

Notice of Application for a Planning Permit

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The land affected by the application is located at:	L2 PS708283 V11457 F077 8 Wattletree Road, Bunyip VIC 3815
The application is for a permit to:	Staged subdivision of the land into multiple lots and native vegetation removal

A permit is required under the following clauses of the planning scheme:

52.17-1	Remove, destroy or lop native vegetation
32.08-3	Subdivide land

APPLICATION DETAILS

The applicant for the permit is:	Nobelius Land Surveyors
Application number:	T230312

You may look at the application and any documents that support the application at the office of the Responsible Authority:

Cardinia Shire Council, 20 Siding Avenue, Officer 3809.

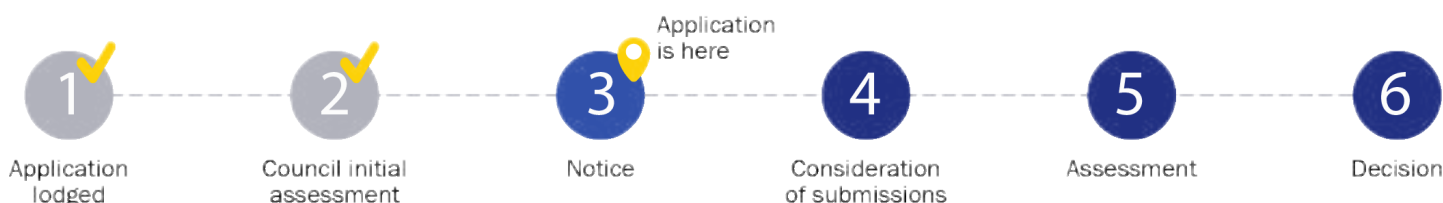
This can be done during office hours and is free of charge.

Documents can also be viewed on Council's website at cardinia.vic.gov.au/advertisedplans or by scanning the QR code.



HOW CAN I MAKE A SUBMISSION?

This application has not been decided. You can still make a submission before a decision has been made. The Responsible Authority will not decide on the application before:		23 September 2025
WHAT ARE MY OPTIONS? Any person who may be affected by the granting of the permit may object or make other submissions to the responsible authority. If you object, the Responsible Authority will notify you of the decision when it is issued.	An objection must: <ul style="list-style-type: none">be made to the Responsible Authority in writing;include the reasons for the objection; andstate how the objector would be affected.	The Responsible Authority must make a copy of every objection available at its office for any person to inspect during office hours free of charge until the end of the period during which an application may be made for review of a decision on the application.



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ePlanning

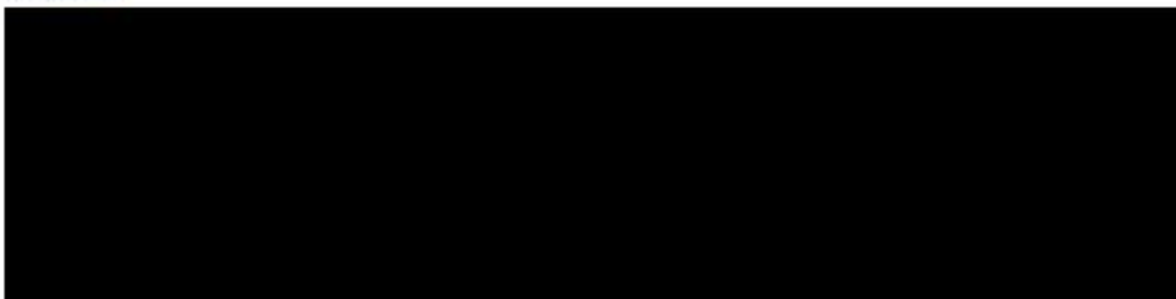
Application Summary

Portal Reference	A223608
Reference No	T293312

Basic Information

Proposed Use	Staged subdivision of the land into 31 lots and removal of native vegetation
Current Use	Vacant - used for grazing
Site Address	8 Watdeene Road Bunyip 3815

Contacts



Regulation Enquiry Type	Amount	Modifier	Payable
	Total		\$0.00

Meetings

Meeting Type	Officer Name	Date of Meeting
Pra Application	Ben Jones	25 Oct 2022



Civic Centre
20 Siding Avenue, Officer, Victoria

Council's Operations Centre (Depot)
Purton Road, Pakenham, Victoria

Postal Address
Cardinia Shire Council
P.O. Box 7, Pakenham VIC, 3810

Email: mail@cardinia.vic.gov.au



Monday to Friday 8.30am–5pm
Phone: 1300 787 624
After Hours: 1300 787 624
Fax: 03 5941 3784

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Documents Uploaded

Date	Type	Filename
27-06-2023	Subdivision Plan	Title L2 PS70828SP dated 27 June 2023.pdf
27-06-2023	Subdivision Plan	0069967186011.2023062714550001.pdf
27-06-2023	Explanatory Letter	Town Planning Report - 8 Wattletree .pdf
27-06-2023	Explanatory Letter	Cover letter - 8 Wattletree.pdf
27-06-2023	Additional Document	Wattletree Road Development Plan Ver 3.pdf
27-06-2023	Additional Document	Wattletree Road F&L Plan + Tree Numbers.pdf
27-06-2023	Additional Document	AS 3559 BAL Assessment Report 8 Wattletree Road Bunyip.pdf
27-06-2023	Additional Document	20230329 - Wattletree Rd Bunyip SWMS.pdf
27-06-2023	Additional Document	22038_Wattletree Rd, Bunyip TIAA_Final.pdf
27-06-2023	Additional Document	22032-FLP (Rev 0).pdf
27-06-2023	Additional Document	2012 Wattletree Rd F&L Plan.pdf
27-06-2023	Additional Document	8 Wattletree Rd Bunyip, NVR Report final wm.pdf
27-06-2023	Additional Document	8 Wattletree Rd Arb Report final wm.pdf
27-06-2023	Invoice A2236DE	Invoice A2236DE.pdf



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Request to amend a current planning permit application

This form is used to request an amendment to an application for a planning permit that has already been lodged with Council, but which has not yet been decided. This form can be used for amendments made before any notice of the application is given (pursuant to sections 50 / 50A of the *Planning and Environment Act 1987*) or after notice is given (section 57A of the Act).

PERMIT APPLICATION DETAILS

Application No.:	T230312
Address of the Land:	8 Wattletyree Road, Bunyip

AMENDMENT TYPE

Under which section of the Act is this amendment being made? (select one)	
Section 50 – Amendment to application at request of applicant before notice:	<input checked="" type="checkbox"/>
Section 50A – Amendment to application at request of responsible authority before notice:	<input type="checkbox"/>
Section 57A – Amendment to application after notice is given:	<input type="checkbox"/>

AMENDMENT DETAILS

What is being amended? (select all that apply)		
What is being applied for <input type="checkbox"/>	Plans / other documents <input checked="" type="checkbox"/>	Applicant / owner details <input type="checkbox"/>
Land affected <input type="checkbox"/>	Other <input type="checkbox"/>	
Describe the changes. If you need more space, please attach a separate page.		
Plans have been revised and details contained within the consultant assessments have been adjusted.		

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Specify the estimated cost of any development for which the permit is required:		
Not applicable <input type="checkbox"/>	Unchanged <input checked="" type="checkbox"/>	New amount \$

DECLARATION

LODGEMENT

Please submit this form, including all amended plans/documents, to mail@cardinia.vic.gov.au

You can also make amendments to your application via the Cardinia ePlanning Portal at <https://eplanning.cardinia.vic.gov.au/>

If you have any questions or need help to complete this form, please contact Council's Statutory Planning team on 1300 787 624.

IMPORTANT INFORMATION

It is strongly recommended that before submitting this form, you discuss the proposed amendment with the Council planning officer processing the application.

Please give full details of the nature of the proposed amendments and clearly highlight any changes to plans (where applicable). If you do not provide sufficient details or a full description of all the amendments proposed, the application may be delayed.

No application fee for s50/s50A requests unless the amendment results in changes to the relevant class of permit fee or introduces new classes of permit fees. The fee for a s57A request is 40% of the relevant class of permit fee, plus any other fees if the amendment results in changes to the relevant class (or classes) of permit fee or introduces new classes of permit fees. Refer to the *Planning and Environment (Fees) Regulations 2016* for more information.

The amendment may result in a request for more under section 54 of the Act and/or the application requiring notification (or re-notification). The costs associated with notification must be covered by the applicant.

Council may refuse to amend the application if it considers that the amendment is so substantial that a new application for a permit should be made.

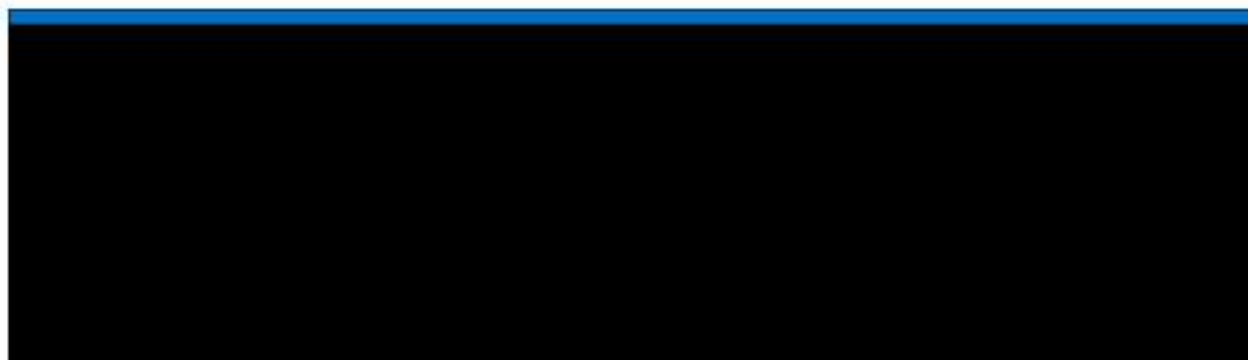
Any material submitted with this request, including plans and personal information, will be made available for public viewing, including electronically, and copies may be made for interested parties for the purpose of enabling consideration and review as part of a planning process under the *Planning and Environment Act 1987*.

Application to amend a current planning application

Application number:	T230312
Address of subject site	Lot 2 PS708283P, 8 Wattletree Road, Bunyip 3815

Pursuant to which section of the Planning and Environment Act 1987 is this amendment being made?	
Section 50 – Amendment to application at request of applicant before notice:	X
Section 50A – Amendment to application at request of responsible authority before notice:	
Section 57A – Amendment to application after notice is given:	

What is the purpose of the amendment? Please list all changes:
The position of the D1 and D2 DSS Bunyip West pipes are shown centrally in the road reserve under the gravel to avoid vegetation impacts, as per Melbourne Water advice.
Revised Arborist and Ecological Assessments (labelled Final 6) and original NVR maps (labelled wattletree nvr aug 24) are provided.
Revised FLP to include tree numbers (Rev H)



Fees	
Amendment in accordance with Section 50 or 50A	Nil
Amendment pursuant to Section 57A	40% of the fee applicable to the original permit class plus the difference in fees if the amendment changes the class of permit to that with a higher application fee.

Lodgement of application

Your application can then be sent via email, mail or submitted in person at Council's Civic Centre.

Assistance

If any assistance in completing this form is required, we recommend you contact Council's Statutory Planning Unit on **1300 787 624** before lodging an application. Insufficient or unclear information may delay the processing of your application.

Note: Any material submitted with this application, including plans and personal information, will be made available for public viewing, including electronically, and copies may be made for interested parties for the purpose of enabling consideration and review as part of a planning process under the Planning and Environment Act 1987.

Cardinia Shire Council
Civic Centre
20 Siding Avenue, Officer

PO Box 7
Pakenham 3810 (DX 81006 Pakenham)

Phone: 1300 787 624
Email: mail@cardinia.vic.gov.au
Web: cardinia.vic.gov.au

National Relay Service (NRS)
TTY: 133 677 (ask for 1300 787 624)
Speak and Listen (speech-to-speech relay): 1300 555 727 (ask for 1300 787 624)

Application to amend a current planning application

Application number:	T230312 PA
Address of subject site	8 Wattletree road, bunyip 3815

Pursuant to which section of the Planning and Environment Act 1987 is this amendment being made?

Section 50 – Amendment to application at request of applicant before notice: ☐

Section 50A - Amendment to application at request of responsible authority before notice: ☒

Section 57A – Amendment to application after notice is given: ☐



What is the purpose of the amendment? Please list all changes:

Lots 305 and 306 have been consolidated therefore the proposed number of lots in the staged subdivision number 30 (previously 31). The preamble to read: "Staged subdivision of the land into 30 lots and removal of native vegetation"



Fees	
Amendment in accordance with Section 50 or 50A	Nil
Amendment pursuant to Section 57A	40% of the fee applicable to the original permit class plus the difference in fees if the amendment changes the class of permit to that with a higher application fee.

Lodgement of application

Your application can then be sent via email, mail or submitted in person at Council's Civic Centre.

Assistance

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National Relay Service (NRS)



Application number:	T230312
Address of subject site	Lot 2 PS708283P, 8 Wattletree Road, Bunyip 3815

Pursuant to which section of the Planning and Environment Act 1987 is this amendment being made?	
Section 50 – Amendment to application at request of applicant before notice:	<input type="checkbox"/>
Section 50A - Amendment to application at request of responsible authority before notice:	<input type="checkbox"/>
Section 57A – Amendment to application after notice is given:	<input checked="" type="checkbox"/>

[illegible]

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Fees	
Amendment in accordance with Section 50 or 50A	Nil
Amendment pursuant to Section 57A	40% of the fee applicable to the original permit class plus the difference in fees if the amendment changes the class of permit to that with a higher application fee.

Lodgement of application

Your application can then be sent via email, mail or submitted in person at Council's Civic Centre.

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Translator Interpretation Service
131 450 (ask for 1300 787 624)



REGISTER SEARCH STATEMENT (Title Search) Transfer of Land Act 1958

Page 1 of 1

VOLUME 11457 FOLIO 077

Security no : 124107180712E

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LAND DESCRIPTION

Lot 2 on Plan of Subdivision 708283P.

PARENT TITLES :

Volume 09798 Folio 905 Volume 10362 Folio 225

Created by instrument PS708283P 14/11/2013

REGISTERED PROPRIETOR

ENCUMBRANCES, CAVEATS AND NOTICES

Any encumbrances created by Section 98 Transfer of Land Act 1958 or Section 24 Subdivision Act 1988 and any other encumbrances shown or entered on the plan set out under DIAGRAM LOCATION below.

DIAGRAM LOCATION

SEE PS708283P FOR FURTHER DETAILS AND BOUNDARIES

ACTIVITY IN THE LAST 125 DAYS

NIL

-----END OF REGISTER SEARCH STATEMENT-----

Additional information: (not part of the Register Search Statement)

Street Address: 8 WATTLETREE ROAD BUNYIP VIC 3815

ADMINISTRATIVE NOTICES

NIL

eCT Control 17349J BDLEGAL
Effective from 20/07/2020

DOCUMENT END



Imaged Document Cover Sheet

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Document Type	Plan
Document Identification	PS708283P
Number of Pages (excluding this cover sheet)	3
Document Assembled	27/06/2023 14:55

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PLAN OF SUBDIVISION				LRS use only EDITION 1	Stage No. <div style="border: 1px solid black; width: 50px; height: 50px; margin: 0 auto;"></div>	Plan Number PS 708283 P
LOCATION OF LAND Parish: Bunyip Township: ---- Section: ---- Crown Allotment: 28 (P) Title Reference: V. 9798 F. 505 & V. 10362 F. 225 Last Plan Reference: Lot 33 LP 5157 Lot 2 PS 400706D Postal Address: 4 - 10 Watlefree Road <i>(if not on lot)</i> Bunyip, 3815 MGAS4 Co-ordinates: E 386 710 <i>(if specific corner not at point)</i> N 5 783 270 Zone 55				<p style="color: red; font-size: small;">This copied document is not to be used for the purpose of the information as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose without the written consent of the Council. The Council is not responsible for the accuracy of the information and agrees that you will only use the document for the purpose specified above and that any dissemination, distribution or display of this plan is void under section 5 of the Subdivision Act 1988.</p> <p>COUNCIL CERTIFICATION AND ENDORSEMENT COUNCIL NAME: CARDINIA REF: 2. This plan is certified under section 11(7) of the Subdivision Act 1988. Date of original certification under section 5 (/ /) 3. This is a statement of compliance issued under section 21 of the Subdivision Act 1988.</p> <p>OPEN SPACE (i) A requirement for public open space under section 18 of the Subdivision Act 1988 has/has not been made (ii) The requirement has been satisfied (iii) The requirement is to be satisfied in Stage Council Delegate Council Seal Date / / Re-certified under section 11(7) of the Subdivision Act 1988 Council Delegate Council Seal Date / /</p>		
Vesting of Roads or Reserves						
Identifier		Council / Body / Person				
Nil		Nil				
Notations						
Depth Limitation. DOES NOT APPLY				Staging This is not a staged subdivision Planning Permit No.		
This is a Spear Plan Underlined bearings and distances have not been re-established and are subject to further survey.				<u>Survey</u> This plan is based on Survey This survey has been connected to permanent marks no(s) In Proclaimed Survey Area No. 71		
Easement Information					LRS use only	
Legend: A - Appurtenant Easement E - Encumbering Easement R - Encumbering Easement (Road)					Statement of Compliance/ Exemption Statement Received <input checked="" type="checkbox"/> DATE 14/11/2013	
Easement Reference	Purpose	Width (Metres)	Origin	Land Benefited/In Favour Of	LRS use only PLAN REGISTERED TIME 2:55 PM DATE 14/11/2013 D. Papeo Assistant Registrar of Titles Sheet 1 of 2 sheets	
E-1	Drainage	3	PS 400706 D	Cardinia Shire Council & All land in PS 400706D.		
E-2	Drainage	3	This Plan	Lot 1 on this Plan.		
NOBELIUS LAND SURVEYORS P.O. Box 461 PARKVIEW 3810 Ph: 03 5941 2112 Fax: 03 5941 2088 info@nobelius.com.au				LICENSED SURVEYOR: R. P. NOBELIUS SIGNATURE DIGITALLY SIGNED. REF: 10374 VERSION B		<div style="border: 1px solid black; width: 100px; height: 100px; margin: 0 auto;"></div> DATE / / COUNCIL DELEGATE SIGNATURE Original sheet size A3



