

Addendum Report

CABE

ESQ1818 Development Panthers Site

Stormwater Quality Management

April 2023

Prepared by

J. Wyndham Prince
Contact: Francis Lane
Phone: 02 4720 3385
Email: jwp@jwprince.com.au
ABN: 67 002 318 621

Prepared for

CABE
Contact: Matthew Twohill
Phone: 02 8818 3600
Email: info@cabe.com.au

Version control

Issue	Author	Reviewer	Approver	Date approved
A	FL	SL	SL	03/04/2023

© Copyright: The information in this document is the property of J. Wyndham Prince Pty Ltd. Use of this document, or passing it on to others, or copying it, in part or in full, without the written permission of J. Wyndham Prince Pty Ltd, is infringement of copyright.

TABLE OF CONTENTS

1.	EXECUTIVE SUMMARY	1
2.	INTRODUCTION	2
3.	STORMWATER QUALITY MODELLING	4
3.1.	Catchments.....	4
3.2.	Modelling Assumptions.....	5
3.3.	Pollutant Load Estimates	5
3.4.	Stream Erosion Index	6

PLATES

Plate 2-1 – Site Locality and Stage Boundaries	2
Plate 3-1 – MUSIC Model Layout (110251-10_MU01.sqz)	4

TABLES

Table 3-1 – Catchment Area Summary	5
Table 3-2 – Estimated Mean Annual Pollutant Loads and Reductions.....	5
Table 3-3 – SEI Assessment and Results	6

APPENDICES

APPENDIX A – MUSIC CATCHMENT PLAN

APPENDIX B - MUSIC-LINK REPORT

1. EXECUTIVE SUMMARY

J. Wyndham Prince prepared a flood impact assessment and water quality management report to support the proposed Stages 1-5 ESQ1818 development of the northern portion of the Panthers site in Penrith in April 2016. Stage 1 of the development has been constructed, and development approval has been granted for Stage 2-3.

A development application (DA22/05454) for Stages 4-5 of the ESQ1818 development was submitted in late 2022 and Council requested additional information. This addendum report has been prepared to address the Council RFI with regard to stormwater.

The Stage 4 & 5 basement entry ramps are covered by podium or roof areas above. All ground floor and podium areas are gravity drained to the adjacent street drainage system. An area of 36m² (for both stage 4 and 5) of catchment has nominally been adopted for the basement pump-out calculations shown on engineering drawing 110251-10-DA4023 (Rev. 2, 10/12/2021). The future construction certificate application calculations will consider the detail design of any entry ramp areas that may discharge to the basement together with the building hydraulics and rainwater tank overflows.

An updated stormwater quality model using MUSIC model has been prepared. The model reflects the latest available DA information for the Stages 1-5 development. The assessment confirms that a Gross Pollutant Trap together with the previously approved 685 m² bio-retention raingarden in the northern portion of the site will achieve the statutory stormwater pollution reduction targets set out in Penrith City Council's (PCC's) Water Sensitive Urban Design Policy (PCC, 2013). The results indicate that there is scope to reduce the size of the bio-retention device and still achieve the statutory pollution reduction targets.

The basement excavation itself will essentially act as a sediment basin during construction and therefore sediment basin calculations are not deemed necessary. Once basement construction is complete, the soil and water management plan shown on engineering drawings 110251-10-DA4700 and DA4701 provides details of the at-grade sediment controls.

This assessment should be read in conjunction with:

- The ESQ1818 Development Panthers Site Flood Impact Assessment and Water Quality Management Report prepared by J. Wyndham Prince (April 2016).
- Architectural drawings by Turner:
 - Stage 1 drawings DA-000-001 to DA-950-002 (Rev. 5 dated 23/08/2018)
 - Stage 2 drawings DA110-010 to DA-760-040 (Rev. P14 dated 12/06/2019)
 - Stage 3 drawings DA-110-010 to DA-910-001 (Rev. P16 dated 18/03/2021)
 - Stage 4 drawings DA-001-001 to DA-910-004 (Rev. 03 dated 09/03/2023)
- J. Wyndham Prince engineering drawings ESQ1818 Stages 4 & 5 Development 110251-10-DA4001 to DA4701 (revisions as per drawing DA4002 Rev. 3 dated 10/12/2021)

Details of our assessment are provided below.

