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	E1 Roof Area Tank	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.89	-0.89
Urban	E1 Roof Area Tank	Stormflow Total Suspended Solids Mean (log mg/L)	1.3	1.3	1.3
Urban	E2 Parks and Basin	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	E2 Parks and Basin	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	E2 Parks and Basin	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	E2 Parks and Basin	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	E2 Parks and Basin	Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6
Urban	E2 Parks and Basin	Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15
Urban	E2 Residential Impervious	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	E2 Residential Impervious	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	E2 Residential Impervious	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	E2 Residential Impervious	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	E2 Residential Impervious	Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6
Urban	E2 Residential Impervious	Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15
Urban	E2 Residential Pervious	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	E2 Residential Pervious	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	E2 Residential Pervious	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	E2 Residential Pervious	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	E2 Residential Pervious	Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6
Urban	E2 Residential Pervious	Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15
Urban	E2 Road (Including Reserve)	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	E2 Road (Including Reserve)	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	E2 Road (Including Reserve)	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	E2 Road (Including Reserve)	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	E2 Road (Including Reserve)	Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6
Urban	E2 Road (Including Reserve)	Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15
Urban	E2 Roof Area Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.32
Urban	E2 Roof Area Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.82
Urban	E2 Roof Area Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.1
Urban	E2 Roof Area Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	E2 Roof Area Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.89	-0.89
Urban	E2 Roof Area Bypass	Stormflow Total Suspended Solids Mean (log mg/L)	1.3	1.3	1.3
Urban	E2 Roof Area Tank	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.32
Urban	E2 Roof Area Tank	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.82
Urban	E2 Roof Area Tank	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.1
Urban	E2 Roof Area Tank	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	E2 Roof Area Tank	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.89	-0.89
Urban	E2 Roof Area Tank	Stormflow Total Suspended Solids Mean (log mg/L)	1.3	1.3	1.3
Urban	E5 Channel and Basin	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	E5 Channel and Basin	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	E5 Channel and Basin	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	E5 Channel and Basin	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	E5 Channel and Basin	Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6
Urban	E5 Channel and Basin	Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15
Urban	W2 Residential Impervious	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	W2 Residential Impervious	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	W2 Residential Impervious	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	W2 Residential Impervious	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	W2 Residential Impervious	Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6
Urban	W2 Residential Impervious	Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	W2 Residential Perivous	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	W2 Residential Perivous	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	W2 Residential Perivous	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	W2 Residential Perivous	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	W2 Residential Perivous	Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6
Urban	W2 Residential Perivous	Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15
Urban	W2 Road (Including Reserve)	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	W2 Road (Including Reserve)	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	W2 Road (Including Reserve)	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	W2 Road (Including Reserve)	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	W2 Road (Including Reserve)	Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6
Urban	W2 Road (Including Reserve)	Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15
Urban	W2 Road (Including Reserve) Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	W2 Road (Including Reserve) Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	W2 Road (Including Reserve) Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	W2 Road (Including Reserve) Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	W2 Road (Including Reserve) Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6
Urban	W2 Road (Including Reserve) Bypass	Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15
Urban	W2 Roof Area Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.32
Urban	W2 Roof Area Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.82
Urban	W2 Roof Area Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.1
Urban	W2 Roof Area Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	W2 Roof Area Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.89	-0.89
Urban	W2 Roof Area Bypass	Stormflow Total Suspended Solids Mean (log mg/L)	1.3	1.3	1.3
Urban	W2 Roof Area Tank	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.32
Urban	W2 Roof Area Tank	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.82
Urban	W2 Roof Area Tank	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.1
Urban	W2 Roof Area Tank	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	W2 Roof Area Tank	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.89	-0.89
Urban	W2 Roof Area Tank	Stormflow Total Suspended Solids Mean (log mg/L)	1.3	1.3	1.3
Urban	W3 Retained Eco Land	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11
Urban	W3 Retained Eco Land	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85
Urban	W3 Retained Eco Land	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2
Urban	W3 Retained Eco Land	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3
Urban	W3 Retained Eco Land	Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6
Urban	W3 Retained Eco Land	Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15