TOWN PLANNING REPORT

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STAGED SUBDIVISION OF THE LAND INTO MULTIPLE
LOTS & THE REMOVAL OF VEGETATION

8 WATTLETREE ROAD, BUNYIP

PROPOSED BY
NOBELIUS LAND SURVEYORS
20 Henry Street, Pakenham, VIC 3810

(03) 5941 4112
www.nobelius.com.au



NOBELIUS
LAND SURVEYORS

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1. PRELIMINARY

ADDRESS	Lot 2 PS708283P, 8 Wattletree Road, Bunyip 3815			
RESPONSIBLE AUTHORITY	Cardinia Shire Council			
ZONE	General Residential Zone- Schedule 1			
OVERLAY	No Overlays			
BUSHFIRE PRONE AREA	Yes			
CULTURAL HERITAGE	Not applicable			
EASEMENTS, RESTRICTIONS, ENCUMBRANCES	No restrictions are recorded on the title. An E1 and E2 easement (both Drainage) on the land			
PROPOSAL	The staged subdivision of the land into thirty (30) lots and the removal of Native Vegetation			
PERMIT TRIGGERS	<ul style="list-style-type: none"> Pursuant to clause 32.08-3 of the GRZ1 a permit is required to subdivide the land. Pursuant to clause 52.17 (Native Vegetation) a permit is required to remove, destroy or lop native vegetation. 			
RELEVANT PLANNING CONTROLS AND INCORPORATED DOCUMENTS	Clause 11 Settlement Clause 13 Environmental Risks & Amenity Clause 15 Built Environment & Heritage Clause 16 Housing Clause 19 Infrastructure Clause 32.08 General Residential Zone Clause 52.17 Native Vegetation Clause 53.01 Public Open Space Clause 53.18 Stormwater Management in Urban Development Clause 56 Residential Subdivision Clause 65.02 Approval of an application to subdivide land Clause 71.03 Integrated decision making <i>Bunyip Township Strategy (21 September 2009)</i>			
SUBMITTED DOCUMENTS	<ul style="list-style-type: none"> Wattletree Road Development Plan (Ver 14) & Feature and Levels Plan - Nobelius Land Surveyors Plan of Survey – Nobelius Land Surveyors Bushfire Attack Level Assessment – Nobelius Land Surveyors Copy of Title & Title Plan Arboricultural Impact Assessment final 8– Healesville Plants, August 2025 NVR & Biodiversity assessment Report – Healesville Plants, V9 August 2025 Functional Layout Plan (REV I) – TaylorMiller/Engmil Engineering Service Report, TaylorMiller, March 2023 Traffic Impact Assessment Report, Transport & Traffic Solutions, February 2023 Stormwater Management Strategy (Rev 7), DPM Consulting Group, April 2025 			
NLS QUALITY SYSTEM	AUTHOR	DATE ISSUED	CHECKED BY	REVISION
	JB	AUGUST 2025	RO	4

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2. INTRODUCTION

This town planning report has been prepared by Nobelius Land Surveyors on behalf of the landowner and is submitted to Cardinia Shire Council to support an application for the staged subdivision of the land into thirty (30) lots and the removal of native vegetation.

The subject site is located in a residential area of Bunyip designated for the development of future residential estates. The land is able to connect to all services and provides an excellent opportunity to provide residential land in a township experiencing sustained growth.

The purpose of this report is to assess the proposed staged subdivision of the land which will ultimately yield thirty (30) lots against the relevant provisions of the Cardinia Planning Scheme, the Bunyip Township Strategy and local and state planning policies. The proposed subdivision has undergone an extensive design process and is informed by a suit of technical assessment to ensure that the proposal is responsive to key site constraints and considerations, such as overland flows and vegetation. The site presents an excellent strategic location for further residential allotments and the proposal responds to and integrates with surrounding residential developments along Wattletree Road to the north and Petty Road to the south.

This report aims to demonstrate that the proposal is:

- Consistent with the State and Local Planning Policy framework;
- Consistent with the requirements of the Cardinia Planning Scheme;
- Consistent with the Bunyip Township Strategy (21 September 2009);
- Consistent with the requirements of Clauses 56; and
- Will satisfactorily integrate with surrounding lot sizes and land uses.

The proposal is entirely appropriate to be granted a planning permit and receive Council's full support on the basis that the proposal supports Cardinia's vision for future residential development on the two sites and is appropriate for the locality.

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3. SUBJECT SITE AND SURROUNDING LOCALITY

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SITE ANALYSIS

The land is formally described as Lot 32 on Plan of Subdivision 708283P, 8 Wattletree Road, Bunyip, contained within Volume 11457 Folio 077. The land is a large “T-Junction” shaped allotment, with dual frontages to Wattletree Road to the north and Petty Road to the south. The site addresses Wattletree Road to the north for a length of 96.74m, and Petty Road in the south for a length of 277.62m. The site has a total area of 40,870m² (4.09 hectares).



24 NYLANDER ROAD, BUNYIP (IMAGE COURTESY OF LASSI, 2022)

The land is undeveloped other than a modest shed in the northern portion of the land which houses a tractor.

The land features an isolated ‘patch’ of vegetation that is generally consistent with the “Woodland” classification under AS3959:2018 and measures approximately 12,000sqm in area. The site features a dam located centrally in the southern portion of the site.

Topographically, the site slopes downward from the high point adjacent to Wattletree Road in the north to the low point of the site which is generally consistent with the current location of the dam.

The remainder of the land is predominately cleared and has been historically employed for grazing.

An E1 easement measuring 3 metres in width extends north from the southern boundary on an 180degree trajectory and has the purpose of Drainage in favour of Cardinia Shire Council and All land in PS400706D.

An E2 easement measuring 3 metres in width and running parallel to the western-most boundary has the purpose of Drainage in favour of Lot 1 on this plan (PS708283P).

A review of the Certificate of Title indicates that the land is not impacted by any encumbering covenants, caveats or restrictions under Section 173 of the *Planning and Environment Act, 1987* or the *Subdivision Act, 1988*.

A copy of the Certificate of Title and current Plan of Subdivision dated within 3 months of application lodgement has been provided as part of this submission.

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PERMIT HISTORY

T120242 A permit was issued for the Subdivision of land into Two (2) lots (boundary realignment), generally in accordance with the approved plans, issued 5 September 2012.

SURROUNDS

Wattletree Road is a residential road in Bunyip that connects to McNamara Road in the west and Hope Street to the east. It provides access to new residential allotments to the north (Gwen Meredith Drive) and proposed lots to the south (9-13 Wattletree Road – T220583).

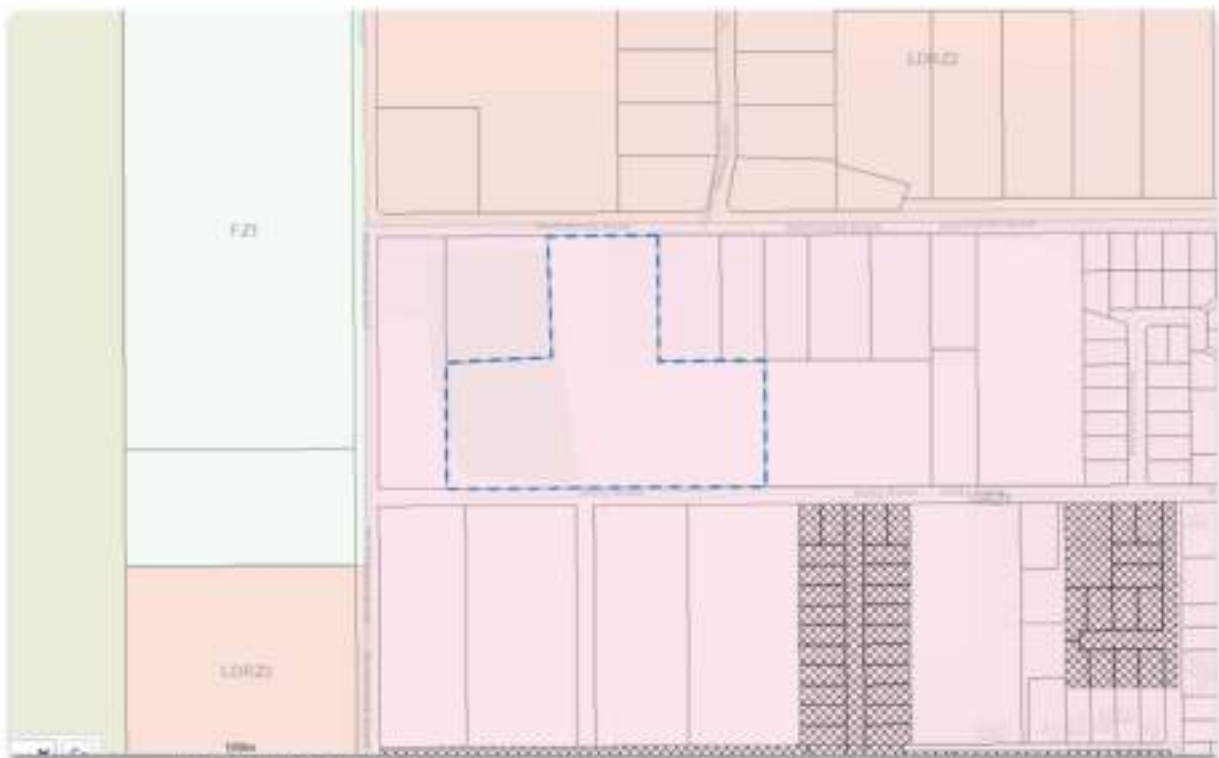
Petty Road is an east-west residential street in Bunyip that has traditionally provided access to lifestyle allotments to the northwest of the town centre. Recent residential development along Petty Road has resulted in a portion of Petty Road being sealed to provide access to new residential allotments (16 and 18 Petty Road, and the subdivision of the land between 24 and 45 Petty Road that sees the northerly extension of Jasmine Street). The recent subdivision and development nestled amongst larger rural lots contributes to an 'evolving' semi-rural character.

Lots adjoining the subject site are generally larger in area (3,961sqm for No. 28 Gwen Meredith Drive to 3.9 hectares at No. 7 Wattletree Road) with dwellings surrounded by modest grazing paddocks with retained vegetation adjacent to title boundaries. The emergence of residential estates such as that which addresses Gwen Meredith Drive is evidence of the growing demand for residential land and housing being experienced in Bunyip in recent times. The Petty Road and Wattletree Road precinct has traditionally comprised large residential allotments used for small scale agriculture and lifestyle purposes and have contributed to the valued rural character of the town. These large rectangular allotments were designated for future residential estates in the Bunyip Township Strategy in 2009, and as such, an emerging character that includes diverse lot sizes and infill residential development is being experienced.

The land immediately adjoining the subject site has been summarised below:

NORTH	Abuts Wattletree Road. Across the road are two parcels of land: 7 Wattletree Road, Bunyip, a developed parcel measuring 3.4 hectares zoned GRZ1; and the southern most lots that address Gwen Meredith Drive, an estate of 16 lots developed with dwellings. These lots are zoned Low Density Residential Zone – Schedule 2.
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SOUTH	Addresses Petty Road with significant roadside vegetation contained in the road reserve. Further south are rural-residential lots; No.'s 45,54,66 and 50 Petty Road. They measure between 1.6 hectares (No. 50 Petty Road) to 2 hectares (No. 45 Petty Road). They are all developed with dwellings. These lots are similarly zoned General Residential Zone.
EAST	No.'s 12 and 14 Wattletree Road abut the subject site to the northeast which are developed with dwellings, with the eastern boundary abutting Lot 2 PS545850 (Petty Road), which is undeveloped. These lots are similarly zoned; General Residential Zone.
WEST	Abuts No. 2 Wattletree Road with a dwelling developed in the northern portion of the site and the balance of land cleared and employed for modest grazing. There is gateway access to Petty Road adjacent to the southern boundary. This site is subject to the General Residential Zone.



PROPOSED PARCELS IN RELATION TO THE SUBJECT SITE (IMAGE COURTESY OF VICPLAN).

ENVIRONMENTAL CONSIDERATIONS

TOPOGRAPHY

Topographically, the land falls from the north to the south with a slope of approximately 1 in 12 across the land, from north to south. The topography, as the below graphic shows, does not pose constraints to the proposed subdivision of the land.

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CULTURAL HERITAGE

The land is not mapped within an area of potential cultural significance.

BIODIVERSITY

No listed flora or fauna species are recorded on the subject site. *NatureKit* (DELWP, 2023) identifies the subject site as featuring a combination of Lowland Forest and Damp Forest, though little of the latter remains. Please refer to the *NatureKit* map below.



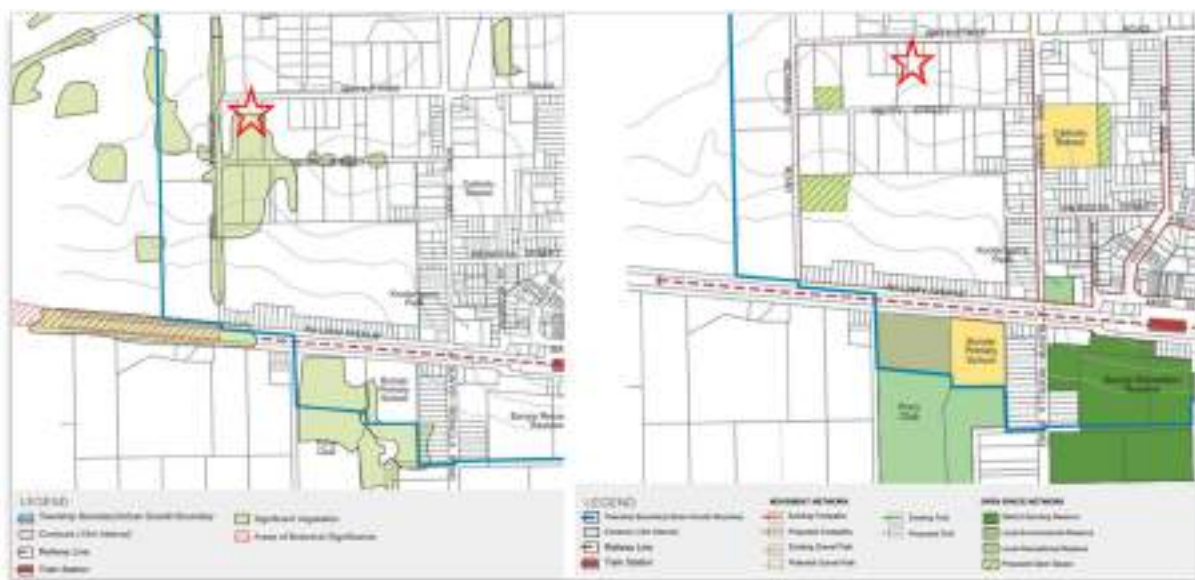
The biodiversity score, and vegetation does not reflect the existing conditions of the site. The subject site is considered a highly modified landscape that has been subject to historical clearing and grazing. The infill residential development occurring within the immediate surrounds can also be argued to have significantly reduced the biodiversity value of the land.

VEGETATION

The landscape is modified, and the land has been extensively cleared for pasture. The vegetation in the road reserve, particularly along Petty Road, is to be retained as part of this proposal.

The biodiversity assessment provided by Healesville Plants, dated June 2023 assessed 86 trees; 54 on the subject site, 2 on the adjoining property to the west and 26 within the road reserve to the south (Petty Road). Of the trees assessed, 47 were found to be indigenous to the area, 1 tree is a planted native species, 35 are exotic species and 3 are dead.

The *Bunyip Township Strategy 2009* identifies that the vegetated area of the site in the western portion site is mapped as having significant vegetation (shown below left from the extract of Figure 10 – Environmental Features where the subject site is shown with a red and white star) and ear-marked as Open Space (shown below right from an extract of Figure 9 – Open Space from the *Bunyip Township Strategy 2009*).



Healesville Plants were engaged to prepare an *Arboricultural Assessment* in June 2023 (as amended 2025) which contains the following information:

- The identification and assessment of trees, including their location, species, dimensions, useful life expectancy and health and structural conditions.
- The arboricultural value of each tree, indicating its merit for retention in the landscape throughout nearby disturbance.
- The size of the TPZ for each tree, in accordance with the Australian Standard 4970, Protection of Trees on Development Sites.
- Recommendations on protective measures for any trees adjacent to development.

The report identifies that mid to large size trees, greater than 10m in height are common within the southern section of the site and the adjacent publicly managed spaces. In total, 95 trees were assessed, 54 on the subject site, and 2 within adjacent third-party managed property and 35 within

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the Petty Road reserve. The most commonly assessed species on the site were *Eucalyptus obliqua*, *E. radiata*, *E. sieberi* and *E. dives*. With several White Stringybark present as large and very old trees.

BUSHFIRE PRONE AREA

The entirety of the subject site is mapped as a designated Bushfire Prone Area. Further information on how the proposal has considered the implications of being mapped within a designated bushfire prone area has been provided in the response to Clause 13.02 in the State and Local Planning Policy section of this report.



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4. THE PROPOSAL

The applicant seeks approval for the staged subdivision of land into thirty (30) lots. It is proposed to stage the subdivision in order to fund the required development and provision of infrastructure and services. Stage 1 requires the land to be subdivided into two lots, which will enable the sale of the southern portion of the site; the two lot subdivision is referenced on the Development Plan (Version 10) as the red, centrally located line that runs in a west to east orientation (see below left). Stage 2 will see the development of the southern portion of the site and Stage 3 will continue the development of the road, access and infrastructure in the northern portion of the site, as per the Concept Plan (Version 14) below. Stage 4 ensures the Temporary Retarding Basin provides stormwater attenuation to the site until such time that the site is connected to alternative drainage. The proposal also seeks permission to removal Native Vegetation, which is discussed in detail below.