2. INTRODUCTION

In April 2016 J. Wyndham Prince prepared a flood impact assessment and water quality management report to support the proposed Stages 1-5 ESQ1818 development of the northern portion of the Panthers site in Penrith. Stage 1 of the development has been constructed, and development approval has been granted for Stage 2-3.

Plate 2-1 below provides an overview of the proposed development and the stage boundaries.

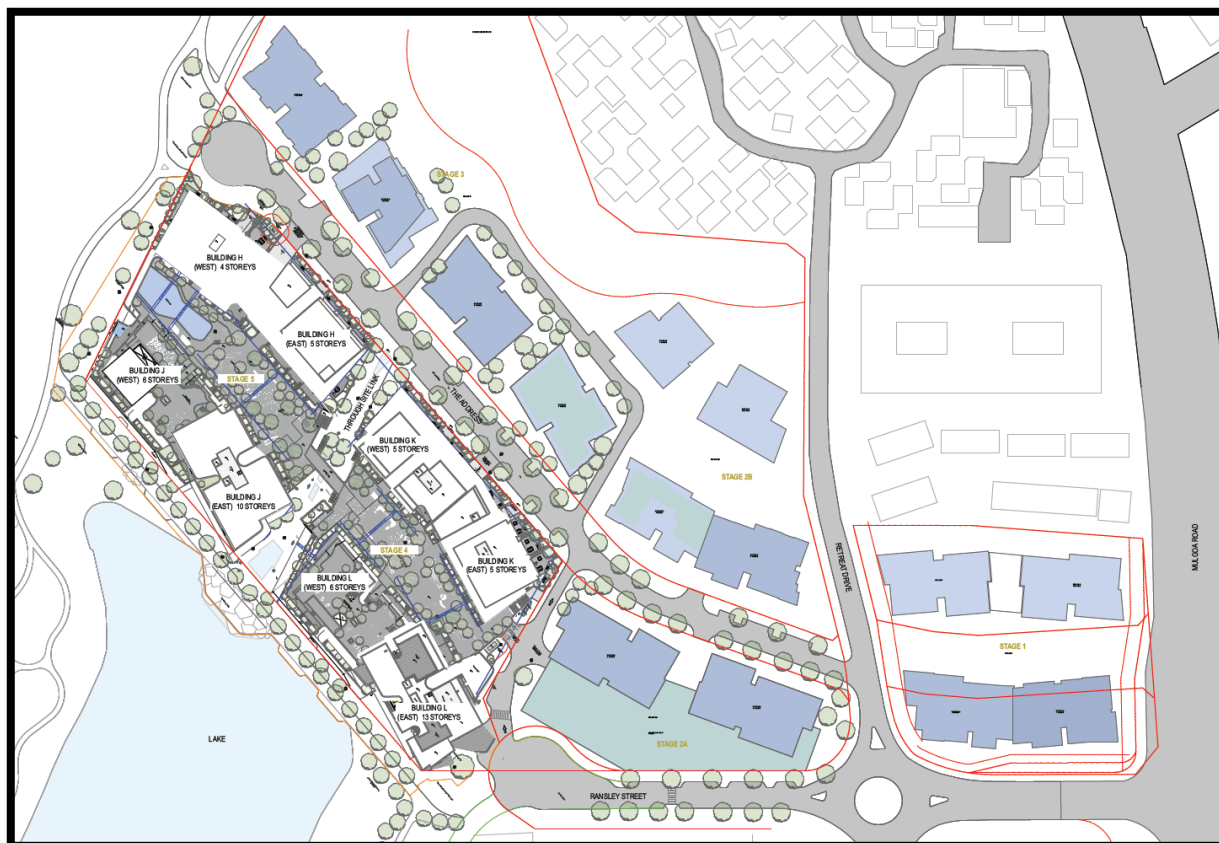


Plate 2-1 – Site Locality and Stage Boundaries

A development application (DA22/05454) for Stages 4-5 of the ESQ1818 development was submitted in late 2022 and Council requested additional information. With regard to stormwater management, the following information was requested:

- Catchment plans for both stages 4 and 5 demonstrating the total ground floor area draining to the basement pump-out system for each stage are to be included in the stormwater plan set. Any provided pump calculations should be based on this total ground floor area draining to the basement.

JWP Response - All driveway entry ramps are covered by podium or roof areas above. All ground floor and podium areas are gravity drained to the street.