Only certain parameters are reported when they pass validation



Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	E Bioretention A	Exfiltration Rate (mm/hr)	0	0	1.98
Bio	W2 Bioretention B	Exfiltration Rate (mm/hr)	0	0	1.98

Only certain parameters are reported when they pass validation

Attachment C – Department of Planning and Environment Email dated 8 July 2022 and Correspondence dated 2 August 2022

From: Jayme Lennon <jayme.lennon@environment.nsw.gov.au>
Sent: Friday, 8 July 2022 11:42 AM
To: David Martin; Peter Francis; Ian Stewart
Cc: Steven Crick; Ellen Mannix; Robin Ward; Matthew Hingee;
lucy.larkins@centralcoast.nsw.gov.au
Subject: RE: [External] Lakes Ridge BCAR, Lake Munmorah - Stormwater and Retention Basins

Follow Up Flag: Follow up
Flag Status: Completed

Hi David, Peter and Ian,

Our Water, Floodplains and Coast team has reviewed the reports provided below and have provided their advice. Collectively, we recommend the following actions are undertaken in order for us to determine that the impacts to the coastal wetlands have been adequately avoided in the current development footprint:

- Modelling of the existing-case scenario to determine background hydrology and water quality
- Remodelling of hydrology and water quality models to incorporate rainwater tanks being installed at residential properties (we are assuming this is already required under BASIX or council requirements).
- Adoption of neutral or beneficial water quality targets and revision of the water treatment system as required in order to achieve this.

A more detailed assessment is provided below:

The Hunter Central Coast Water Floodplains and Coast Team have reviewed the following documents:

- BRS (April 2022) "Stormwater Management Report 285-325 Pacific Highway, Lake Munmorah"
- BRS (April 2022) "Flood Impact Assessment Report 285-325 Pacific Highway, Lake Munmorah"

Both reports are light on the details for the assumptions made with regard to the modelling. The flood impact assessment is deemed satisfactory for the planning proposal stage of the development. The stormwater management and potential impacts on coastal wetlands is a key issue of concern.

The proposed Lake Munmorah Site is located within the Lake Macquarie catchment. The Site is largely undeveloped and includes two watercourses that drain northward into an adjacent wetland areas. The coastal wetland is identified within Resilience and Hazard SEPP's 'Coastal Wetlands and Littoral Rainforest Area Map'. A 'Proximity Areas for Coastal Wetlands' is located in the northwester corner of the Site.

Coastal wetlands are sensitive ecosystems that perform many functions. These coastal ecosystems are vital for environmental, economic, social and cultural reasons. Coastal wetlands are recognised as an important part of the NSW coastal zone, as defined in the *Coastal Management Act 2016 (CM Act)*.

Management objectives for coastal wetlands (and littoral rainforests) outlined in the CM Act extend to (*clause 6 (2)*):

- (a) to protect coastal wetlands and littoral rainforests in their natural state, including their biological diversity and ecosystem integrity***
- (b) to promote the rehabilitation and restoration of degraded coastal wetlands and littoral rainforests,*
- (c) to improve the resilience of coastal wetlands and littoral rainforests to the impacts of climate change, including opportunities for migration,***
- (d) to support the social and cultural values of coastal wetlands and littoral rainforests,*
- (e) to promote the objectives of State policies and programs for wetlands or littoral rainforest management.*

Wetlands are sensitive to physical disturbances, changes in hydrology and stormwater pollution. Key activities that threaten the biological diversity, ecosystem integrity and resilience of coastal wetland include:

- Clearing and harming marine vegetation
- Landform modifications (e.g., earthworks, artificial draining) both within and adjacent to wetland areas
- Changes in the quantity and quality of surface and groundwater flows into and out of the wetland areas (i.e., modifications to the hydrological integrity of wetlands)

These threatening processes are recognised in the Chapter 2 (Coastal Management) of the Resilience and Hazard SEPP, for example (clause 2.7 and 2.8).

The proposed land use changes will increase the development intensity of the site. This would increase pollutant loads and change the natural flow regimes entering the adjacent wetland areas.

The water quality treatment train for the development include GPTs and bioretention areas. There is no mention of rainwater tanks and associated reuse opportunities. The following two tables (figure 7 & 8) show the post development water quality treatment trains results for the west and east discharge points. They meet / exceed council's minimum pollution removal performance targets below in figure 5.