SUBDIVISION PROPOSAL

The proposed lot configuration is as per the Plan of Subdivision prepared by Nobelius Land Surveyors (Version 14, above). The purpose of the Building Envelopes (hereafter BEs) is to illustrate compliance with the requirements of the Bunyip Township Strategy with 7 meter front setbacks, 2.5 meter side and rear setbacks and show that 87% of lots have a minimum area of 700sqm. Additionally, the BEs (Lots 301, 305, 306) have regard for the Tree Protection Zones of onsite and third-party trees.

The details of each stage have been provided in the table below:

STAGE	LOTS	AREA	TOTAL AREA
1	1	10,358m ²	4.09 hectares
	2	30,510m ²	
2	201	719m ²	3.051 hectares
	202	700m ²	
	203	779m ²	
	204	700m ²	
	205	700m ²	
	206	700m ²	
	207	883m ²	
	208	883m ²	
	209	700m ²	
	210	700m ²	
	211	716m ²	
	214	700m ²	

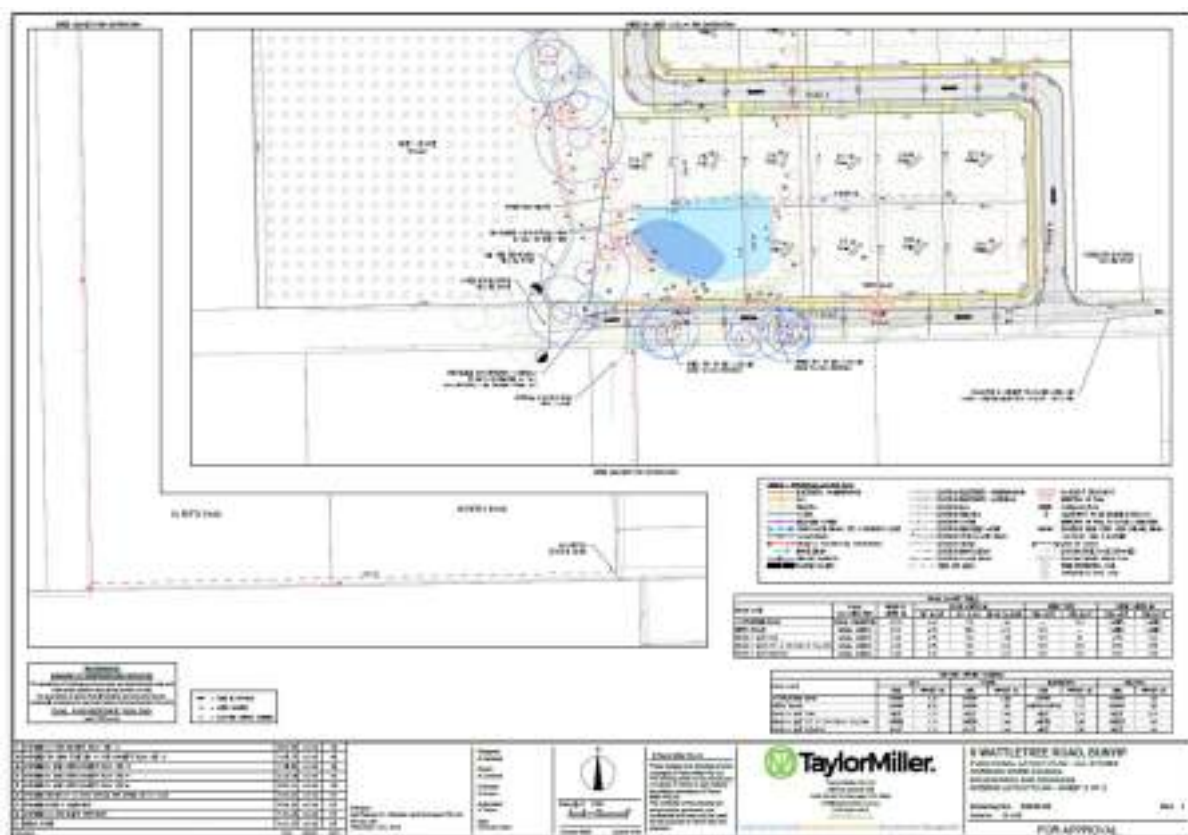
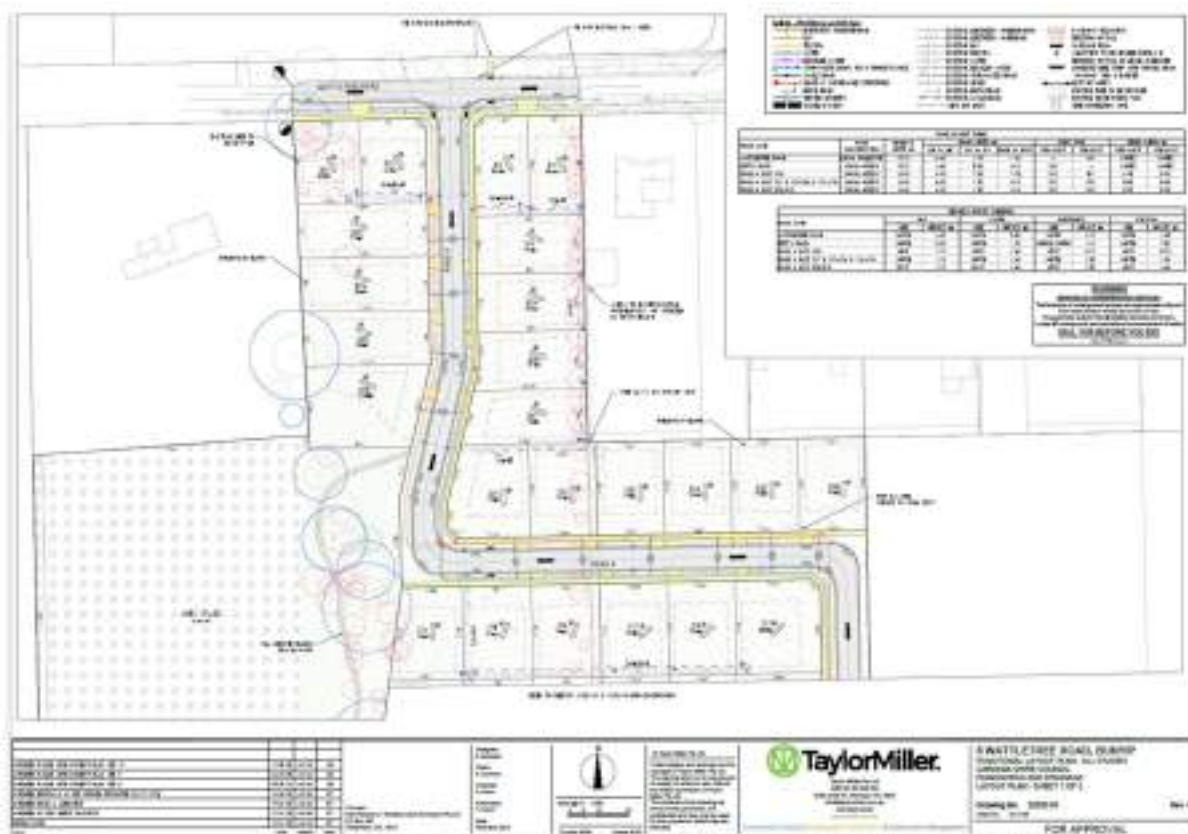
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	215 216 217 218 Reserve No.1 Road R-1	717m ² 716m ² 700m ² 700m ² 1,3228m ² 5,780m ²	
3	301 302 303 304 305 306 307 308 309 310 311 312	613m ² 612m ² 778m ² 768m ² 758m ² 1,043m ² 723m ² 707m ² 700m ² 700m ² 594m ² 590m ²	1.036 hectares
4	212 213	715m ² 846m ²	Temporary Retarding Basin 1,561m ²

The subdivision has been proposed in stages to ensure construction of services can be funded.

Lots 301, 302, 311 and 312 will address Wattletree Road with access provided via shared crossovers to preserve roadside vegetation. Lots 208 - 211 will address Petty Road and have individual crossovers. The balance of lots will address the centrally located road reserve with individual crossovers. Please refer below to an extract from the Functional Layout Plan (Rev I) from (*TaylorMiller/EngMil*) (as amended), dated August 2025

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A Service Provision Assessment by Taylor Miller/EngMil dated August 2025 (Rev I) has been provided to support this submission. The report details the available services and is referenced below.

The centrally located road has a north to south orientation that provides access and egress to and from the proposed subdivision from Wattletree Road in the north and Petty Road in the south. The road is designed to meet the requirements of an 'Access Street' modified to suit Bunyip Township, as per the Engineering Design & Construction Manual, VicRoads and Austroads. Below is a cross-section with reference to the Functional Layout Plan, *TaylorMiller/EngMil*, dated August 2025.



The site is subject to the Melbourne Water Drainage Scheme '2883-Bunyip West DSS'. Melbourne Water is the responsible Authority for major drainage projects in the vicinity. A Stormwater Management Strategy (Ver 7) by *DPM Consulting* dated 23rd April 2025 (as revised) has been submitted in support of this planning application. The report identifies the internal and external drainage, identifies flood mitigation measures and key drainage infrastructure that are required. Integrated Water Management (IWMP) and Water Sustainable Urban Design (WSUD) provides the basis for addressing the afore-mentioned issues.

There are three identifiable 'catchments' as indicated by the green, brown and purple shaded areas below (Figure 7, page 14 of the submitted SWMS by DPM Consulting). The three shaded areas drain to either open drains and associated culverts under Petty Road or the onsite dam.



It is understood that the drainage scheme, Bunyip West DDS, is active. The subject site ultimately relies on the delivery of drainage scheme pipelines and constructed waterways to convey post development flows to a retarding basin, as per the plan below (Figure 9, page 15 of the submitted SWMS, DPM Consulting). The Temporary Retarding Basin will be decommissioned once the future drainage infrastructure (RB1/WL1) is delivered. Additional retardation of overland flows will be provided by water tanks on each site that provides toilet flushing and irrigation to lots and attenuate overland flows and reduce storage requirements of the TRB.

Please note that Melbourne Water have provided consent and planning permit conditions and consent to locate D1-D2 of the DSS to the middle of the gravel section of Petty Road to avoid tree impacts (as per email dated 14 April 2025; MWA1316297).



A MUSIC model of the proposal has been undertaken by DPM Consulting, the results of which are summarised below. The MUSIC model shows the TRB will satisfy treatment train effectiveness.

	Proposed Development	BPEMG
TSS reduction [%]	84.9	80%
TP reduction [%]	59.8	45%
TN reduction [%]	21.6	45%

SUMMARY OF THE MUSIC RESULTS (TABLE 4, PAGE 25 OF THE SWMS REPORT PROVIDED BY DPM CONSULTING).

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VEGETATION REMOVAL

In total, 95 trees were assessed, 54 on the subject site, and 2 within adjacent third-party managed property and 35 within the Petty Road reserve (Please refer to the Arborist Assessment, Ver 7, July 2025). Of the onsite and third party trees assessed, seventy four (74) are proposed for removal and eighteen (19) will experience minor TPZ encroachment. Three individual trees and 'patch' a require permission to remove are Native Vegetation, triggering clause 52.17 requirements. A Native Vegetation Information Report by *Healesville Plants* has been submitted to support this application and is summarised below and discussed in detail in Section 7.

Trees proposed for removal are as follows (page 86-88; August 2025):

- Trees 2-9 are exotic planted species required to be removed to facilitate the development of sites 301-303.
- Trees 12-37 are exotic planted species adjacent to the eastern boundary. They are in poor condition required to be removed to facilitate the development.
- Tree 38 is exotic planted tree which requires removal for the dam works and lot 215.
- Trees 39 -47 are indigenous and located in the vicinity of the dam – self-seeded and required to be removed to facilitate the earthworks for the TRB and subsequent lots 211-215. These trees require offsetting and are mapped in the NVR.
- Trees 61-83 are indigenous trees are located within the Petty Road reserve and will require removal to facilitate the road, footpaths and crossovers for lots 209-213 and have been mapped in the NVR as they require offsetting.
- Trees 84 and 86 are very large old trees and require removal to facilitate road and lot development and have been mapped in the NVR to be offset.
- Tree 85 is an indigenous species of low retention value. It is required to be removed due to its structural integrity and is mapped in the NVR to be offset.

Pursuant to Clause 52.17 Native Vegetation, locally indigenous, non-planted vegetation requires a permit (and offset) to remove, destroy or lop. The NVR by Healesville Plants found that Clause 52.17 will apply to Trees onsite and in the road reserve. The remainder of indigenous trees on the site are contained in the 'reserve' to be vested to Council.

Trees to be retained that will incur <10% incursion include Tree 1 which is a large old tree located in the northwest portion of the site. It can be retained with work in lot 301 however it has been offset due to consequential loss from the division of the site. The encroachment is calculated as 8.1%. Trees 10 and 11 are third party trees that will experience encroachment, 2.6% and 1.2% respectively, by lots 304 and 305 building envelopes. Trees 48 to 57 are located in the south western portion of the site, some of which are large old trees with high retention value. Trees 48 and 49 will experience 1.2% encroachment from fences associated with Lots 213 and 214. Tree 58 is a large old tree on Petty Road reserve and will experience no new2 encroachment from the road works in petty Road. Updated assessment of trees identified as A to I located to the south of Petty Road will experience minor additional encroachment (<10%) and no SRZ incursion from roads works in Petty Road. Trees A, B (dead), C, F & H have existing TPZ and SRZ incursion. It is unlikely that road works in Petty Road will result in any additional detrimental incursions given the existing compaction and permeability of Petty Road, and the swale drain to the south of the road that is subject to regular 'de-littering' by Council contractors. As per the amended Arborist report, Ver 7, July 2025, these trees have existing major incursion into their TPZ and SRZs. New encroachment for trees C, D, E, G and H is likely within the encroachments calculated below (extracted from the table on page 88, Arborist Report, Ver 7).

Column 2 shows existing encroachment, and column 3 shows encroachment from the proposal. Column 4 shows the percentage of the new encroachment.

Tree ID	Existing encroachment %	Proposed encroachment %	NEW encroachment % estimated from works to construct crossovers, set formalised drainage infrastructure levels, install services and footpaths= Proposed % minus Existing%	Distance to new works (excluding road surfacing at or above grade)
A	28% TPZ inc. SRZ	28%	0%	NA
B	Dead	Dead	0%	NA
C	31% TPZ inc. SRZ	35%	<10% (4%)	5.9m
D	29% TPZ	37%	<10% (8%)	6.5m
E	41% TPZ inc. SRZ	59%	>10% (18%)	5m
F	5% TPZ	5%	0%	NA
G	40% TPZ inc. SRZ	58%	>10% (18%)	5m
H	28% TPZ	34%	<10% (6%)	6.5m
I	21% TPZ	21%	0%	NA

As noted on page 89 of the Arborist Report Ver 7, if Council deem these trees lost then an updated NVR will be provided as a condition of a planning permit, should one be issued.

NATIVE VEGETATION REMOVAL

The provision of infrastructure and the road, services, and the lot configuration requires the removal of indigenous vegetation. Whilst all efforts have been made to retain as much vegetation as possible on the site, Council permission is sought for the removal of several trees that were unable to be accommodated in the proposed design.

- Of the trees assessed, 47 are identified as indigenous.
- Tree 1 in an indigenous tree and is proposed to be retained, but has been offset given it looks to be consequential loss due to the lots being created are smaller than 4,000m² and the tree may be subject to loss at a later date.
- Trees 38 and 39 are indigenous, require permission to be removed and require offsetting. An extract of the NVR report is provided in Section 8 of this report.
- Trees 40 to 42 are indigenous, require permission to be removed and require offsetting. An extract of the NVR report is provided in Section 8 of this report.
- Trees 44 to 47 are indigenous, require permission to be removed and require offsetting. An extract of the NVR report is provided in Section 8 of this report.
- Trees 61 to 65 are indigenous, require permission to be removed and require offsetting. An extract of the NVR report is provided in Section 8 of this report.
- Trees 66 and 83 are indigenous, require permission to be removed and require offsetting. An extract of the NVR report is provided in Section 8 of this report.
- Trees 84, 85 and 86 are indigenous, require permission to be removed and require offsetting. An extract of the NVR report is provided in Section 8 of this report.

Please note: Weed species identified on the eastern fringe of the bushland reserve can be removed without a permit. Their removal will effectively disrupt the canopy connection within, and on the

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fringe, of the bushland reserve. This will further mitigate risk associated with bushfire though given the isolated nature of the reserve, a fire would need to ignite within the reserve which would significantly reduce the capacity of the fire to build intensity given the area of the bushland reserve.

5. RELEVANT PLANNING CONTROLS

The following section addresses the objectives and requirements of the zoning and overlay controls relevant to the subject site identifying how these planning controls relate to the proposal, trigger an assessment and how we have addressed the requirements of planning provisions.

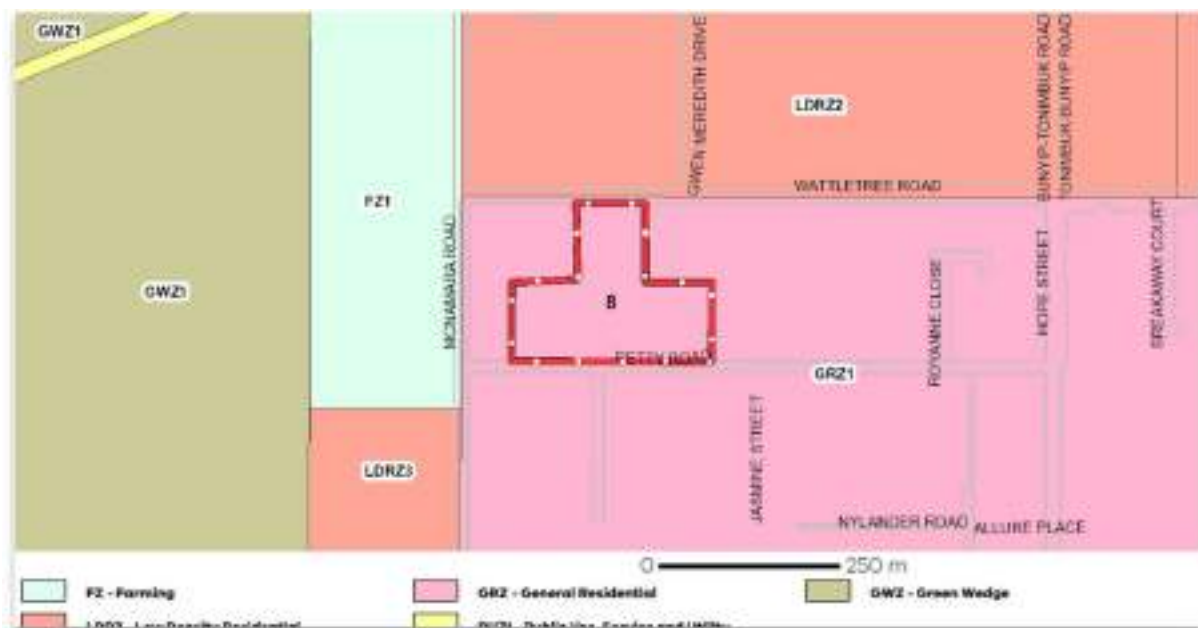
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ZONING CONTROLS

The following provides a brief summary of the planning controls relevant to the subject site identifying how these planning controls relate to the proposal.