- The stormwater plans have only provided a basement pump-out calculation for stage 4. Please also provide a calculation for the stage 5 basement pump-out system. These calculations are to be in accordance with appendix L of AS3500.3 and the requirements of clause 3.4 of Council's Stormwater Drainage Specification for Building Developments.

JWP Response – As per the comment above, all ground floor and podium areas are gravity drained to the street. An area of 36m² (for both stage 4 and 5) of catchment has nominally been adopted for calculations. The future construction certificate application calculations will consider the detail design of the building hydraulics.

- An updated Stormwater Strategy and MUSIC Model is required which outlines how the overall ESQ development will manage and treat stormwater, including during the construction phase for all stages.

Consideration needs to be given to temporary sediment basins for stage 4 & 5 should the raingarden be operational under DA18/0999.

JWP Response - An updated MUSIC model is provided, please see Section 3 below for details. The basement excavation itself will essentially act as a sediment basin and therefore sediment basin calculations are not deemed necessary. The soil and water management plan shown on engineering drawings 110251-10-DA4700 and DA4701 provides details of the at-grade sediment controls.

Details of the updated MUSIC stormwater quality assessment are provided below.

3. STORMWATER QUALITY MODELLING

The stormwater quality assessment has been updated using version 6.3.0 of the MUSIC modelling software, and in accordance with Penrith City Council's (PCC's) Water Sensitive Urban Design (WSUD) Policy (2013) and WSUD Technical Guidelines (Version 4, 2020).

The model provides a number of features relevant for the development:

- It is able to model the potential nutrient reduction benefits of gross pollutant traps and bio-retention systems.
- It provides mechanisms to evaluate the attainment of water quality objectives.

The MUSIC modelling was undertaken to demonstrate that the stormwater management system proposed for the ESQ1818 development will result in reductions in overall post-development pollutant loads that comply with the designated target objectives.

Penrith City Council have established default parameters for use in MUSIC models to represent the generation of various pollutants by different land uses. A MUSIC model representing the proposed ESQ1818 development was prepared to demonstrate compliance with PCC's Water Sensitive Urban Design Policy (PCC, 2013).

3.1. Catchments

Plate 3-1 below shows the general layout of the MUSIC model for the ESQ1818 Stages 1-5 development. A MUSIC Catchment Plan is provided in Appendix A. Except for a small amount of bypassing catchment in Stage 2b (refer Plate 2-1 above and Plate 3-1 below), it is understood that stormwater runoff from the development will be directed to a GPT and then a bio-retention basin in the northern portion of the site.



Plate 3-1 – MUSIC Model Layout (110251-10_MU01.sqz)

3.2. Modelling Assumptions

The following assumptions and parameters have been adopted in the MUSIC modelling:

- In accordance with PCC's Water Sensitive Urban Design Policy (PCC, 2013), the target pollutant removal rates are 85% Suspended Solids (TSS), 60% Total Phosphorus (TP) and 45% Total Nitrogen (TN).
- The "road" and "roof" areas are assumed to be 100% impervious. The remaining podium and urban area is modelled as "open space" and is assumed to be 50% impervious. Refer to Table 3-1 for details of the catchment area breakdown.

Table 3-1 – Catchment Area Summary

Catchment	Total Area (ha)	Road (ha)	Roof (ha)	Urban Pervious (ha)	Urban Impervious (ha)	Impervious (%)
Stage 1	0.867	0.035	0.371	0.231	0.231	73%
Stage 2-5	4.572	0.499	1.674	1.199	1.199	74%
Stage 2-3 Bypass	0.039			0.019	0.019	50%
Total:	5.478	0.53	2.04	1.45	1.45	73.5%

- The bio-retention basins consist of a filtration bed with either gravel or sandy loam media and an extended detention zone of 300 mm deep designed to detain and treat first flush flows. The media bed of the raingardens is 500 mm deep.
- The bio-retention media bed areas are sized to compensate for any bypassing catchment.
- It is assumed that trash and gross sediments will be effectively removed prior to entering the raingardens by the proposed GPT units. A generic style GPT has been adopted (no TSS, TP or TN removal).
- A treatable flow of 0.73 m³/s has been adopted based on the 12d drainage design 4EY flow at the splitter pit. All flow in excess of this are assumed to bypass the bio-retention basin.
- The bio-retention device was modelled with a media bed area of 685 m² and it is assumed that the average surface area would be 10% larger than the modelled media bed area.