	Sources	Residual Load	% Reduction
Flow (ML/yr)	189	186	1.4
Total Suspended Solids (kg/yr)	28900	5640	80.5
Total Phosphorus (kg/yr)	57.4	24.3	57.7
Total Nitrogen (kg/yr)	423	210	50.3
Gross Pollutants (kg/yr)	4550	75.5	98.3

Figure 7: MUSIC model results - Eastern Catchment

	Sources	Residual Load	% Reduction
Flow (ML/yr)	68.2	67.5	1
Total Suspended Solids (kg/yr)	10660	2100	80.2
Total Phosphorus (kg/yr)	28.8	9.38	67.9
Total Nitrogen (kg/yr)	154	82.7	46.1
Gross Pollutants (kg/yr)	1650	6.68	99.6

Figure 8: MUSIC model results - Western Catchment

Table 11.1 Minimum Pollutant Removal Performance Targets (Australian Runoff Quality 2006)

Pollutant	Performance Requirements (Targets)
Total Suspended Solids (TSS)	90% reduction in the post-development mean annual load
Total Nitrogen (TN)	45% reduction in the post-development mean annual load
Total Phosphorus (TP)	45% reduction in the post-development mean annual load
Gross Pollutants	90% reduction in the post-development mean annual load (for pollutants greater than 5mm in diameter)
Hydrology	The post-development peak discharge must not exceed the pre-development peak discharge for flows for the 5, 20 and 100% AEP event

Figure 5: Minimum Pollutant Removal Performance Targets (CCC Civil Works Specification)

An increase to stormwater pollutants could potentially impact the downstream coastal wetland. The proponent has not provided information on the pollutants generated from the existing scenario (pre development). It is

recommended the stormwater pollutant performance targets be neutral or beneficial effect on water quality (i.e. post to pre development scenarios) to ensure there are no impacts to the coastal wetland.

Council also requires that the stormwater peak flows discharging from the site in the 1%, 5% & 20% AEP post development are equal or below the pre development scenario. Table 4 below demonstrates that proponent has satisfied this criteria, with the use of detention basins on both discharge points. This assessment was undertaken using the DRAINS model.

Table 4 Pre and Post Development Flows from the Development

Catchment	Storm Event (AEP)	Pre-Development Flow (m ³ /s)	Post-Development Flow (m ³ /s)
Eastern	20%	5.11	5.11
	5%	7.95	5.79
	1%	12.3	11.0
Western	20%	7.54	7.52
	5%	11.5	10.7
	1%	17.6	16.7

The coastal wetlands could be sensitive to the amount of total volume of fresh water received from upstream stormwater. It is recommended that the total volume stormwater discharged to the coastal wetland is not increased from the pre to post development scenarios.. This can be assessed using the existing MUSIC model that the proponent has prepared updated with the existing land use scenario.

Please let me know if you require any further information.

Kind regards,

Jayme Lennon (She/Her)

Senior Conservation Planning Officer, Hunter Central Coast Branch
Biodiversity and Conservation Division
Department of Planning and Environment

T (02) 9585 6935 M 0447 822 510 E jayme.lennon@environment.nsw.gov.au

dpie.nsw.gov.au

Level 3, 6 Stewart Avenue
Newcastle West NSW 2302
Locked Bag 1002, Dangar NSW 2309

Working days Monday to Friday, 09:00am - 05:00pm

Please note our branch email address has changed. Please send all new planning requests to huntercentralcoast@environment.nsw.gov.au where they will be entered into our document management system and be forwarded to our Senior Team Leader.





The Department of Planning, Industry and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.


Please consider the environment before printing this email.

We work flexibly. I'm sending this message now because it's a good time for me. I don't expect that you will read, respond to, or action this message outside of your own regular hours.

From: David Martin <DMartin@wedgetail.com.au>
Sent: Wednesday, 29 June 2022 9:36 PM
To: Steven Crick <Steven.Crick@environment.nsw.gov.au>; Jayme Lennon <jayme.lennon@environment.nsw.gov.au>
Subject: RE: Lakes Ridge BCAR, Lake Munmorah - Stormwater and Retention Basins

Hi Steven,

Please see the **Stormwater Management Plan** and **Flood Impact Assessment Report** linked below.