GENERAL RESIDENTIAL ZONE

The subject site and all surrounding land is mapped within the General Residential Zone – Schedule 1 (GRZ1).



The General Residential Zone has the following purposes relevant to this proposal:

- To implement the Municipal Planning Strategy and the Planning Policy Framework.
- To encourage development that respect the neighbourhood character of the area.
- To encourage a diversity of housing types and housing growth particularly in locations offering good access to services and transport.
- To allow educational, recreational, religious, community and a limited range of other non-residential uses to serve local community needs in appropriate locations.

Pursuant to **Clause 32.08-3**, a permit is required to subdivide land.

An application to subdivide land must meet the requirements of Clause 56 (for 16-59 lots, the objectives and standards of all Clauses except Clause 56.03-1 to 56.03-3, 56.03-5, 56.06-1 and 56.06-3. An assessment of the proposal against the requirements of clause 56 is presented in Section 7 of this report.

This application has satisfied the application requirements outlined in **Clause 32.08-11 Application requirements** by providing the following information:

- A site and context description and design response as required in Clause 56. A Clause 56 assessment is included as part of this town planning report.
- A site feature plan, concept plan, and proposed plan of subdivision, all of which are drawn to scale and dimensioned, and show:
 - Site shape, size, dimensions and orientation.
 - The siting and use of existing and proposed buildings.
 - Adjacent buildings and uses.
 - The building form and scale.
 - Setbacks to property boundaries.

SCHEDULE 1 TO GENERAL RESIDENTIAL ZONE

No specific neighbourhood character objectives or requirements relevant to the site or the proposed subdivision are described within the schedule to the zone which applies to the *General Residential Areas*.

GENERAL RESIDENTIAL ZONE - DECISION GUIDELINES

The decision guidelines contained in Clause 32.08-13 have been considered in the proposed design. An assessment of the proposal against each relevant guideline is provided below:

General

- *The Municipal Planning Strategy and the Planning Policy Framework.*
- *The purpose of this zone.*
- *The objectives set out in a schedule to this zone.*
- *Any other decision guidelines specified in a schedule to this zone.*
- *The impact of overshadowing on existing rooftop solar energy systems on dwellings on adjoining lots in a General Residential Zone, Mixed Use Zone, Neighbourhood Residential Zone, Residential Growth Zone or Township Zone.*

Subdivision

- *The pattern of subdivision and its effect on the spacing of buildings.*
- *For subdivision of land for residential development, the objectives and standards of Clause 56.*

In summary, the proposal meets the requirements of the Municipal Planning Strategy and the Planning Policy Framework as addressed in Section 6 (below). The proposal contemplates the staged subdivision of land into thirty (30) lots ranging in size from 622sqm (Lot2 211 and 217) to 1,399sqm (Lot 305), which are generally consistent in area to lots proposed and developed in similarly zoned land in Bunyip. Schedule 1 is silent on additional objectives and decision guidelines to those nominated in the zone. While impacts of overshadowing will be determined in the event planning applications are lodged for residential development it should be noted that building envelopes feature 2.5 metre setbacks from side and rear boundaries, which are consistent with the Bunyip Township Strategy 2009 and in excess of the minimum side and rear setbacks contained in clause 56 and will contribute to the

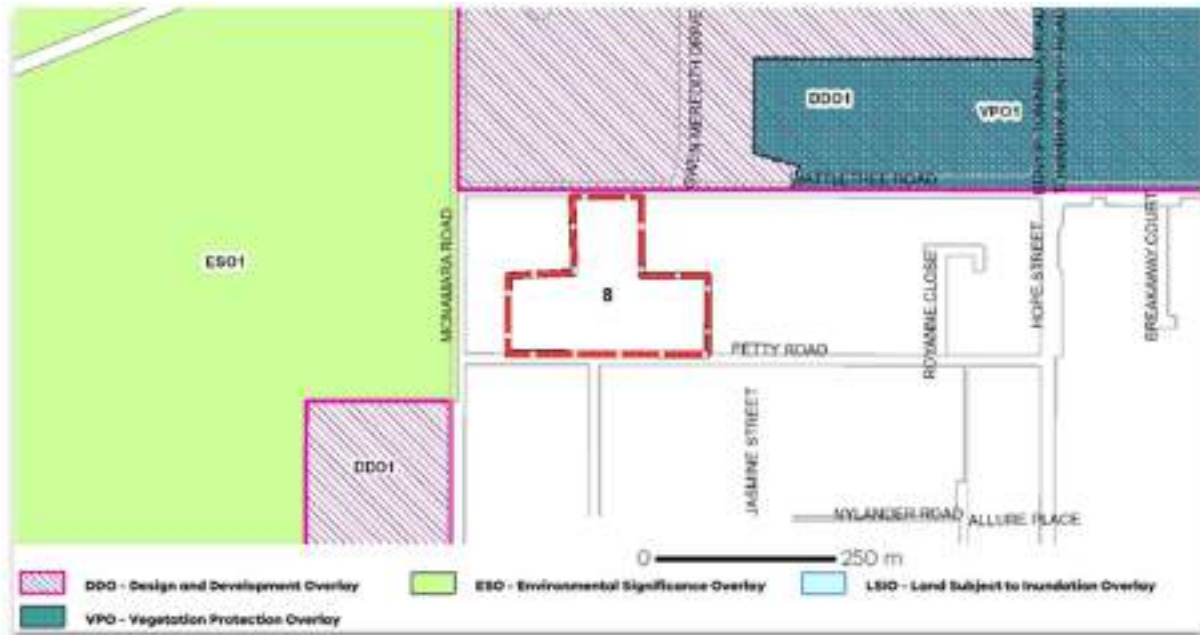
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avoiding adverse impacts on any rooftop solar systems on adjoining land. Battle-axe lot configurations have been avoided to ensure street frontages and passive surveillance opportunities. Trees have been preserved where possible.

As such, the proposed subdivision is appropriate for the General Residential Zone.

OVERLAYS

No overlays directly affect the land, as demonstrated in the image derived from *VicPlan* (2022) below:



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6. MUNICIPAL PLANNING STRATEGY

CLAUSE 21.01-2 KEY INFUENCES AND CLAUSE 21.01-3 KEY ISSUES

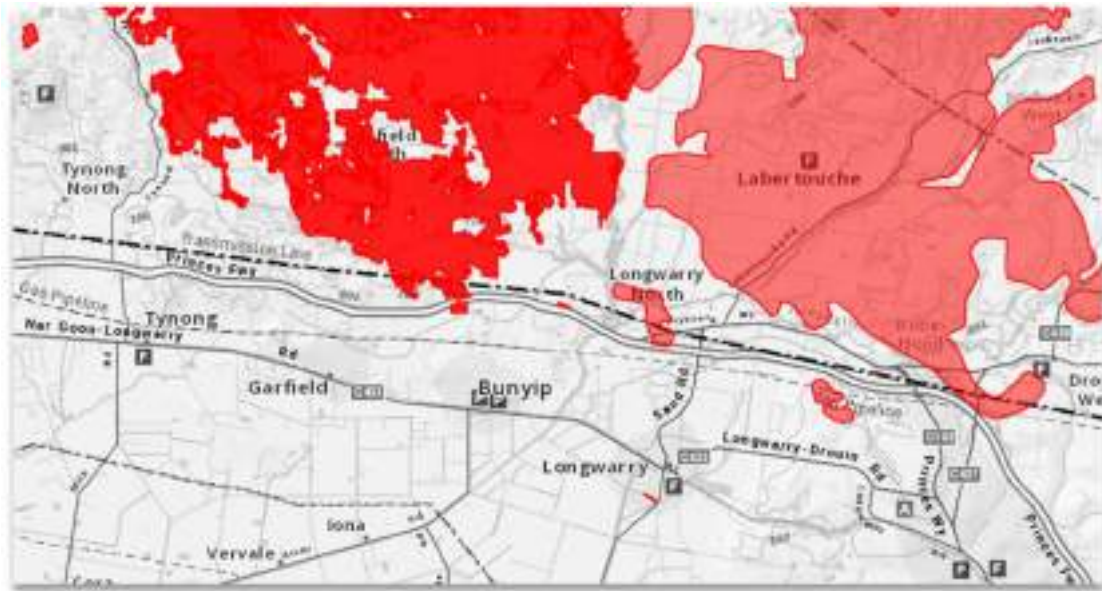
The Cardinia Shire seeks to be recognised as a unique place of environmental significance where our quality of life and sense of community is balanced by sustainable and sensitive development, population and economic growth. The proposal is sensitive to the key issues facing Cardinia that have regard to preserving environmentally heritage significant areas, mitigating risks associated with flooding and bushfire, providing housing and services for a growing community, and facilitating economic development. The subject site is located within the strategic residential area of Bunyip and is consistent with the Cardinia Shire Strategic framework plan at clause 21.01-5.

CLAUSES 21.02 ENVIRONMENT, 21.02-2 LANDSCAPE AND 21.02-3 BIODIVERSITY

Clause 21.02 Environment has the objective, among others, to manage development to mitigate impacts on the operation and health of waterway systems via the provision of retention and treatment of domestic wastewater. Please read our response to the requirements of Clause 21.02 in conjunction with the *Stormwater Management Strategy, dated 29th March 2023, provided by DPM Consulting Group*. **Clause 21.02-2 Landscape** and **Clause 21.02-3 Biodiversity** seek to avoid eroding the existing biodiversity of the Shire and its significant contribution to the landscape. The vegetation contained within the site has been assessed by *Healesville Plants*. Please read in conjunction with the

Arboricultural Assessment dated June, 2023. The arboricultural assessment included 86 trees where the high value trees have been protected and preserved through considered design of the proposed subdivision. A reserve with an approximate area of 12,000sqm is located in the south west portion of the site and will be vested to council to be preserved as habitat for the Southern Brown Bandicoot and other flora and fauna.

Clause 21.02-3 Bushfire management acknowledges the high risk associated with some of the areas within the shire. Bunyip has modest slope with vegetation coverage akin to grazed paddocks (AS3959-2018) as opposed to the more steeply sloped and densely vegetated areas associated with the Bunyip State Reserve to the north of the Princess freeway, which has experienced fire damage as a result of the 2009 and 2019 fires (refer below). Locating subdivision and infill development in existing low risk areas such as Bunyip meets the primary objective of all planning provisions that seek to mitigate bushfire risk.



Bunyip has topographic and vegetation characteristics that make it a low risk area as evidenced by the Victorian Fire Risk mapping above, 2023.

CLAUSES 21.03 SETTLEMENT AND HOUSING, 21.03-4 RURAL TOWNSHIPS

Clause 21.03 Settlement and Housing and more specifically **Clause 21.03-4 Rural Townships** identifies Bunyip as a large rural township, and highlights the key issues facing rural townships that are relevant to our submission as:

- *Retaining and enhancing the existing rural township character.*
- *Acknowledging that the capacity for growth varies depending on the environmental and infrastructure capacities of each of the towns.*
- *Designing with regard to the surrounding unique characteristics of the townships.*

The proposed subdivision addresses these key issues through ensuring that the lot sizes are respectful and consistent with the existing subdivision patterns and lifestyle and amenity values of the surrounding neighbourhood. High value vegetation will be preserved through design with servicing constraints catered to via the provision of a temporary retarding basin.

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Clause 21.08-2 Bunyip ensures use and development proposals are consistent with the requirements of the Bunyip Township Strategy, September 2009. As previously stated, the subject site is located within the area identified as New Residential Estates within the Strategic Framework Plan, refer below (Figure 5, Bunyip Township Strategy, September 2009 with the subject site outlined in red) which have the capacity to accommodate the projected growth of residential (infill) development within the Bunyip township boundaries while preserving existing township character through lot size mechanisms (refer to Sections 4.7 Objectives and 4.8 Policy, Bunyip Township Strategy, September 2009).



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7. STATE AND LOCAL PLANNING POLICY FRAMEWORK

This part of the report assesses and responds to the legislative and policy requirements for the project outlined in the Cardinia Planning Scheme and in accordance with the Planning and Environment Act 1987. The relevant clauses of the State & Local Planning Policy Framework for subdivisions of the type presented in this report are largely contained in Clauses 11, 13, 15, 18 and 19. The proposal is located within of the study area of the Bunyip Township Strategy.

An assessment against the relevant clauses of the Cardinia Planning Scheme has been provided below:

CLAUSE 11 SETTLEMENT

Clause 11.01-1S Settlement and **Clause 11.02-1S Supply of urban land** have regard for the development of sustainable growth and development that preserves the distinction between the residential areas of townships such as Bunyip and the green wedge zoned land that surrounds such communities. They have the shared objective to ensure a sufficient supply of land is available for residential, commercial, retail, industrial recreational, institutional, and other community uses, with the intensification of existing urban areas nominated as a viable option. Our proposal is consistent with this objective.

CLAUSE 13 ENVIRONMENTAL RISKS AND AMENITY

Clause 13.01-1S Natural hazards and climate change is a recently introduced planning mechanism (VC216, 10/06/2022) that seeks to prioritise risk-based planning in an effort to minimise the impacts of natural hazards associated with climate change. One strategy that has salience here is the directive to focus growth and development to low-risk locations. The subject site is not vulnerable to flooding, though it is subject to the intensified risks associated with bushfire (identified within a Bushfire Prone Area). The proposal contemplates the subdivision of land within an existing residential area and the development of a road that dissects the lot and facilitates access and egress, which is consistent with risk mitigation policies.

Clause 13.02-1S (Bushfire) of the Planning Scheme applies to all decision making relating to land that is within a BPA; subject to the BMO; or proposed to be used or developed in a way that may create a bushfire hazard and seeks:

To strengthen the resilience of settlements and communities to bushfire through risk-based planning that prioritises the protection of human life.

Strategies employed to achieve the above-mentioned objective include:

- *prioritising the protection of human life;*
- *requiring a robust assessment of the bushfire hazard and risk assessment before any strategic or statutory decision is made; and*
- *directing population growth and new settlements to low risk locations.*

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Clause 13.02-1S provides strategies that seek to mitigate risk associated with bushfire. The following table provides a response to the strategies of clause 13.02-1S.

Clause 13.02-1S (Bushfire) of the Planning Scheme applies to all decision making relating to land that is within a BPA; subject to the BMO; or proposed to be used or developed in a way that may create a bushfire hazard and seeks:

To strengthen the resilience of settlements and communities to bushfire through risk-based planning that prioritises the protection of human life.

Strategies employed to achieve the above-mentioned objective include:


- *prioritising the protection of human life;*
- *requiring a robust assessment of the bushfire hazard and risk assessment before any strategic or statutory decision is made; and*
- *directing population growth and new settlements to low risk locations.*

Clause 13.02-1S provides strategies that seek to mitigate risk associated with bushfire. The following table provides a response to the strategies of clause 13.02-1S.