3.3. Pollutant Load Estimates

Total annual pollutant load estimates were derived from the results of a MUSIC model based on a stochastic assessment of the developed site incorporating the proposed water quality treatment system. The estimated annual pollutant loads and reductions for TSS, TP, TN and Gross Pollutants for the Panthers North development are presented in Table 3-2.

Table 3-2 – Estimated Mean Annual Pollutant Loads and Reductions

Pollutant	Total Catchment Source Loads	Minimum Reduction Required	Total Residual Load	Total Reduction Achieved	Total Reduction Achieved
	(kg/yr)	(kg/yr)	(kg/yr)	(kg/yr)	(%)
TSS	3,220	2,737	363	2,857	88.7%
TP	7	4.30	2	4.54	68.7%
TN	56	25.1	23	32.7	58.6%
GP	667	600	5	662	99.2%

The results confirm that a GPT and the currently approved bio-retention basin with a media bed area of 685 m² will achieve the statutory pollution reduction targets set out in PCC's Water Sensitive Urban Design Policy (PCC, 2013). The results indicate that there is scope to reduce the size of the bio-retention media area and still achieve the statutory pollution reduction targets.

A MUSIC-Link report is provided in Appendix B.

3.4. Stream Erosion Index

In accordance with Table 1 – Water Sensitive Urban Design Requirements of PCC's Water Sensitive Urban Design Policy (2013), we have undertaken a Stream Erosion Index (SEI) assessment to ensure that the duration of post-development stream forming flows are no greater than 3.5 times the duration of stream forming flows under existing conditions.

The methodology to determine the SEI complies with the Draft NSW MUSIC Modelling Guide (2010). The node used to represent the site under existing conditions was a forest node.

A summary table of the SEI assessment and results is provided in Table 3-3.

Table 3-3 – SEI Assessment and Results

	Determination of Critical Flow									Stream Erosion Index		
Assessment Location	Area (km ²)	t _c = 0.76A ^{0.38} (hour)	t _c (minutes)	I ₂ (mm/hr)	C ₁₀	FF ₂	C ₂	Q ₂ (m ³ /s)	Q _{crit} (m ³ /s)	Pre Dev Outflow (ML/yr)	Post Dev Outflow (ML/yr)	SEI
Site Discharge	0.0547784	0.25	15	61.5	0.38	0.74	0.2812	0.263	0.132	1.06	1.91	1.8

The SEI for the site was determined to be 1.8, which is less than the maximum 3.5 set out in PCC's Water Sensitive Urban Design Policy (PCC, 2013).

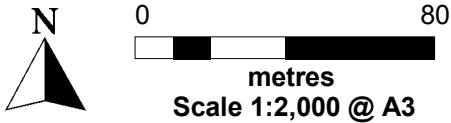
APPENDIX A – MUSIC CATCHMENT PLAN

Filename: J:\110251 - Panthers North Precinct\10 - Stage 4 and 5\SWF\MapInfo\Figures\110251-10_Fig3-1_All_MUS_A.wor



LEGEND
MUSIC Catchment

- Site Boundary
- MUSIC Catchments
- Bypassing Catchment
- Stage 1 Roof
- Stage 2-3 Roof
- Stage 4-5 Roof
- Active Open Space
- Road Pavement
- Bio-retention Raingarden (685 m²)
- Gross Pollutant Trap



Projection: GDA 1994 MGA Zone 56

Figure 3-1
ESQ1818 Development
Panthers Site

MUSIC
Catchment Plan

APPENDIX B - MUSIC-LINK REPORT

MUSIC-link Report

Project Details		Company Details	
Project:	ESQ1818 Stage4-5	Company:	J. Wyndham Prince
Report Export Date:	3/04/2023	Contact:	Francis Lane
Catchment Name:	110251-10_MU01	Address:	Level 2/50 Belmore Street Penrith NSW 2750
Catchment Area:	5.477ha	Phone:	02 4720 3385
Impervious Area*:	146.7%	Email:	flane@jwprince.com.au
Rainfall Station:	67113 PENRITH		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1999 - 31/12/2008 11:54:00 PM		
Mean Annual Rainfall:	691mm		
Evapotranspiration:	1158mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.34		
Study Area:	Penrith		
Scenario:	Penrith 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: Report Junction	Reduction	Node Type	Number	Node Type	Number
Flow	5.13%	Bio Retention Node	1	Urban Source Node	10
TSS	88.8%	GPT Node	1	Forest Source Node	1
TP	68.7%	Generic Node	2		
TN	58.7%				
GP	99.2%				

Comments

Pollution reductions not required for pre-development node. Modelled for SEI Only.