 [CC180099 FIA\[1\].pdf](#)

 [CC180099 Stormwater Management Report\[2\].pdf](#)

Let me know if you have any issues accessing the reports through the links provided.

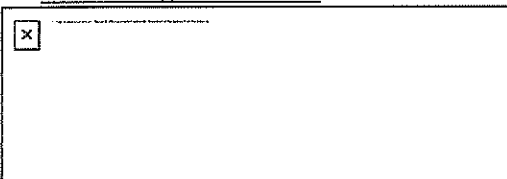
Cheers,
David

David Martin
Senior Ecologist
Accredited BAM Assessor

M: 0425 318 679

E: dmartin@wedgetail.com.au

W: www.wedgetail.com.au



'I acknowledge Aboriginal people as the traditional custodians of the land on which I work and pay my respects to Elders past, present and emerging.'

This email may contain confidential information. If you have received this email—including any attachments—in error, please notify the sender promptly and delete the email and any attachments from all of your systems.

From: Steven Crick <Steven.Crick@environment.nsw.gov.au>
Sent: Wednesday, 29 June 2022 4:59 PM
To: David Martin <DMartin@wedgetail.com.au>; Jayme Lennon <jayme.lennon@environment.nsw.gov.au>
Subject: RE: Lakes Ridge BCAR, Lake Munmorah - Stormwater and Retention Basins

Hi David

We can't say if we accept the studies and drainage design at this point. BCD's Water Floodplains and Coast (WFC) team has experts in hydrology and water quality and I will refer the relevant studies to them to review. I understand the relevant information comes from the stormwater management report – can you please provide the full report and if there is a flooding assessment, can you please provide this also?

My initial feedback is that the water quality targets may be too low. The Resilience and Hazards SEPP has provisions that prohibit development that will significantly affect coastal wetlands through water quality impacts (amongst others). We will confirm any issues following the review by our WFC team.

Regards

Steven Crick
Senior Team Leader – Planning
Hunter Central Coast Branch
Biodiversity & Conservation Division
Department of Planning & Environment

6 Stewart Avenue, Newcastle, 2300
Locked Bag 1002, Dangar, 2309
T 02 4927 3248
M 0402 279 129

From: David Martin <DMartin@wedgetail.com.au>
Sent: Wednesday, 29 June 2022 3:22 PM
To: Steven Crick <Steven.Crick@environment.nsw.gov.au>; Jayme Lennon <jayme.lennon@environment.nsw.gov.au>
Subject: RE: Lakes Ridge BCAR, Lake Munmorah - Stormwater and Retention Basins

Hi Steven and Jayme,

Did you guys have an opinion on the results of the modelling below.

We are looking at deciding on a final location and footprint for the basin along the western boundary of the site. The basin will be outside of the riparian buffer of the mapped wetland, and only just within the coastal wetland proximity area (100m buffer). Discharge volumes will be on par with that pre-development, and the post-development water quality will be in line with Central Coast Council's water quality performance targets.

Let me know if this is something that the BCD are likely to support, and if the level of detail below would be fine for inclusion within the BCAR.

Thanks again.

Kind Regards,
David

David Martin
Senior Ecologist

M: 0425 318 679



Wedgetail Consulting Pty Ltd
ABN: 93 640 388 683

'I acknowledge Aboriginal people as the traditional custodians of the land on which I work and pay my respects to Elders past, present and emerging.'

This email may contain confidential information. If you have received this email—including any attachments—in error, please notify the sender promptly and delete the email and any attachments from all of your systems.

From: David Martin
Sent: Monday, 27 June 2022 12:07 PM
To: Steven Crick <Steven.Crick@environment.nsw.gov.au>; Jayme Lennon <jayme.lennon@environment.nsw.gov.au>
Subject: Lakes Ridge BCAR, Lake Munmorah - Stormwater and Retention Basins

Hi Steven and Jayme,

Hope you're both well and had a great weekend!