PROTECTION OF HUMAN LIFE

GIVE PRIORITY TO THE PROTECTION OF HUMAN LIFE BY:	RESPONSE
<i>Prioritising the protection of human life over all other policy considerations.</i>	<ul style="list-style-type: none"> • This proposal contemplates a 30 lot subdivision on land evidencing a modest slope and bushland reserve to be vested to Council. The report demonstrates that the proposal meets the requirements of Clause 13.02-1S including the long term use and development controls through siting and construction to the required BAL. • Defendable Space will improve the safety of residential lots to the east and southeast, in the event a fire approaches from the west and north west, and lots to the north east should a fire approach from the south west. • The land provides access and egress to areas in Bunyip that are not mapped within the BPA.
<i>Directing population growth and development to low risk locations and ensuring the availability of, and safe access to, areas where human life can be better protected from the effects of bushfire.</i>	<ul style="list-style-type: none"> • Increased urban development is evident in an area, with increased road networks and 'urbanised' land management, effectively reducing vegetation cover and potential fire runs that can direct fire into Bunyip. • The surrounding landscape is consistent with a Type two whereby vegetation beyond 150m from the site has the potential to create neighbourhood-scale destruction, however the readily available egress options provide thoroughfare to shelter from bushfire (DELWP, 2017) • The overall design can respond to the modified woodland vegetation in the reserve through setbacks, vegetation management to achieve

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	<p>defendable space and appropriate BAL construction standards.</p> <ul style="list-style-type: none"> • The existing road network facilitates vehicle egress to surrounding areas identified as low risk locations, and areas mapped outside the BMO and BPA, as per below (subject site is represented by the blue dot).  <ul style="list-style-type: none"> • Access and egress are facilitated from Wattletree and Petty Roads to Hope Street (north to south orientation) which provides access and egress to Nar-Nar Goon-Longwarry Road to the south and the Princess Freeway to the north. • It must be noted that while lot 214 is identified as BAL29 and Lot 306 is labelled BAL40 (refer to the BAL40 MAP V30, this is a reflection of their proximity to the bushland reserve, which is an isolated patch of modified vegetation with little chance of fire building intensity that will result in neighbourhood destruction. The road network is shown to provide multiple egress options to low risk locations. • Lot 306 is proposed as a higher BAL because the Building Envelope extends into the BAL contour shown for that BAL by 4 metres however, it must be noted that this provides a 'functional' building envelope, and is unlikely to elevate risk per se as the weed removal from the reserve will decrease the biomass in the reserve and ability for a fire to build intensity. This higher BAL should be provided as a restriction on the Plan of Subdivision as a precaution for future land owners.
<p><i>Reducing the vulnerability of communities to bushfire through the consideration of bushfire risk in decision making at all stages of the planning process.</i></p>	<ul style="list-style-type: none"> • An application to subdivide the land needs to articulate how the design responds to the identified bushfire risk. Here the subdivision can achieve separation distances from any hazard that equates to BAL12.5, 19 and 29, with the higher BALS generated by the proximity to the onsite reserve, which is an isolated vegetated area with no fire runs

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	<p>connecting it to the north or northwest, or southwest.</p> <ul style="list-style-type: none"> • The land to the north has been developed in accordance with the LDRZ, with similarly zoned land to the north west and south west.
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BUSHFIRE HAZARD IDENTIFICATION AND ASSESSMENT

IDENTIFY BUSHFIRE HAZARD AND UNDERTAKE APPROPRIATE RISK ASSESSMENT BY:	RESPONSE
<i>Applying the best available science to identify vegetation, topographic and climatic conditions that create a bushfire hazard.</i>	<ul style="list-style-type: none"> • The Cardinia Planning Scheme relies on the planning proposal to respond to bushfire based on current assessment methods. • Clause 13.02-1S and 21.02-3 Bushfire management have been considered and addressed by the proposal. • Clause 71.02-3 Integrated Decision Making strengthens the importance of bushfire planning as an appropriate tool to reconcile potential conflicts in design and vision. • The assessment method aligns with AS3959:2018; please review the Bushfire Hazard Site Assessment in this report.
<i>Considering the best available information about bushfire hazard including the map of designated bushfire prone areas prepared under the Building Act 1993 or regulations made under that Act.</i>	<ul style="list-style-type: none"> • The planning proposal responds to the Bushfire Prone Area. The land is not mapped within the Bushfire Management Overlay. • This report evidences that sufficient setbacks from vegetation can be achieved to warrant BAL29 to be applied to Lot 214 and BAL40 to lot 306; BAL19 to lots 213 and 305 with the balance lots achieving BAL12.5.
<i>Applying the Bushfire Management Overlay in planning schemes to areas where the extent of vegetation can create an extreme bushfire hazard</i>	<ul style="list-style-type: none"> • The BMO does not apply to the land recognising that the land is in an area of LOW bushfire hazard. The requirements of the BPA are addressed in this report.
<i>Considering and assessing the bushfire hazard on the basis of:</i> <ul style="list-style-type: none"> • <i>Landscape conditions - meaning the conditions in the landscape within 20 kilometres and potentially up to 75 kilometres from a site;</i> • <i>Local conditions - meaning conditions in the area within approximately 1 kilometre from a site;</i> • <i>Neighbourhood conditions - meaning conditions in the area within 400 metres of a site; and,</i> • <i>The site for the development</i> 	<ul style="list-style-type: none"> • The development of land in the BPA requires the four scales to be considered. • The Landscape conditions are represented in Figure 5 (below); • The Local conditions (1km radius from the site) are considered in Figure 6 (below); • The Neighbourhood conditions (400m from the site) are considered in Figure 7 (below); and • The Site conditions are shown in the BAL contour map in Figure 8 (below).

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<i>Consulting with emergency management agencies and the relevant fire authority early in the process to receive their recommendations and implement appropriate bushfire protection measures.</i>	It is expected that the Council may consult with the CFA with regard to this proposal, although it is not a mandatory referral requirement.
<i>Ensuring that strategic planning documents, planning scheme amendments, planning permit applications and development plan approvals properly assess bushfire risk and include appropriate bushfire protection measures.</i>	<ul style="list-style-type: none"> • This report provides evidence that informs the design and provides a basis for approval of the planning proposal, with regard to bushfire risk. • Assessing the site-based bushfire risk and including appropriate bushfire protection measures (e.g. managed vegetation, BALs, separation from the hazard, access and egress) enables the achievement of the direction of the Planning Scheme.
<i>Not approving development where a landowner or proponent has not satisfactorily demonstrated that the relevant policies have been addressed, performance measures satisfied or bushfire protection measures can be adequately implemented.</i>	<ul style="list-style-type: none"> • Perhaps the most salient element of clause 13.02 as it empowers the Responsible Authority to refuse a permit application until it is satisfied that the bushfire protection measures are being implemented. • This report demonstrates that the risk of bushfire should not be a reason for refusal.

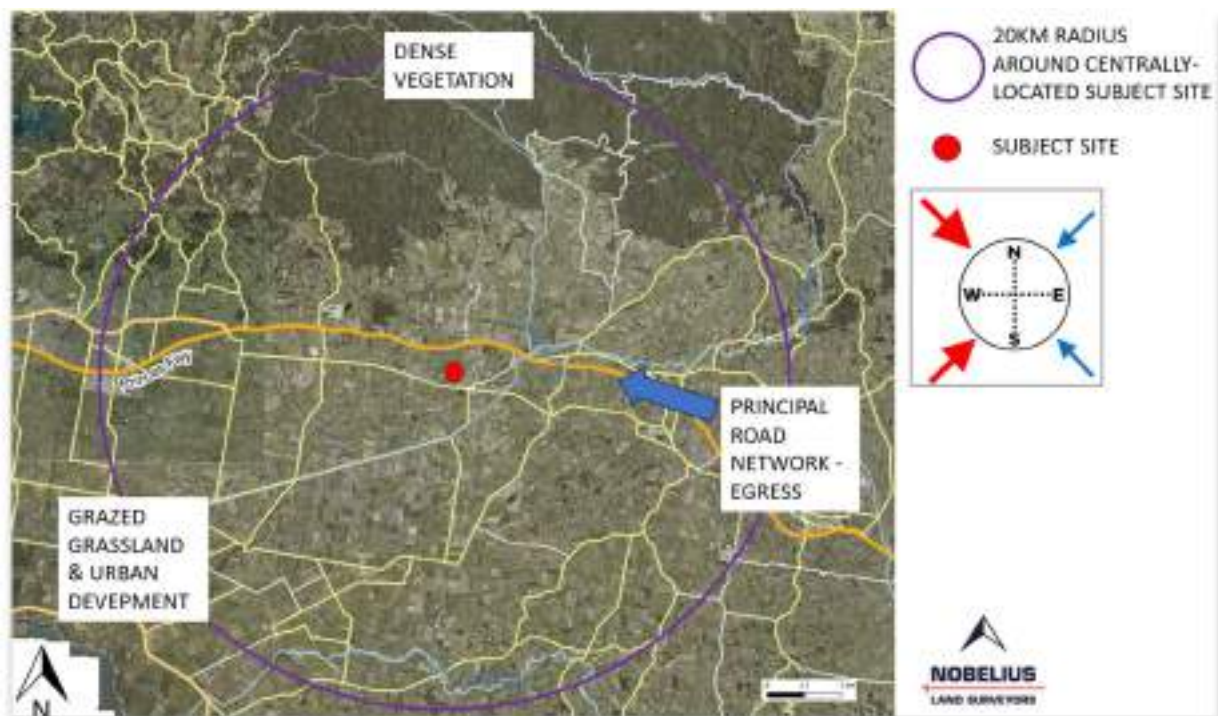


FIGURE 5 (ABOVE) – LANDSCAPE CONDITIONS WITHIN 20KM OF THE SUBJECT SITE.

Landscape conditions (as indicated above) – The area within a 20km radius of the site features a combination of landscapes consisting of cleared farming and grazing; rural/urban development, urban development and densely forested areas. To the north, approximately 7kms away are the foothills of the Dandenong Ranges which exhibit extensive pockets of dense vegetation consistent with the Forest and Woodland classifications of AS3959-2018 *Construction of Buildings in bushfire-prone areas* and steep topography. The site is surrounded by a patchwork of farming and grazing land interspersed

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with rural development to the east, south and west. There is an extensive 'firebreak' between the subject site and the forested State Park to the north. The surrounding road network features principal transport corridors including Princes Freeway (having a west to east orientation), Nar Nar Goon-Longwarry Road (East to west orientation), Bunyip-Modella Road (north to south orientation). The relevance of the road network is that they are most likely those roads that will become the main access points and thoroughfares during an emergency situation.

Local conditions (please refer to the map below) – The area within a 1km radius of the subject site features a combination of land use and development consistent with rural residential zones and general residential zones. To the north is land subject to the GRZ, LDRZ2 and LDRZ3, FZ1 and GWZ1 accessed via a local road network that generally provides for west to east and north to south movement. Vegetation is generally planted native trees adjacent to boundaries and within road reserves with a distinct cleared area separating the subject site from the Bunyip State Park to the north. The land is generally employed for rural residential development in all but a westerly direction with Green Wedge and Farm zoned land within 1km. Bunyip features gentle topography that flattens out to the south.

The most likely bushfire scenario as illustrated by Figures 5 and 6, is for an ignition in the densely vegetated land to the north of the Princes Highway (Bunyip State Park) and for a fire to be 'driven' by a north westerly wind (common in the summer months), which could deliver embers and the risk of further ignition to the township of Bunyip. The land between the Bunyip State Park and the subject site features a patchwork of rural, grazed land and urban development, which is likely to impede fire runs to the onsite vegetation.



FIGURE 6 (ABOVE) – LOCAL CONDITIONS WITHIN 1KM OF THE SUBJECT SITE.

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FIGURE 7 (ABOVE) – NEIGHBOURHOOD CONDITIONS WITHIN 400M OF THE SUBJECT SITE.

Neighbourhood conditions within 400m of the site (please refer to the map above) – The subject site is surrounded by land characterised as rural residential land that is subject to intensifying residential development. Land to the north is subject to a current planning application that seeks the subdivision of land into 30 lots. Land to the north, east and south is development with larger residential lots. Vegetation is contained to roadside reserves with an isolated ‘cluster’ located in the southwest portion of the site and adjacent to Macnamara Road. This vegetation is consistent with modified woodland (AS3959:2018 Construction of buildings in Bushfire Prone Areas).

SETTLEMENT PLANNING

PLAN TO STRENGTHEN THE RESILIENCE OF SETTLEMENTS AND COMMUNITIES AND PRIORITISE PROTECTION OF HUMAN LIFE BY:	RESPONSE
<i>Directing population growth and development to low risk locations, being those locations assessed as having a radiant heat flux of less than 12.5 kilowatts/square metre under AS3959:2018 Construction of Buildings in Bushfire Prone Areas (Standards Australia, 2018).</i>	<ul style="list-style-type: none"> • The land is adjacent to lots in an established residential area that feature predominantly grass vegetation cover interspersed with modified woodland (to the west) and planted gardens. The site is assessed as meeting the requirements of BAL29 (maximum BAL) given the slope and modified woodland to the west within the site. • It must be noted that one lot is assessed as BAL29, one lot assessed as BAL40, two lots achieve BAL19 and the balance achieve BAL12.5. • It must also be noted that the land is only mapped as BPA, not BMO and the BAL assessment is determined by the existing onsite bushland reserve, which is isolated and

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	<p>does not feature significant fire runs to land to the northwest or south west – the directions from which a bushfire threat is likely to emanate.</p> <ul style="list-style-type: none"> • This report shows that the proposed development can achieve suitable mitigation to the bushfire hazard.
<i>Ensuring the availability of and access to areas assessed as BAL-LOW rating under AS3959-2018 Construction of Buildings in Bushfire Prone Areas (Standards Australia, 2018) where human life can be better protected from the effects of bushfire.</i>	<ul style="list-style-type: none"> • Areas of the site and surrounds can achieve BAL LOW, as per the BAL Contours plan in Figure 8 (below). • There are two access and egress options to areas of more urbanized built form where the BPA does not apply.
<i>Ensuring the bushfire risk to existing and future residents, property and community infrastructure will not increase as a result of the future land use and development.</i>	<ul style="list-style-type: none"> • The development of the land will reduce bushfire risk to the residence and surrounding lots to the north west, east and south east given the additional road network. • The increased level of vegetation management will reduce the risk of bushfire to existing dwellings and residents on adjacent lots.
<i>Achieving no net increase risk to existing and future residents, property and community infrastructure, through the implementation of bushfire protection measures and where possible reduce the bushfire risk overall.</i>	The BPA applies to the land recognising that the land is in an area of low bushfire hazard. The subdivision will implement the current regulations pertaining to bushfire construction, setbacks and vegetation management, which will decrease the overall threat to the subject site and surrounding lots.
<i>Assessing and addressing the bushfire hazard posed to the settlement and the likely bushfire behaviour it will produce at a landscape, settlement, local, neighbourhood and site scale, including the potential for neighbourhood-scale destruction.</i>	Please refer to the Landscape Plan at Figure 5 (above); the Local Plan at Figure 6, and Neighbourhood conditions considered in Figures 7 with the Site conditions shown in Figure 8. The landscape is consistent with a Landscape Type Two (DELWP, 2017:14) with access and egress readily available and the onsite bush reserve 'isolated' from surrounding vegetation. This reduces the bushfire threat from the broader landscape. The conditions from a neighbourhood and local scale can also be mitigated given the increasing urban development surrounding the site.
<i>Assessing alternative Low Risk locations for settlement growth on a regional, municipal, settlement, local and neighbourhood basis.</i>	<ul style="list-style-type: none"> • The proposal contemplates the subdivision of land that evidences one lot assessed as BAL29 and lot 306 as BAL40 given their proximity to the bushland reserve. Once the understory weeds are removed, there will be a canopy separation between some of the outer vegetation proximate to the developable lots and reduced biomass within the reserve, which will address vertical and

	<p>horizontal continuity of vegetation and impede the spread of any fire, should one ignite in or to the wets of the bushland reserve.</p> <ul style="list-style-type: none"> The proposal increases resilience by applying a prescribed management to the defendable space across the land, which benefits the existing residential lots adjacent to the subject site.
<p><i>Not approving any strategic planning document, local planning policy, or planning scheme amendment that will result in the introduction or intensification of development in an area that has, or will on completion have, more that BAL-12.5 rating under AS3959:2009.</i></p>	<ul style="list-style-type: none"> Perhaps the most important element of clause 13.02 as it empowers the Responsible Authority to refuse a permit application until it is satisfied with the bushfire protection measures being implemented. The proposal contemplates a statutory application only, and is not a strategic proposal. This report demonstrates that the risk of bushfire should not be a reason for refusal.

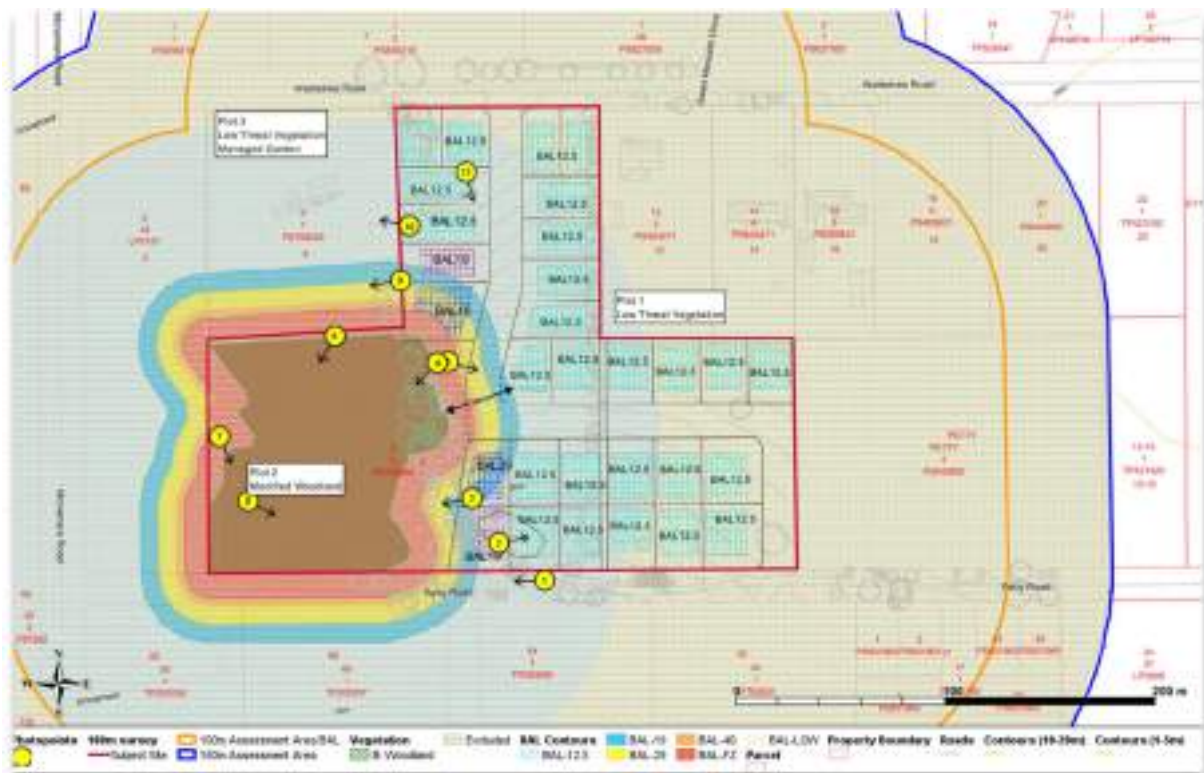


FIGURE 8 (ABOVE) – BAL CONTOUR PLAN SHOWING THE PROPOSED SUBDIVISION, MOST LOTS CAN ACHIEVE BAL 12.5 AS PER THE REQUIREMENTS ASSOCIATED WITH SETTLEMENT PLANNING; LOT 213 WILL ACHIEVE BAL19; LOT 214 WILL ACHIEVE BAL29 AND LOT 309 IS CLASSIFIED AS BAL40 ONLY BECAUSE THE SOUTHWESTERN PORTION OF THE BUILDING ENVELOPE IS LOCATED IN THE AREA DESIGNATED AS BAL40. NORTH-FACING ELEVATIONS OF A DWELLING COULD BE CONSTRUCTED WITH MATERIALS THAT MEET BAL29 CONSTRUCTION CLASSIFICATIONS GIVEN THEY WOULD COMPLY WITH THE SHEILDING PROVISIONS OF AS3859:2018.