High flow bypass from GPT is directed around bio-retention.

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Forest	Forest [5.478 ha]	Area Impervious (ha)	None	None	0
Forest	Forest [5.478 ha]	Area Pervious (ha)	None	None	5.478
Forest	Forest [5.478 ha]	Total Area (ha)	None	None	5.478
GPT	GPT	Hi-flow bypass rate (cum/sec)	None	99	0.73
Post	Post-Development Node	% Load Reduction	None	None	92.4
Post	Post-Development Node	GP % Load Reduction	90	None	99.8
Post	Post-Development Node	TN % Load Reduction	45	None	93.1
Post	Post-Development Node	TP % Load Reduction	60	None	94.7
Post	Post-Development Node	TSS % Load Reduction	85	None	95.8
Pre	Pre-Development Node	% Load Reduction	None	None	80.3
Pre	Pre-Development Node	TN % Load Reduction	45	None	78.6
Pre	Pre-Development Node	TP % Load Reduction	60	None	78.1
Urban	Stage 1 Road	Area Impervious (ha)	None	None	0.035
Urban	Stage 1 Road	Area Pervious (ha)	None	None	0
Urban	Stage 1 Road	Total Area (ha)	None	None	0.035
Urban	Stage 1 Roof	Area Impervious (ha)	None	None	0.371
Urban	Stage 1 Roof	Area Pervious (ha)	None	None	0
Urban	Stage 1 Roof	Total Area (ha)	None	None	0.371
Urban	Stage 1 Urban Impervious	Area Impervious (ha)	None	None	0.231
Urban	Stage 1 Urban Impervious	Area Pervious (ha)	None	None	0
Urban	Stage 1 Urban Impervious	Total Area (ha)	None	None	0.231
Urban	Stage 1 Urban Pervious	Area Impervious (ha)	None	None	0
Urban	Stage 1 Urban Pervious	Area Pervious (ha)	None	None	0.231
Urban	Stage 1 Urban Pervious	Total Area (ha)	None	None	0.231
Urban	Stage 2-3 Bypass Urban Impervious [0.019 ha]	Area Impervious (ha)	None	None	0.019
Urban	Stage 2-3 Bypass Urban Impervious [0.019 ha]	Area Pervious (ha)	None	None	0
Urban	Stage 2-3 Bypass Urban Impervious [0.019 ha]	Total Area (ha)	None	None	0.019
Urban	Stage 2-3 Bypass Urban Pervious [0.019]	Area Impervious (ha)	None	None	0
Urban	Stage 2-3 Bypass Urban Pervious [0.019]	Area Pervious (ha)	None	None	0.019
Urban	Stage 2-3 Bypass Urban Pervious [0.019]	Total Area (ha)	None	None	0.019
Urban	Stage 2-3 Urban Impervious [1.199 ha]	Area Impervious (ha)	None	None	1.199
Urban	Stage 2-3 Urban Impervious [1.199 ha]	Area Pervious (ha)	None	None	0
Urban	Stage 2-3 Urban Impervious [1.199 ha]	Total Area (ha)	None	None	1.199
Urban	Stage 2-5 Road [0.499 ha]	Area Impervious (ha)	None	None	0.499
Urban	Stage 2-5 Road [0.499 ha]	Area Pervious (ha)	None	None	0
Urban	Stage 2-5 Road [0.499 ha]	Total Area (ha)	None	None	0.499
Urban	Stage 2-5 Roof [1.674 ha]	Area Impervious (ha)	None	None	1.674
Urban	Stage 2-5 Roof [1.674 ha]	Area Pervious (ha)	None	None	0
Urban	Stage 2-5 Roof [1.674 ha]	Total Area (ha)	None	None	1.674

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	Stage 2-5 Urban Pervious [1.199 ha]	Area Impervious (ha)	None	None	0
Urban	Stage 2-5 Urban Pervious [1.199 ha]	Area Pervious (ha)	None	None	1.199
Urban	Stage 2-5 Urban Pervious [1.199 ha]	Total Area (ha)	None	None	1.199
Only certain parameters are reported when they pass validation					

Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	99	100
Pre	Pre-Development Node	GP % Load Reduction	90	None	0
Pre	Pre-Development Node	TSS % Load Reduction	85	None	70.9

Only certain parameters are reported when they pass validation