Following on from our discussion on Tuesday regarding the impacts of the proposed Lakes Ridge development and retention basins on water quality and quantity into wetlands offsite, Ian Stewart has pulled together this information for inclusion into the BCAR (instead of conducting a full Coastal Wetland Impact Assessment).

Can you let me know if you are happy with the conclusions and level of detail provided below.

A Stormwater Management Report was prepared for Alda, Rose Group and Urban Villager to support a Planning Proposal to NSW Department of Planning and Central Coast Council for a proposed residential subdivision at 285-325 Pacific Highway, Lake Munmorah.

The report demonstrates compliance with on-site detention and water quality requirements of Central Coast Council.

The site's stormwater management has been prepared with consideration to:

- a. Wyong Development Control Plan 2013;*
- b. Central Coast Council Civil Works Specification Design Guideline 2020; and*
- c. Australian Rainfall and Runoff, 2019.*

Water quality modelling was carried out using the MUSIC software program and Central Coast Council's MUSIC-Link data. The proposed treatment train comprises of proprietary gross pollutant traps and bioretention areas and exceeds the minimum pollutant reduction targets specified by Council.

On-site detention (OSD) modelling was carried out using the DRAINS software program and rainfall data adopted from Australian Rainfall and Runoff, 2019. Two (2) OSD basins are proposed with the outlet configuration designed to restrict peak discharges from the site to no more than under existing conditions for the 5%, 20% and 1% AEP storm events.

Central Coast Council's water quality treatment requirements are specified in Section 11 of Council's Civil Works Specification – Design Guideline 2020 and is summarised below.

**Table 11.1 Minimum Pollutant Removal Performance Targets
(Australian Runoff Quality 2006)**

Pollutant	Performance Requirements (Targets)
Total Suspended Solids (TSS)	80% reduction in the post-development mean annual load
Total Nitrogen (TN)	45% reduction in the post-development mean annual load
Total Phosphorous (TP)	45% reduction in the post-development mean annual load
Gross Pollutants	90% reduction in the post-development mean annual load (for pollutants greater than 5mm in diameter)
Hydrology	The post-development peak discharge must not exceed the pre-development peak discharge for flows for the 5, 20 and 100% AEP event

Results of the on-site detention Drains modelling for pre-development and post-development flows are presented below.

Catchment	Storm Event (AEP)	Pre-Development Flow (m ³ /s)	Post-Development Flow (m ³ /s)
Eastern	20%	5.11	5.11
	5%	7.95	5.79
	1%	12.3	11.0
Western	20%	7.54	7.52
	5%	11.5	10.7
	1%	17.6	16.7

Note that the above Post-Developed Flow is a combination of piped and weir flows.

The above table confirms that the proposed OSD measures reduce flows from the development for both the Eastern Catchment and the Western Catchment to no greater than pre-development conditions for the 20%, 5% and 1% AEP storm events in accordance with Council's requirements.

It is therefore concluded that the proposed development meets the requirements of Central Coast Council with respect to on-site detention and water quality.

If you have any questions please don't hesitate to get in contact.

Cheers,
David

David Martin
Senior Ecologist

M: 0425 318 679



Wedgetail Consulting Pty Ltd
ABN: 93 640 388 683

'I acknowledge Aboriginal people as the traditional custodians of the land on which I work and pay my respects to Elders past, present and emerging.'

This email may contain confidential information. If you have received this email—including any attachments—in error, please notify the sender promptly and delete the email and any attachments from all of your systems.

This email is intended for the addressee(s) named and may contain confidential and/or privileged information. If you are not the intended recipient, please notify the sender and then delete it immediately. Any views expressed in this email are those of the individual sender except where the sender expressly and with authority states them to be the views of the NSW Office of Environment, Energy and Science.

PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL

This email is intended for the addressee(s) named and may contain confidential and/or privileged information. If you are not the intended recipient, please notify the sender and then delete it immediately. Any views expressed in this email are those of the individual sender except where the sender expressly and with authority states them to be the views of the NSW Office of Environment, Energy and Science.

PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL



Our ref: DOC22/295080-18

Your ref: CC180099

Ian Stewart

Director
Barker Ryan Stewart Pty Ltd
ian@brs.com.au

Dear Ian,

Biodiversity Certification Application – 285-335 Pacific Highway, Lake Munmorah

I refer to the Biodiversity Certification Application for 285-335 Pacific Highway, Lake Munmorah. Biodiversity and Conservation Division (BCD) has reviewed the amended Biodiversity Certification Assessment Report (BCAR), dated 6 July 2022; the Swift Parrot Habitat assessment dated 20 July 2022 and the Swift Parrot Serious and Irreversible Impact (SAII) assessment.

BCD's recommendations are provided in **Attachment A** and associated comments are provided in **Attachment B**. BCD recommends that the revised BCAR is referred to council for further comment prior to resubmission. BCD notes that future revisions of the BCAR should also be provided with tracked changes, as well as a table identifying which sections of the BCAR address each recommendation.

If you require any further information regarding this matter, please contact Jayme Lennon, Senior Conservation Planning Officer, on 9585 6935 or via email at huntercentralcoast@environment.nsw.gov.au

Yours sincerely

A handwritten signature in black ink, appearing to read 'S. Crick'.

STEVEN CRICK
Senior Team Leader Planning
Hunter Central Coast Branch
Biodiversity and Conservation Division

2 August 2022

Enclosure: Attachments A and B

BCD's recommendations

285-335 Pacific Highway, Lake Munmorah Biodiversity Certification Assessment Report

1. The avoidance and minimisation measures in the revised BCAR should be consistent with the development footprint in the planning proposal as well as the swift parrot SAI assessment and Lakes Ridge Swift Parrot Habitat Assessment received by email 20 July 2022 as well as the water flow and pollutants assessment received by email 18 July 2022.
2. A detailed impact assessment of potential impacts to coastal wetlands to the final development footprint should be added to the BCAR. This should outline how impacts to the coastal wetlands mapped under the Resilience and Hazards SEPP have been avoided, and detailing any impacts to water bodies, through changes to water quality and hydrology of watercourses and impacts to riparian vegetation both onsite and downstream.
3. The proposal should be referred to the Department of Climate Change, Energy, Environment and Water as soon as possible.
4. BCD recommends that Central Coast Council is consulted further regarding the adequacy of the response to Central Coast Council's original comments.
5. A Biodiversity Management Plan should accompany the BCAR. This should address both the construction and in perpetuity maintenance phases and include details on the rehabilitation plan, a timeline on how initial and ongoing targets will be achieved, how threatened species will be protected and monitored and who will be responsible for the current and future management of the C2 zones.
6. The survey methods used for the red-backed button-quail (*Tunix maculosus*) should be justified and conducted in accordance with the *Threatened Biodiversity Database Collection*.
7. BCD recommends that threatened species records are uploaded to the BioNet database.
8. The following items are required to meet the minimum requirements of the BAM and Biodiversity Certification Application and should be provided as part of a revised BCAR or as an addendum to the application form:
 - Shapefiles of the swift parrot species polygon
 - Section 4 of the Biodiversity Certification Application requires the attachment of maps indicating the cadastre and subject site boundary to the form
 - The required maps, such as the site and location maps should be labelled to match requirements in table 25 of the BAM
 - Connectivity of different habitat areas should be demonstrated on the Site map and/or location map
 - Maps and details of alternative development footprints which demonstrate why this footprint is more favourable for biodiversity values should be provided
 - Maps and tables which display the TEC extent and patch size for each native vegetation zone

- Table 5 of the BCAR should include the sensitivity to gain class for each ecosystem credit species
- A table detailing species credit species recorded or assumed as present within the subject land, habitat constraints or microhabitats associated with the species, counts of individuals (flora)/extent of suitable habitat (flora and fauna) (as described in BAM Subsection 5.2.6) and biodiversity risk weighting (BAM Section 5.4)
- The actions and outcomes of measures to avoid and minimise impacts in Table 14 should be addressed separately
- A digital shapefile of the alternative and final footprint
- Demonstration of efforts to avoid and minimise impacts on biodiversity values (including prescribed impacts) associated with the proposal location in accordance with Chapter 7, including an analysis of alternative modes, technologies, routes, locations, and sites.
- Identification of any other site constraints that the proponent has considered in determining the location and design of the proposal (as described in BAM Section 7.2.1(3.))
- Assessment of indirect impacts on vegetation and threatened species and their habitat including the nature, extent, frequency, duration, and timing, documenting the consequences, reporting limitations/assumptions and what threatened entities and habitat are likely to be affected (as described in BAM Section 8.2)
- A map showing location of impacts requiring offset, impacts not requiring offset and any areas not requiring assessment
- Data for the ultrasonic devices showing the confirmed microbat calls for threatened species.