Site conditions (Please refer to the BAL Map above generated by *FireMaps*, 2025) – The site features a gentle downward slope from the high point adjacent to Wattletree Road down toward Petty Road. The site is dominated by grazed pasture with onsite livestock maintaining the grass in a Low Threat state consistent with 2.2.3.2 (f), *AS3959:2018 Construction of buildings in Bushfire Prone Areas*. The

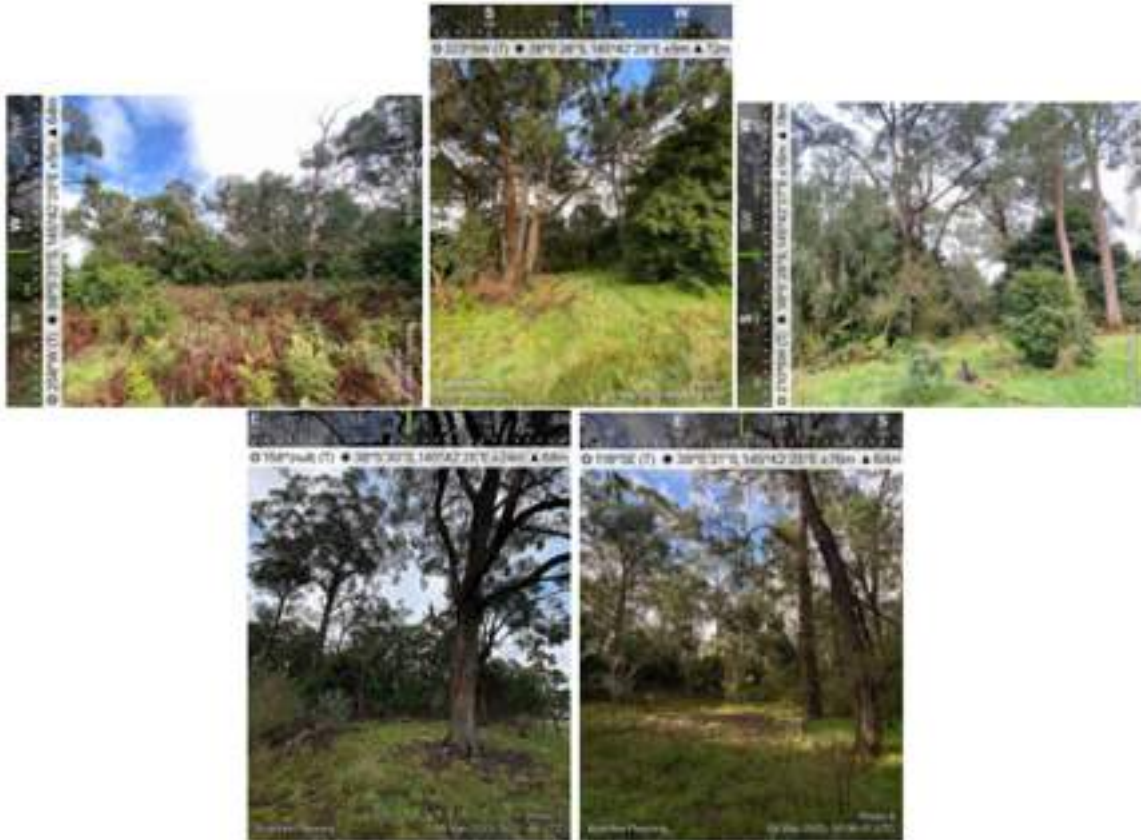
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bushland patch featuring a measurable area of 12,000sqm is located in the southwest portion of the site and is being preserved and vested to Council. This is consistent with the Strategic Framework Plan for Bunyip (Figure 5, page 14, Bunyip Township Strategy, September 2009).

Portions of the site is consistent with a low risk location having a radiant heat flux of less than 12.5 kilowatts/square metre under AS3959-2018 (Construction of Buildings in Bushfire Prone Areas, Standards Australia, 2020) as indicated by the BAL Contour Map above and identified by the BAL 12.5, generated by *FireMaps*, 2025. Sites located in the vicinity of the proposed bushland reserve exhibit higher BAL ratings however, it is salient to note that the reserve is an isolated pocket of vegetation that is modified Woodland (AS3959:2018) where much of the midrange canopy is identified weed species (sweet pittosporum) which will be removed therefore reducing the risk profile of the reserve. The canopy of the trees located on the eastern fringe of the bushland reserve will achieve a separation of 5 metres from similarly mature trees further west, effectively reducing the capacity of fire transfer from tree to tree via the canopy. Given the isolated nature of the reserve, it is highly unlikely to contribute significant bushfire risk, despite the proximity of proposed developable lots to the east of the reserve. It should also be noted that if the application were subject to the BMO and the requirements of clause 53.02 the subdivision would be assessed as a Pathway 3 in clause 53.02 and be required to show a capacity to meet the defendable space requirements of in columns A, B, or C (Table 2), which provides for a maximum Bushfire Attack Level (BAL) of 29. It should be noted that the BAL for all lots other than 305, 306, 213 and 214 achieve BAL 12.5. The removal of weed species located on the eastern fringe of the bushland reserve will reduce the extent of BAL 29 contours and effectively reduce the bushfire risk to those lots adjacent to the reserve. Lot 214 is located to the east of the reserve and the western portion of the building envelope is subject to a BAL29. Lot 306 is shown as achieving BAL40 as the building envelope has been extended to the south, and encroaches into the BAL contours for BAL40 (orange band in the *FireMap* above). An additional BAL should be undertaken for construction for Lot 306 however, it is likely that the shielding provisions of AS3959:2018 could be applied, meaning north-facing elevations could be constructed to BAL29 as they would be shielded from exposure to the direction of the threat (to the south west).

GPS embedded photos (refer below) that correlate to the *FireMap* above clearly evidence the modified nature of the Woodland vegetation classification (AS3959:2018) on the eastern fringe and within the Bushland Reserve. Photos 3, 4, 6, 7 and 8 (below: clockwise from top left) show sweet pittosporum and other mid canopy shrubs that are identified as weeds in the Arboricultural Report (*Healesville Plants*, June 2023, as amended) and can be removed without a permit. Their removal will improve the integrity of the bushland reserve and mitigate the localised risks associated with bushfire.

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*Please read in conjunction with the Bushfire Attack Level Report provided by *Nobelius Land Surveyors*, dated June 2023. It should be noted that AS3959 recommends that a conservative approach be applied to the determination of the Bushfire Attack Level hence the BAL 29 rating (which will likely be reduced once understorey weed species are removed as per the recommendations of the Ecologist report) with the majority achieving BAL 12.5.

*Please refer to additional comments contained in **Section 9** of this report that address clause 71.02-3 Integrated Decision Making.

Access for emergency services to the site, and egress options from the site are consistent with the standards of **clause 53.02** and the strategies of **clause 21.02-4 Bushfire management**. Petty Road to the south and Wattle Tree Road to the north provide connections to Hope Street to the east, which provides a north to south thoroughfare. The proposed subdivision implies a modest increase to the residential population of Bunyip in an area that provides service provision, interconnected road networks where the risk of bushfire is mitigated.

AREAS OF HIGH BIODIVERSITY CONSERVATION VALUE

The objective here is to ensure settlement growth and development approvals can implement bushfire protection measures without unacceptable biodiversity impacts by discouraging settlement growth and development in bushfire affected areas that are of high biodiversity conservation value.

The land is adjacent to a bushland reserve where understorey vegetation and weeds have grown unchecked. The removal of the weeds species will reduce understorey vegetation; addressing vertical and horizontal continuity of the canopy. This will reduce bushfire risk and also support the vitality of indigenous species.

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There are two lots that meet the requirements of BAL 29 conditions given the topography of the land and their proximity to the bushland reserve. Construction to BAL29 reduces the risks associated with ember attack. The balance of lots meet the requirements of BAL12.5 (Please refer to Figure 8, above) and mitigate the bushfire risk posed by the surrounding land, particularly with regard to vegetation management.

USE AND DEVELOPMENT CONTROL IN A BUSHFIRE PRONE AREA

REQUIREMENTS	RESPONSE
<p><i>Use and development control in a Bushfire Prone Area designated in accordance with regulations made under the Building Act 1993, bushfire risk should be considered when assessing planning applications for the following use and development:</i></p> <ul style="list-style-type: none"> • Subdivision of more than 10 lots • Accommodation <p><i>When assessing a planning permit application for the above uses and development:</i></p> <ul style="list-style-type: none"> • Consider the risk of bushfire to people, property and community infrastructure. • Require the implementation of appropriate bushfire protection measures to address the identified bushfire risk. • Ensure new development can implement bushfire protection measures without unacceptable biodiversity impacts. 	<ul style="list-style-type: none"> • Development controls do apply as the proposal contemplates the subdivision of land (more than 10 lots). This report demonstrates that the subdivision is suitably located on land zoned for residential land use and development and meets the requirements of clause 13.02-1S including the long term intent of the use and development controls. • This report provides responses to the requirements of clauses 13.02, including an assessment of likely fire behaviour and risk to future residents. Please refer to Figures 5 and 6, on page 28. • In the context of strategic planning decisions, these strategies need to consider the '<i>net increase in risk to existing and future residents</i>'. As it relates to the objectives at Clause 13.02-1S of the Planning Scheme, it is necessary to ensure that the protection of human life is prioritised when decisions are made. However, the strategies listed at Clause 13.02-1S in the Planning Scheme are <i>not</i> 'mandatory requirements' and <i>it is not necessary</i> to 'tick every box'. It is more important to ensure that decisions are consistent with the State policy objectives and build resilient communities.

PLANNING POLICY DOCUMENTS TO BE CONSIDERED	RESPONSE
Any relevant approved state, regional and municipal fire prevention plan.	Fire prevention measures included in the Metropolitan Bushfire Management Strategy 2020 ensures roadsides and public space is managed; fire suppression is managed through planned burns, slashing, spraying and mulching.
AS3959:2018 Construction of Buildings in Bushfire Prone Areas (Standards Australia, 2018).	Bushfire Attack Levels employ this standard to determine the BAL for the site. Section 7 (for BAL29); Section 6 (for BAL19) and Section 5 (for BAL12.5) of the standard has regard to the construction of a dwelling in accordance with BAL requirements.

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Living in bushfire-prone areas – CSIRO & Standards Australia (SAA HB 330-2009, December, 2009)	This is the handbook to AS3959, which does not need to be considered in the planning proposal.
Any Bushfire Prone Area map prepared under the Building Act 1993 or regulations made under the Act.	The updated Bushfire Prone Area mapping has been considered in this report.

CLAUSE 15 BUILT ENVIRONMENT AND HERITAGE

Clause 15 Built Environment and Heritage has the objective to ensure planning delivers built form that is of high quality and efficient, responsive to the surrounding landscape and character including its associated risks, protective of heritage and provides the functionality required by the community. The proposal aligns with the objective of **Clause 15.01-3S Subdivision design**, which is:

- *To ensure the design of subdivisions achieves attractive, safe, accessible, diverse and sustainable neighbourhoods.*

The proposal contemplates the staged subdivision of the land to produce 30 residential lots and the creation of a temporary retarding basin located within 1km of the commercial centre of Bunyip. The subdivision seeks to balance the provision of attractive lot design through generously sized allotments that retain that vegetation identified as significant and structurally viable. Centrally located access with connection to Petty Road and Wattletree Road and provides multiple entry and exit points favoured by bushfire mitigation strategies. The subject sites are conveniently located within walking range of reserves and sporting facilities, which promotes the objective of **Clause 15.01-4S Healthy neighbourhoods**.

Clause 15.01-5S Neighbourhood character has the objective to:

- *..recognise, support and protect neighbourhood character, cultural identity, and sense of place.*

The immediate area is characterised as contributing to New Residential Estates within the Strategic Framework Plan (Figure 5, Bunyip Township Strategy, September 2009) with the capacity to accommodate the projected growth of residential (infill) development within the Bunyip township boundaries while preserving existing township character through lot size mechanisms (refer to Sections 4.7 Objectives and 4.8 Policy, Bunyip Township Strategy, September 2009).

CLAUSE 18 TRANSPORT

Clause 18 Transport has regard to the provision of ‘connectivity’ for residents to social and economic opportunity which facilitates reliable movement for people and goods and supports environmental sustainability, health and wellbeing. Of salience here are the strategies of Clause 18.0-1S Land use and transport integration that seeks to reduce distances people have to travel between their place of residence and their employment, education, service providers, which promotes mobility within and between communities. Our proposal implies infill residential development within the existing township boundary whereby residents would be within 1km of the commercial centre of Bunyip. This promotes non-car dependant mobility and supports active living and improved wellbeing synonymous with the 20-minute neighbourhood (**Clause 18.01-2S Transport system**) and sustainable and safe

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transport (**Clause 18.01-3S**), and the strategies of **Clause 18.02-1S Walking**, **Clause 18.02-2S Cycling** and **Clause 18.02-3S Public Transport** given Bunyip Rail Station is within 1 km of the subject site.

CLAUSE 19 INFRASTRUCTURE

Clause 19 has regard to the provision of infrastructure to our growing community. **Clauses 19.03-2S Infrastructure design and provision** and **19.03-3S Integrated water management** has the objective to provide timely, efficient and cost-effective development infrastructure that meets the community needs by integrating planning and engineering design of new subdivisions and development. In this regard our proposal has acknowledged that the provision of drainage is of salience and must be catered for on the land. The design has provided for a Temporary Retarding Basin in the southern portion of Stage 2 where the outfall is located at the lowest point of the lot. Please read our response to the requirements of Clause 19 in conjunction with the *Stormwater Management Strategy, dated 29th March 2023, provided by DPM Consulting Group.*

RELEVANT & INCORPORATED DOCUMENTS

BUNYIP TOWNSHIP STRATEGY 2009

The Bunyip Township Strategy, 2009 (referred to as the strategy hereafter) outlines the following vision for Bunyip:

A rural township with extensive recreational opportunities, potential for substantial growth and a commercial and retail centre providing an extensive range of services to the township and nearby residents.

The Bunyip Township will contain a range of housing types that respect the rural character of the town and the natural landscape. Open space areas will be diverse, to allow access for active and passive recreation while ensuring the protection of remnant vegetation and wildlife corridors to allow the movement of species throughout the landscape.

Of the many strategic objectives outlined within the strategy, the following are particularly relevant to this proposal:

- *Provide for the growth of Bunyip as an attractive rural township*
- *Maintain the rural township character*
- *Provide a range of lot sizes and types to accommodate a mix of household and lifestyle types*
- *Protect and enhance the environment, especially those elements which contribute to the character of the Bunyip Township*

The strategy identifies the following existing pattern of residential development in Bunyip (as per 2009 when the strategy was implemented):

Residential development in Bunyip reflects a number of housing styles from Edwardian to modern design with the initial stages of the present day township site having been surveyed during the 1860s. A key characteristic of Bunyip is the significantly higher proportion of large lot sizes compared with other townships. Lot sizes generally range from 500 square metres to 1.5 hectares and the larger lots on the fringe of the township help to integrate the township with

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the surrounding rural properties. Lot in Bunyip's residential precincts predominately retain single-storey detached dwellings with generous setbacks from the street.

The strategy identifies the subject site (shown as a white star) as being located within Residential Precinct 4 – Established Rural Residential Areas, as per the map below:



THE BUNYIP EXISTING CHARACTER PRECINCTS – TOWNSHIP CHARACTER ASSESSMENT MAP
(BUNYIP TOWNSHIP STRATEGY, 2009).

The subject site is mapped as land designated for new residential estates (Precinct 2 – New Residential Estates) in the Strategic Framework Plan, an extract of which has been provided below:

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STRATEGIC FRAMEWORK PLAN (BUNYIP TOWNSHIP STRATEGY, 2009)

Township character assessments of preferred character precincts delineated four preferred character residential precincts for Bunyip. The subject site is mapped within the new residential estates precinct (precinct 2), which has the following preferred character:

New residential estates will retain the rural character with a high proportion of large lots, combined with wide nature strips and roads, and a significant canopy of street trees. New development will integrate with the sloping and undulating terrain and be designed and constructed to a high standard.

Table 10 of the strategy outlines the Precinct character guidelines for Precinct 2. A response has been provided by Nobelius Land Surveyors to demonstrate how the proposal satisfies Council's vision for the future residential estates precinct:

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LOT CHARACTERISTICS

- 80% of lots to remain larger than 700sqm
- Minimum lot size of 600sqm
- Minimum front setback of 7 metres
- Minimum side boundary setback of 2.5 metres
- Maximum building site coverage should not exceed 40% of lot
- Minimum lot width of 18m

Response

The proposed lot configuration and sizes achieve the preferred lot characteristics outlined above.

The proposal achieves 87% of lots with an area that exceeds 700sqm. The proposal includes the creation of 30 lots, and only 4 of these lots are less than 700sqm.

No lots are smaller than 590m².

All lots can achieve a building envelope with a minimum front setback of 7 metres.

All lots can achieve a building envelope with a minimum side boundary setback of 2.5 metres.

All lots can achieve a building envelope that does not exceed 40 per cent of the lot.

All lots (with the exception of 312) have achieved a minimum lot width of 18m.

GENERAL

- *Encourage a diversity of development styles*
- *Maintain a sense of spaciousness between allotments of the residential areas through*
 1. *No front fences or if fenced, low front fences or open wire fences to allow gardens and nature strips to merge.*
 2. *Providing sufficient open space or garden areas.*
 3. *Retaining existing vegetation.*
 4. *Providing new trees and garden spaces.*
- *Discourage small allotments of less than 600sqm*
- *Require a landscape plan to accompany all applications for new subdivisions*
- *Vegetation along McNamara and Petty Road to be retained.*
- *Maintain wide street reserves of 16-18m for local streets.*
- *Retain treed area in the western part of the precinct.*
- *Maintain a rectangular street and lot layout.*
- *Ensure protection and conservation of native vegetation including street trees and roadside vegetation.*
- *Ensure all new developments include extensive street tree plantings at an early stage of development.*
- *Encourage the inclusion of native vegetation and garden space for private and commercial development.*
- *Maintain a high level of quality in the design and construction of new buildings as well as continuity with the character of the areas existing built form.*
- *Ensure building height respects the existing character of the surrounding area.*
- *Residential developments should not include gated street formats but should connect visually and physically to the surrounding areas.*
- *Developments to integrate with the existing landform.*

Response

A Functional Layout Plan has been prepared *TaylorMiller/EngMil, August 2025*, that indicates the road design and width to accommodate street tree planting and a sense of spaciousness consistent with the rural residential character of Bunyip.

The proposal includes the removal of trees with trees (identified as 59-83 and A to I) in the council managed road reserve to the north of the subject site along Petty Road. The character guidelines for this particular precinct outline that vegetation in the road reserves is required to be retained, and that native vegetation should be protected however, a meeting with Council engineers (dated 27th February 2025) has confirmed that the provision of services and necessary infrastructure is not commensurate with the preservation of road-side vegetation. The lot sizes allow for building envelopes that have sufficient setbacks for garden space and avoid impacts on native vegetation where possible.

The proposed subdivision of the land into 30 lots does not include lots smaller than 590m².

The local street to provide access to the lots in the subdivision is proposed to be a width of 16m. The rectangular street and lot layout has been reinforced through the proposed subdivision.

No development of dwellings is proposed as part of this subdivision application.

SUBDIVISION

- Demonstrate how the new subdivision relates to the existing and intended use and development of adjoining land.
- Develop clear, legible road networks incorporating the existing grid layout which provide a high level of internal connectivity and external linkages for local vehicle, pedestrian and bicycle movements.
- Maintain generous street, footpath and easement widths in new developments. Provide a minimum width for internal streets of 7.3 metres to allow for parking on either side and access for emergency vehicles.
- Discourage cul-de-sacs and, if used, they should be connected through to another street by a wide reserve and path for safe pedestrian and bicycle access.

Response

The proposed subdivision is consistent with the residential subdivisions occurring on the land immediately adjoining the subject site. The proposed street network reinforces the existing grid layout and is able to connect with the existing local vehicle, pedestrian and bicycle networks.

Subsection 4.6 identifies the following key issues relevant to the development of residential land in Bunyip:

- *Bunyip has several large areas of undeveloped land within the township boundary. Developing vacant land within the township will provide the opportunity to increase the township's population and therefore create economic and social benefits, making the town more sustainable in the long term.*

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- *While increasing the number of lots to increase the population is important, the general character of Bunyip is that of a rural township and it is important to maintain that character in all new developments.*
- *Increasing the diversity of lots and dwelling types will allow people a broader range of housing options, as well as accommodate existing residents of Bunyip as they age and their housing needs change.*

Subsection 4.7 outlines the objectives to be met by future residential development of the town:

- *Facilitate growth of residential development in Bunyip to a population of approximately 3,500 people.*
- *Ensure that the long-term residential capacity and township boundaries are clearly defined.*
- *Ensure the long-term sustainability of the community by providing residential development for a range of lifestyle opportunities.*
- *Ensure that infill residential development is integrated and respects the existing character of the township.*
- *Maintain generous street, footpath and easement width in new developments.*

The proposal contemplates residential subdivision within the township boundary that will enable residents to access township amenity and services. The subdivision design illustrates a sensitivity to the existing character of Bunyip while accommodating for population growth and long term economic sustainability.

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8. PARTICULAR PROVISIONS

The relevant particular provisions/documents that will be addressed are identified below:

- Clause 52.12 Bushfire exemptions
- Clause 52.17 Native vegetation
- Clause 53.01 Public open space contribution and subdivision
- Clause 53.18 Stormwater management in urban development
- Clause 56 Residential Subdivision

CLAUSE 52.12 BUSHFIRE EXEMPTIONS

Clause 52.12 Bushfire protection exemptions seek to facilitate the removal of vegetation in specific circumstances to support and protect human life and property. **Clause 52.12-1 Exemptions to create defensible space around buildings used for accommodation** and **Clause 52.12-2 Exemption for vegetation removal along a fence line** provide exemptions that enable the removal, destruction or lopping of vegetation within 10m metres of an existing building to create defensible space and along a boundary fence between properties and in different ownership if all the requirements are met:

- *The fence must be located in an area that is designated as a bushfire prone area under the Building Act 1993.*
- *The fence must have been constructed before 10 September 2009.* The internal fencing has been on the prior to 2009.
- *The clearing alongside both sides of the fence when combined must not exceed 4 metres in width, except where land has already been cleared 4 metres or more along one side of the fence, then up to 1 metre can be cleared along the other side of the fence.*

The site is located within the BPA (as indicated previously, refer to the assessment to the requirements of clause 13.02-1S) and the existing fence lines were constructed prior to 10 September 2009 however, the location of the trees that require removal (and offsetting) do not meet the requirements of clause 52.12-2.

Please read in conjunction with the *Arboricultural Impact Assessment dated June 2023*, and amended March 2025, provided by *Healesville Plants*.

CLAUSE 52.17 NATIVE VEGETATION

Clause 52.17 has the following purposes:

- *To ensure that there is no net loss to biodiversity as a result of the removal, destruction or lopping of native vegetation. This is achieved by applying the following three step approach in accordance with the Guidelines for the removal, destruction or lopping of native vegetation (Department of Environment, Land, Water and Planning, 2017) (the guidelines):*
 1. *Avoid the removal, destruction or lopping of native vegetation.*
 2. *Minimise the impacts from the removal, destruction or lopping of native vegetation that cannot be avoided.*
 3. *Provide an offset to compensate for the biodiversity impact if a permit is granted to remove, destroy or lop native vegetation.*

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- *To manage the removal, destruction or lopping of native vegetation to minimise land and water degradation.*

Pursuant to Clause 52.17 Native Vegetation, locally indigenous, non-planted vegetation requires a permit (and offset) to remove, destroy or lop. *Healesville Plants* have prepared a *Native Vegetation Removal Report* of all vegetation on the subject site and adjacent to the subject site and have found that Clause 52.17 will apply to several trees.

As per the Native Vegetation Report by Healesville Plants dated June 2023 (revised March 2025) Trees 1, 39-47 and 61-86 are indigenous trees and require offsetting.

AVOID, MINIMISE AND OFFSET

As per the NVR, page 23, tree removal can not be avoided on this site. Exotic weed species have been referred for removal to reduce BAL requirements and risk associated with bushfire. Of the 86 trees proposed for removal, 29 are exotic species. While Tree 1 has been shown to be offset as a consequence of proximity of construction, it will be retained. It was previously proposed to retain trees in the Petty Road reserve with crossovers designed to avoid trees and footpaths shown to be above grade and meandering around trees. Despite several iterations of plans and revisions made in an attempt to retain these trees, the provision of services has made the retention of these trees unviable. New street trees can be planted in the road reserve and it has been recommended in the NVR that these trees be of the same species and provenance. Please read in conjunction with the revised NVR provided by *Healesville Plants*, March 2025.

Offsets are determined via an Intermediate Pathway and requires 0.363 hectares to be offset. Please refer to NVRR ID:311_20240815_JGB, extract below.

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Report details

Date created: 15/08/2024

Local Government Area: CARDINIA SHIRE

Registered Aboriginal Party: Bunurong

Coordinates: 145.70861, -38.09227

Address: 8 WATTLETREE ROAD BUNYIP 3815

Regulator Notes

Removal polygons are located:

Summary of native vegetation to be removed

Assessment pathway	Intermediate Assessment Pathway		
Location category	Location 1 The native vegetation extent map indicates that this area is not typically characterised as supporting native vegetation. It does not meet the criteria to be classified as Location Category 2 or 3. The removal of less than 0.5 hectares of native vegetation in this area will not require a Species Offset.		
Total extent including past and proposed removal (ha) <small>Includes endangered EVCs (ha): 0</small>	0.363	Extent of past removal (ha)	0
		Extent of proposed removal - Patches (ha)	0.152
		Extent of proposed removal - Scattered Trees (ha)	0.211
No. Large Trees proposed to be removed	4	No. Large Patch Trees	1
		No. Large Scattered Trees	3
No. Small Scattered Trees	0		

The following offsets are required should a permit be granted:

Any approval granted will include a condition to secure an offset, before the removal of native vegetation, that meets the following requirements:

General Offset amount ¹	0.152 General Habitat Units
Minimum strategic biodiversity value score ²	0.442
Large Trees	4
Vicinity	Melbourne Water CMA or CARDINIA SHIRE LGA

CLAUSE 53.01 PUBLIC OPEN SPACE CONTRIBUTION AND SUBDIVISION

A subdivision of the land attracts the requirement of a contribution to the council for (the provision of) Public Open Space the value of which is calculated as a percentage of the value of the land intended to be used for residential development. Clauses 53.01-1 and 53.02-2 (under section 18 (8)(a) of the Subdivision Act 1988) set out exemptions from Public Open Space requirements specified in the scheme including where the subdivision is:

- *of a building used for residential purposes where each lot contains part of the building. The building must have been constructed or used for residential purposes immediately before 30 October 1989 or a planning permit must have been issued for the building to be constructed or used for residential purposes immediately before that date.*
- *a commercial or industrial building provided each lot contains part of the building.*
- *for the purpose of excising land to be transferred to a public authority, council or a Minister for a utility installation.*
- *subdivides land into two lots and the council considers it unlikely that each lot will be further subdivided.*

The proposal does not qualify for any of the above-mentioned exemptions therefore the subdivision of land will attract a Public Open Space Contribution of the value of 8 per cent of the total value of the land, as per the requirements of the schedule to clause 53.01.

Please note that the area that measures approximately 12,000sqm of retained bush located in the southwestern portion of the site will be vested to council as a bushland reserve. It is requested that the valuation of land take this into account with the contribution consistent with the subtraction of the area of this land from the calculation of the Public Open Space Contribution.

CLAUSE 53.18 STORMWATER MANAGEMENT IN URBAN DEVELOPMENT

The purpose of clause 53.18 is to ensure that stormwater in urban development is managed in a way that mitigates the impacts of stormwater on the environment, property and public safety, and to provide cooling, local habitat and amenity benefits. Clause 53.18-1 states that this clause applies to an application under a provision of a zone to subdivide land, construct a building, or construct or carry out works, other than for an application to *subdivide land in a residential zone for residential purposes*. While an assessment of the proposal against the requirements of clauses 53.18-4 to 53.18-6 is not required, a Stormwater Management Plan has been provided by *DPM Consulting Group, dated 29th March 2023, as amended in 2025*. This Management Strategy responds to Melbourne Water Drainage Scheme. The Stormwater management strategy proposes the viability of stormwater quality treatment to Best Practice Environmental Management objectives and investigates Integrated Water management (IWM) opportunities in accordance with the Integrated Water Management Framework for Victoria and with Council's Integrated Water Management Plan (2014).

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CLAUSE 56 RESIDENTIAL SUBDIVISION

Clause 56 is applicable to this proposal, and has the following purposes:


- *To implement the Municipal Planning Strategy and the Planning Policy Framework.*
- *To create liveable and sustainable neighbourhoods and urban places with character and identity.*
- *To achieve residential subdivision outcomes that appropriate respond to the site and its context for:*
 - *Metropolitan Melbourne growth areas.*
 - *Infill sites within established residential areas.*
 - *Regional cities and towns.*
 - *To ensure residential subdivision design appropriately provides for:*
 - *Policy implementation*
 - *Liveable and sustainable communities.*
 - *Residential lot design.*
 - *Urban landscape.*
 - *Access and mobility management.*
 - *Integrated water management.*
 - *Site management.*
 - *Utilities.*

Clause 32.08 General Residential Zone states that applications for the subdivision of land into 16-59 lots must meet all objectives and standards in Clause 56, except for Clauses 56.03-1 to 56.03-3, 56.03-5, 56.06-1 and 56.06-3.

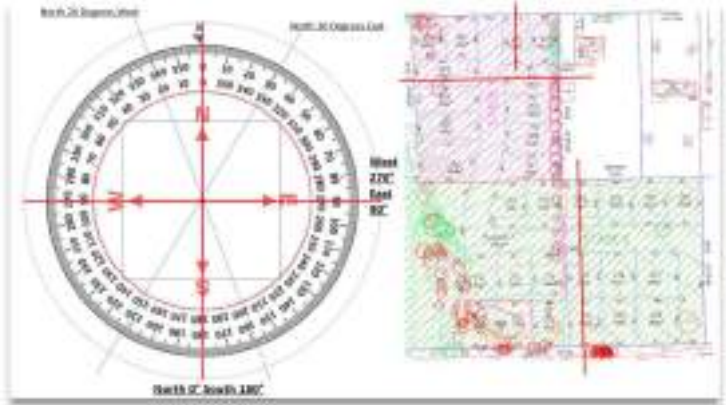
An assessment of the proposal against the relevant objectives and standards contained within Clause 56 is provided below:

CLAUSE	RESPONSE
56.01 SUBDIVISION SITE AND CONTEXT DESCRIPTION AND DESIGN RESPONSE	
56.01-1 Subdivision site and context description	Please refer to Section 3 Subject site and surrounding locality within the report (above) and the Feature Plan lodged in conjunction with this proposal.
56.01-2 Subdivision design response	Please refer to Section 4 The Proposal and Section 7 Planning Controls and our response to clause 15.01-3S within the report (above) and the proposed plan of subdivision lodged in conjunction with this proposal.
56.02 POLICY IMPLEMENTATION	
56.02-1 Strategic implementation objective	Complies with Standard C1 Please refer to Section 5 Planning Controls and our responses to State and Local policies in Section 7 , Relevant Incorporated Documents in Section 7 and Particular and General Provisions in Sections 8 and 9 (above).

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56.03 LIVEABLE AND SUSTAINABLE COMMUNITIES	
56.03-1 Compact and walkable neighbourhoods' objective	Standard C2 NA
56.03-2 Activity Centre objective	Standard C3 NA
56.03-3 Planning for community facilities objective	Standard C4 NA
56.03-4 Built environment objective	Complies with Standard C5 A description of the elements that contribute to the identity and character of Bunyip have been provided in Section 3 Subject site and surrounding locality and a response of the proposal to the existing character has been provided in Sections 7 and 8 .
56.03-5 Neighborhood character objective	Complies with Standard C6 The proposal complies with the relevant standards and objectives under this clause. Please read in conjunction with our response to Clause 15.01-5S Neighbourhood character , the Bunyip Township Strategy (September 2009) and Clause 21.08-2 Bunyip (Sections 6 and 7 above).
56.04 LOT DESIGN	
56.04-1 Lot diversity and distribution objectives	Complies with Standard C7 The proposal provides for thirty (30) additional lots that range between 590m ² to 1,043m ² with the majority, over 87%, meeting minimal lot area requirements (minimum of 700sqm lots) specified in the Bunyip Township Strategy (Sept, 2009) and are comparable to the area of other recent subdivisions in the vicinity, notably on Jasmine Street to the south east and more generous than those lots that address Geranium Rise and Magnolia Way to the south. The subject site is located within 1.5kms of the Bunyips' commercial centre and Railway Station. 
56.04-2 Lot area and building envelopes objective	Complies with Standard C8 Each building envelope has a front setback of 7 metres and side and rear setbacks of 2.5metres except where they avoid Tree Protection Zones. This is consistent with the requirements of the Bunyip Township Strategy, 2009. The building envelopes indicate that any subsequent built form

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	<p>with a maximum of two stories can achieve setbacks that protect solar access of existing dwellings and any future onsite development; avoid easements and protect existing onsite vegetation.</p> <p>The standard requires that lots in excess of 500m² should be able to contain a rectangle measuring 10 metres by 15 metres, equating to an area of 150m².</p> <p><u>Lot 306</u> has a generous area of 1,043m² and features a Habitable Building Envelope that measures 408m² (an area more generous than the required area of 150m²) and ensures built form is separated from the vegetation to the southwest and can meet building regulation requirements commensurate with BAL29 (AS3959:2018). The lot can accommodate a Habitable Building Envelope that is located adjacent to the northern title boundary 10m x 15m, though the habitable building envelope is larger in area than the minimum requirements. The lot also features a Non-Habitable Building Envelope that allows for outbuildings and other non-habitable built form such as pools.</p> <p>As required by standard C8; the proposed building envelope of lot 306 specifies a relevant siting requirement and is setback from the front boundary by 7 metres and from all side boundaries by 2.5 metres, as is the adjoining lot 305, and has the capacity of meeting standards A10 to A15 of clause 54.</p>
56.04-3 Solar orientation of lots objective	<p>Complies with Standard C9</p> <p>The proposal positions lots in both north/south and east/west orientation with dimensions adequate to protect solar access.</p>  <p>Of the 30 lots, 22 are orientated with their long axis within the range north 20 degrees west to north 30 degrees east, which equates to 73% of the lots.</p> <p>The lots are adequately sized with BE's suitably setback from boundaries to ensure solar access.</p>
56.04-4 Street orientation objective	<p>Complies with Standard C10</p> <p>The proposed lots are orientated to either the proposed internal road that dissects the lot, or to Petty Road (lots 208-214) or to Wattletree Road (lots 301-302 and 311-312). Lots</p>

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	will take benefit from access to, and surveillance of, the Reserve No.1 contained within the proposal.
56.04-5 Common Area objective	Standard C11. NA - No Common Property is proposed. The road network enables public access and facilitates connectivity. The proposed bushland reserve will be vested to Council and managed by Council as a public open area.
56.05 URBAN LANDSCAPE	
56.05-1 Integrated urban landscape objective	Complies with Standard C12 A road is proposed that dissects the proposed subdivision which features widths and design that is consistent with 'Access Roads' in Bunyip and will incorporate street trees, lighting and pedestrian pathways into the landscape design. The 'Reserve No. 1' provides for the protection of the existing flora and fauna on the site and in the vicinity with the weeds species identified so they can be removed. The temporary Retarding Basin will continue to provide for onsite stormwater attenuation and a mechanism to settle suspended particles prior to them leaving the site and entering the stormwater drainage to the south of the site.
56.05-2 Public open space provision objectives	Standard C13 The Reserve No. 1 is technically Public Open Space as it will be accessible to the public. It will contribute to the preservation of the rural residential character of Bunyip and the relationship that future residents have with their surroundings. The benefits of Public Open Space are multiple including the provision of shading and the reduction of urban heat island effects; provide habitat for flora and fauna; reduce motor traffic noise and promoting active mobility (metropolis.com).
56.06 ACCESS AND MOBILITY MANAGEMENT	
56.06-1 Integrated mobility objectives	Complies with Standard C14 The road will be designed to incorporate a footpath within the road reserve to facilitate walkability, cycling, and connectivity to Petty Road in the south and Wattletree Road in the north. This will contribute to the footpath network between the subject site and the commercial centre of Bunyip and Bunyip Railway Station. Please read in conjunction with the Functional Layout Plan provided by <i>TaylorMiller</i> (amended), March 2025.
56.06-2 Walking and cycling network objectives	Complies with Standard C15 The surrounding street network features interlinked pavements and footpaths that can be used to access the commercial centre to the south, and Bunyip Railway Station. The proposed road will feature a footpath that provides connectivity to future walking and cycling networks on Petty