BCD's detailed comments

285-335 Pacific Highway, Lake Munmorah Biodiversity Certification Assessment Report

Biodiversity

1. The impacts of the final development footprint should be considered throughout the BCAR.

The development footprint has been through several iterations since the original BCAR was submitted to BCD. The resubmitted BCAR should be updated to reflect this. The areas avoided and proposed actions to minimise impacts to biodiversity within the BCAR should be consistent with the planning proposal as well as the details provided in the Swift Parrot SAI assessment and Lakes Ridge Swift Parrot Habitat Assessment received by email 20 July 2022. The BCAR should also be consistent with the water flow and pollutants assessment received by email 18 July 2022.

Recommendation 1

The avoidance and minimisation measures in the revised BCAR should be consistent with the development footprint in the planning proposal as well as the swift parrot SAI assessment and Lakes Ridge Swift Parrot Habitat Assessment received by email 20 July 2022 as well as the water flow and pollutants assessment received by email 18 July 2022.

2. The BCAR should include a detailed assessment of impacts to coastal wetlands

It is expected that impacts to coastal wetlands are avoided in biodiversity certification applications. The subject site contains coastal wetlands along its north-western border and has the proximity area for coastal wetlands layer present onsite, within the development footprint. Two first order creeks run through the site and flow into the coastal wetlands.

This project will increase runoff into these waterways because of increased impervious surfaces and changes to land use. There will be further permanent impacts as there are plans to place a detention basin within each of these waterways. These activities will result in changes to the water bodies, water quality and hydrology both onsite and downstream. These changes will also cause both direct and indirect impacts to the retained vegetation.

It is acknowledged that some of these issues have been worked through in correspondence with BCD since the last version of the BCAR was completed. This correspondence, along with the modelling provided to BCD 18 July 2022 should form the basis for the assessment to be added to the BCAR.

Recommendation 2

A detailed impact assessment of potential impacts to coastal wetlands to the final development footprint should be added to the BCAR. This should outline how impacts to the coastal wetlands mapped under the Resilience and Hazards SEPP have been avoided, and detailing any impacts to water bodies, through changes to water quality and hydrology of watercourses and impacts to riparian vegetation both onsite and downstream.

3. It is recommended that the BCAR and proposal are referred to the federal Department of Climate Change, Energy, Environment and Water.

The proposal is expected to impact on Matters of National Environmental Significance (MNES) with regard to the Charmhaven apple (*Angophora inopina*) and the swift parrot (*Lathamus discolor*) which are both listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). Therefore, referral to the Department of Climate Change, Energy, Environment and Water should be undertaken as soon as possible. There are risks involved in not referring the proposal to the federal government early in the planning process as the federal legislation and state legislation can differ in their requirements for offsetting or the extent of impacts which are considered acceptable.

Recommendation 3

The proposal should be referred to the Department of Climate Change, Energy, Environment and Water as soon as possible.

4. BCD recommends referring this proposal back to Central Coast Council.

The consultation process with council in the BCAR assessment process is iterative. Central Coast Council (Council) should have the opportunity to respond to the feedback that the consultant has provided to the issues Council has raised. This will provide BCD with an indication as to whether the applicant has adequately addressed Council's concerns in accordance with Section 8.6(1) of the BC Act and Biodiversity Certification Fact Sheet #3 – Council consultation required under the Act.

Recommendation 4

BCD recommends that Central Coast Council is consulted further regarding the adequacy of the response to Central Coast Council's original comments and the latest BCAR.

5. The management and ownership of the proposed conservation areas should be clarified.

The purpose of the biodiversity certification process is to provide certainty to both the future development outcomes of the site and how its biodiversity values will be managed. As such, more detail over the future of the management and ownership of the retained and rehabilitated vegetation in the C2 zones is required.

The management plan for the conservation plan should cover both the construction phase as well as management of these lands in perpetuity for the purposes of conservation. The construction phase should cover immediate direct and indirect impacts of the clearing and development onsite, as well as any revegetation/regeneration activities. These are roughly outlined in the email from Wedgetail dated 8 July 2022.

The ongoing management phase should cover all maintenance aspects of the Conservation Areas. These include the timing, frequency and duration of regeneration efforts, weed control, threatened species monitoring, management of rubbish dumping, illegal timber removal or any other activities that will have direct or indirect impacts on the conservation areas. The ownership of the land for both these stages should be clearly identified, with support indicated from all participating parties.

Recommendation 5

A Biodiversity Management Plan should accompany the BCAR. This should address both the construction and in perpetuity maintenance phases and include details on the rehabilitation plan, a timeline on how initial and ongoing targets will be achieved, how

threatened species will be protected and monitored and who will be responsible for the current and future management of the C2 zones.

6. There are some inconsistencies in the fauna surveys

It was noted that stick nest searches were used as a survey method for the Red-backed Button-quail (*Turnix maculosus*). As a ground-dwelling species, BCD considered this to be inappropriate. This species typically breeds between October to February in NSW, so August would not be an appropriate time of the year to search for nests.

Recommendation 6

The survey methods used for the red-backed button-quail (*Tunix maculosus*) should be justified and conducted in accordance with the *Threatened Biodiversity Database Collection*.

7. Onsite threatened species records should be uploaded to Atlas of Living Australia

The records for threatened species found onsite have yet to be uploaded to BioNet. BCD notes that these records should be submitted as per the reporting requirements of the Scientific Licence covering the surveys.

Recommendation 7

BCD recommends that threatened species records are uploaded to the BioNet database.

8. There are details missing from the Biodiversity Certification Application and BCAR

Table 25 of the BAM details minimum requirements for BCARs. There are also minimum requirements for the Biodiversity Certification Application forms. Some of these details are missing from the BCAR and Biodiversity Certification Application.

Recommendation 8

The following items are required to meet the minimum requirements of the BAM and Biodiversity Certification Application and should be provided as part of a revised BCAR or as an addendum to the application form:

- Shapefiles of the swift parrot species polygon
- Section 4 of the Biodiversity Certification Application requires the attachment of maps indicating the cadastre and subject site boundary to the form
- The required maps, such as the site and location maps should be labelled to match requirements in table 25 of the BAM
- Connectivity of different habitat areas should be demonstrated on the Site map and/or location map
- Maps and details of alternative development footprints which demonstrate why this footprint is more favourable for biodiversity values should be provided
- Maps and tables which display the TEC extent and patch size for each native vegetation zone
- Table 5 of the BCAR should include the sensitivity to gain class for each ecosystem credit species
- A table detailing species credit species recorded or assumed as present within the subject land, habitat constraints or microhabitats associated with the species, counts of individuals (flora)/extent of suitable habitat (flora and fauna) (as described in BAM Subsection 5.2.6) and biodiversity risk weighting (BAM Section 5.4)

- The actions and outcomes of measures to avoid and minimise impacts in Table 14 should be addressed separately
- A digital shapefile of the alternative and final footprint
- Demonstration of efforts to avoid and minimise impacts on biodiversity values (including prescribed impacts) associated with the proposal location in accordance with Chapter 7, including an analysis of alternative modes, technologies, routes, locations, and sites.
- Identification of any other site constraints that the proponent has considered in determining the location and design of the proposal (as described in BAM Section 7.2.1(3.))
- Assessment of indirect impacts on vegetation and threatened species and their habitat including the nature, extent, frequency, duration, and timing, documenting the consequences, reporting limitations/assumptions and what threatened entities and habitat are likely to be affected (as described in BAM Section 8.2)
- A map showing location of impacts requiring offset, impacts not requiring offset and any areas not requiring assessment
- Data for the ultrasonic devices showing the confirmed microbat calls for threatened species.