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	Road and Wattletree Road. The foot path/s are designed to Australian Standards and include permeable nature strips to encourage landscaping.
56.06-3 Public transport network objective	NA – Standard C16
56.06-4 Neighbourhood street network objective	Complies with Standard C17 The Functional Layout Plan provided by <i>TaylorMiller</i> (as amended) evidences the proposed road and footpath which are designed to Australian Standards and function as Local Access Streets (as per the definition in the Bunyip Township Strategy, September 2009: page 35) and include permeable nature strips to encourage landscaping. They provide connectivity to the existing walking and cycling networks on the roads to the east and south.
56.06-5 Walking and cycling network detail objectives	Complies with Standard C18 It is acknowledged in the Bunyip Township Strategy (September 2009: 37-38) that the road and footpath network in Bunyip requires improvement to ‘progressively upgrade local roads’ requiring new subdivision proposals to provide connectivity of pedestrian and vehicular networks. The proposed through road achieves pedestrian and vehicular access (and egress via Petty and Wattletree Roads).
56.06-6 Public transport network detail objectives	NA – Standard C19
56.06-7 Neighbourhood street network detail objectives	Complies with Standard C20 The proposed road, “Road R-1” features a navigable width of 16 metres. This width is capable of accommodating emergency and waste vehicles and providing for shared paths, integrated water management, street landscaping including trees, lighting and infrastructure. The road is designed to accommodate minimum corner splays at the intersections with Petty and Wattletree Roads, consistent with the minimum requirements in Table C1 for Access Street – Level 1 widths. Please read in conjunction with the FLP provided by <i>TaylorMiller/EngMil</i> , dated August 2025 and the Traffic Impact Assessment by <i>T&TS</i> , dated February 2023.
56.06-8 Lot access objective	Complies with Standard C21. The proposed lots have vehicular street access consistent with those requirements for Access Street – Level 1 (Table C1). Please read in conjunction with the Traffic Impact Assessment provided by <i>T&TS</i> , February 2023, and the FLP provided by <i>TaylorMiller/EngMil</i> , Revision I.
56.07 INTEGRATED WATER MANAGEMENT	
56.07-1 Drinking water supply objectives	Complies with Standard C22 The supply of drinking water will be designed and constructed in accordance with the requirements, and provided to the

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	boundary of all lots, to the satisfaction of the relevant water authority.
56.07-2 Reused and recycled water	Complies with Standard C23 The supply of reused and recycled water will be designed, constructed and managed in accordance with the requirements, and provided to the boundary of all lots to the satisfaction of the relevant water authority.
56.07-3 Wastewater management objective	Complies with Standard C24 Wastewater systems will be designed, constructed and managed in accordance with the requirements, consistent with the relevant approved domestic wastewater management plan, and provided to the boundary of all lots, to the satisfaction of the relevant water authority. Please read in conjunction with the Stormwater and Integrated Water Management Plan by <i>DPM Consulting</i> , dated 23 rd April 2025.
56.07-4 Stormwater management objectives	Complies with Standard C25 The urban stormwater management system has been designed and will be managed in accordance with the requirements and to the satisfaction of the relevant drainage authority. Please read in conjunction with the <i>Stormwater Management Strategy dated 23rd April 2025</i> (as amended) provided by <i>DPM Consulting Group</i> . The proposed stormwater drainage system will be seamlessly integrated with the existing stormwater drainage infrastructure in the area and will accommodate flood modelling events specified within the standards. Stormwater Quality modelling using MUSIC by DPM Consulting demonstrates that the proposed Temporary Retarding Basin partially meets the BPEMG for clause 56.07. No water quality treatment is expected within the proposed development in anticipation of the delivery of the future drainage scheme asset WL/RB1, in accordance with the Bunyip West DSS.
56.08 SITE MANAGEMENT	
56.08-1 Site Management objective	Compliance with Standard C26 The proposal contemplates subdivision however, trenching to facilitate service provision and access construction will avoid TPZ's of any vegetation identified to be retained as per the recommendations of the assessing arborist report by <i>Healesville Plants (amended)</i> , dated August, 2025. Waterways and drainage channels to the south of the site will be protected from runoff via the employment of the Temporary Retarding Basin, which will arrest runoff from the site to the land to the south of the site. Litter and construction waste will be collected and removed from site.
56.09 UTILITIES	
56.09-1 Shared trenching objectives	Compliant with Standard C27

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	Shared trenching will be prioritised where appropriate and achievable.
56.09-2 Electricity, telecommunications and gas objectives	Complies with Standard C28 Electricity, telecommunications and reticulated water supply systems will be provided in shared trenches where possible with the requirements of the relevant servicing agency stipulated in any planning permit issued and provided to the satisfaction of the relevant authority.
56.09-3 Fire hydrant objective	Complies with standard C29 Fire hydrants will be provided not more than 120metres from the rear of each lot and no more than 200metres apart, to the satisfaction of the relevant authority.
56.09-4 Public lighting objective	Complies with Standard C30 Public lighting will be provided to the proposed road and fitted with energy efficient fittings. The public light will be designed according to Australian Standards LG-002: Lighting for Roads and Public Spaces.

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9. GENERAL PROVISIONS

The relevant general provisions that will be addressed in this section are identified below:

- Clause 65 Decision Guidelines
- Clause 65.01 Approval of an Application or Plan
- Clause 65.02 Approval of an application to subdivide land
- Clause 71.02-1 Purpose of the Planning Policy Framework
- Clause 71.02-3 Integrated decision making

CLAUSE 65 DECISION GUIDELINES

Clause 65 states that the Responsible Authority must decide whether the proposal will provide acceptable outcomes in terms of the decision guidelines of this Clause. The decision guidelines of Clause 65.01 and 65.02 relating to the approval of an application or plan and an application to subdivide the land respectfully are relevant to this application.

CLAUSE 65.01 APPROVAL OF AN APPLICATION OR PLAN

The decision guidelines outlined in Clause 65.01 are applicable to this proposal, in particular:

- *The matters set out in Section 60 of the Act.*
- *Any significant effects the environment, including the contamination of the land, may have on the use or development.*

The land is not identified as being contaminated. The site constraints and considerations of the land including native vegetation, topography and any overland flows have been responded to throughout the design process.

- *The Municipal Planning Strategy and the Planning Policy Framework.*
- *The purpose of the zone, overlay or other provision.*
- *Any matter required to be considered in the zone, overlay or other provision.*
- *The orderly planning of the area.*

The planning considerations have been adequately addressed within this report in sections 4-7.

- *The effect on the environment, human health and amenity of the area.*

The proposed subdivision does not pose any foreseeable adverse impacts to the environment, human health or the amenity of the area. Any potential adverse impacts have been identified and responded to throughout the design process.

- *The proximity of the land to any public land.*

The proposed subdivision does not adversely impact any public land within the vicinity of the site.

- *Factors likely to cause or contribute to land degradation, salinity or reduce water quality.*

No foreseeable factors that may cause or contribute to land degradation, salinity or reduced water quality have been identified during the design process.

- *Whether the proposed development is designed to maintain or improve the quality of stormwater within and exiting the site.*

A stormwater and drainage assessment was undertaken as part of the design process, and the proposed subdivision design is responsive to the findings of the assessment.

- *The extent and character of native vegetation and the likelihood of it's destruction.*

Native vegetation is proposed to be removed and will be offset as per the requirements of Clause 52.17 Native vegetation. The subject site in it's existing state is a highly modified landscape, with the majority of the site cleared for small scale agriculture and lifestyle living.

- *Whether native vegetation is to be or can be protected, planted or allowed to regenerate.*

The proposed subdivision provides landscaping buffers and lot sizes with dimensions appropriate for the planting and establishment of native vegetation. Additionally, the Reserve No. 1 will provide for opportunities to preserve native vegetation and provides habitat for indigenous fauna.

- *The degree of flood, erosion or fire hazard associated with the location of the land and the use, development or management of the land so as to minimise any such hazard.*

The subject site is not prone to flood or erosion. The site is mapped as a designated bushfire prone area and the risk has been further addressed in our response to Clause 13.02 and 71.02-3.

- *The adequacy of loading and unloading facilities and any associated amenity, traffic flow and road safety impacts.*

Loading and unloading facilities are not relevant to this proposal.

- *The impact the use or development will have on the current and future development and operation of the transport system.*

The proposed subdivision does not adversely impact on the current and future development and operation of the transport system.

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CLAUSE 65.02 APPROVAL OF AN APPLICATION TO SUBDIVIDE LAND

The decision guidelines outlined in Clause 65.02 have been considered in the proposed design. A response has been provided where applicable to demonstrate how the proposal meets the decision guidelines outlined below:

- *The suitability of the land for subdivision.*
- *The existing use and possible future development of the land and nearby land.*
- *The availability of subdivided land in the locality and the need for the creation of further lots.*

The land is zoned for residential purposes and has been designated for future residential development in the Bunyip Township Strategy 2009. Surrounding land is experiencing infill residential development, and the lot sizes and street network of the proposed subdivision will integrate with and compliment the emerging character of the new residential precinct.

- *The effect of development on the use or development of other land which has a common means of drainage.*

A stormwater and drainage strategy has been developed to support the proposed subdivision to ensure that overland flows do not adversely affect any other land with common means of drainage.

- *The subdivision pattern having regard to the physical characteristics of the land including existing vegetation.*

The subdivision is responsive to the constraints and considerations posed by the site, including native vegetation and overland flows.

- *The density of the proposed development.*

The density of the proposed subdivision is appropriate for the locality and reflects the subdivision patterns seen on surrounding land.

- *The area and dimensions of each lot in the subdivision.*

The proposed subdivision has achieved lots with areas and dimensions consistent with those required by the Bunyip Township Strategy 2009.

- *The layout of roads having regard to their function and relationship to existing roads.*
- *The movement of pedestrians and vehicles throughout the subdivision and the ease of access to all lots.*

The proposed street layout is functional in design and integrates with the existing street network.

The movement of pedestrians and vehicles is facilitated through the north-south street through the centre of the subject site.

- *The provision and location of reserves for public open space and other community facilities.*

The proposal does include a modest bushland reserve for public open space which is consistent with the Framework Plan contained in the Bunyip Township Strategy 2009.

- *The staging of the subdivision.*

The subdivision is proposed to be undertaken in three stages, which is appropriate for the size and scale of the subdivision and allows for the appropriate infrastructure to be implemented as the subdivision progresses through the stages. The staging has also been proposed as a mechanism that

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facilitates the funding of the development as the sale of land identified as Stage 2 will fund the development of Stage 3 land.

- *The design and siting of buildings have regard to safety and the risk of spread of fire.*

The risk of fire to the proposed subdivision is mitigated by the highly modified landscapes surrounding the subject site, and the isolated nature of the bushland reserve in the south western portion of the site. The site has been assessed as having a BAL ranging from 12.5 to 29. Please refer to the submitted BAL Heat Map, NLS 2025.

- *The provision of off-street parking.*

All lots are able to support off-street parking.

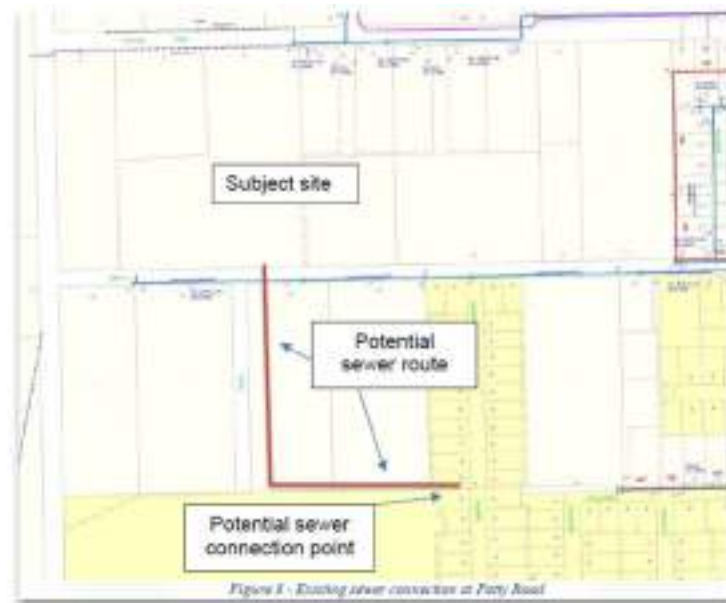
- *The provision and location of common property.*
- *The functions of any body corporate.*

No common property is proposed as part of this subdivision avoiding the necessity of a body corporate model.

- *The availability and provision of utility services, including water, sewerage, drainage, electricity and gas.*
- *If the land is not sewered and no provision has been made for the land to be sewered, the capacity of the land to treat and retain all sewage and sullage within the boundaries of each lot.*

The subject site is able to connect to all services. While there are no gravity sewer assets located in the vicinity of the site, a possible option for connection and provision as discussed in the Engineering Servicing Report by *TaylorMiller/EngMil*, dated August 2025 suggests the construction of a gravity sewer main along the unmade road reserve to the south for approximately 220m and then east for approximately 180m along the southern boundary of No. 45 and 54 Petty road to an existing sewer manhole within a neighbouring subdivision (refer to figure 8, Page 10 of the *TaylorMiller/EngMil* report – extracted below) Similar developments in the vicinity employ small sewer pumping stations with pressure rising mains to service their developments however this method of sewer construction can often be expensive.

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- *Whether, in relation to subdivision plans, native vegetation can be protected through subdivision and siting of open space areas.*

An Arboricultural Impact Assessment has been undertaken that has outlined where native vegetation is located and can be retained. All efforts have been made to retain as much vegetation as possible.

- *The impact the development will have on the current and future development and operation of the transport system.*

The proposed subdivision does not adversely impact on the current and future development and operation of the transport system. The proposed road network can accommodate buses should a route be proposed that employs the proposed road network.

CLAUSE 71.02-3 INTEGRATED DECISION MAKING

Clause 71.02-3 Integrated decision making seeks to balance the needs and expectations of the community in terms of the provision of built form to accommodate a growing population, protection of the environment, economic wellbeing, various social needs, management of resources and infrastructure.

Clause 71.02-3 has been recently updated (February, 2022) and aims to balance these needs and expectations through the employment of the Planning Scheme to ensure conflicting objectives are balanced in favour of net community benefit and sustainable development for the benefit of present and future generations. It states that in bushfire affected areas, planning must prioritise the protection of human life over all other policy considerations.

Our proposal contemplates the subdivision of land in an area identified as predominantly low risk (BAL 12.5) to the threat of bushfire. Despite the perceived elevated risk associated with the bushland reserve no. 1, we have shown that the reserve is an isolated patch of vegetation that is highly modified Woodland and is disconnected from bushland to the north; effectively mitigating 'fire run' potential and the likelihood of an intense fire impacting the proposed lots.

An integrated approach to bushfire planning can be exemplified through the strategic identification of suitable land for future development that is located with little hazardous vegetation, or low threat

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vegetation within 150metres that significantly reduces the possibility of extreme bushfire behaviour occurring and neighbourhood-scale destruction highly unlikely, and where access and egress is available via multiple routes. This strategic location of settlement reduces the risk to the community and also to the vegetation and associated biodiversity that would be required to be removed or managed to mitigate hazard. An integrated approach to bushfire planning can be implemented at the neighbourhood scale to reduce the risk of hazard to the community, as per the example provided below (DELWP, 2020). This approach addresses the provision of developable lots and the location of different land uses, the provision of open space requirements for the community, and safe access and egress, and is exemplified by the graphic below.



The subdivision of the subject site provided an initial plan that aligned with the strategies above however, the preservation of high value onsite vegetation required a revision of plans that redirected the internal road to align with the eastern most boundary. Vegetation management within the proposed bushland reserve will remove understorey weeds and retard the connectivity of vegetation, effectively reducing the effective BAL for lots 213, 214 and 306. There are multiple access and egress options to and from the site, ensuring residents can leave the site should a bushfire occur, and access BAL Low areas. These mechanisms ensure there is a balance between the provision of lots for residential development as demanded by the community, the preservation and management of vegetation to reduce and mitigate environmental risks, and preserve the viable biodiversity assets associated with the bushland reserve, achieving the objectives of clause 71.02-3.

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10. CONCLUSION

It is submitted that the proposal is consistent with the relevant policies and provisions of the Cardinia Planning Scheme and should receive Council's support for the following reasons:

- The proposal is consistent with the Municipal Planning Strategy and the Planning Policy Framework.
- The proposal is consistent with the purpose of the General Residential Zone – Schedule 1.
- As stated in this report, the matters for consideration under the *Planning and Environment Act, 1987* and associated *Planning and Environment Regulations 2015* has been satisfactorily addressed through compliance with the Cardinia Planning Scheme, demonstrating the subdivision is compatible with the existing subdivision and development pattern in the surrounding area.
- Onsite and third party vegetation has been assessed. Detailed assessments have been provided for each tree with high value vegetation preserved where possible and offset where unavoidable.
- The proposed lot sizes have dimensions appropriate for building envelopes that will provide for future dwellings that will not overshadow the existing rooftop solar energy systems on dwellings on adjoining residential lots.
- The proposal is respectful of the neighbourhood character and subdivision pattern evident in surrounding residential developments.
- The proposal has satisfied all relevant objectives and standards of Clause 56.
- The proposal effectively reduces and mitigates bushfire risk.
- The proposal provides effective temporary retardation of overland flows until such time as the Bunyip West DSS becomes available.
- The proposal provides a bushland reserve that preserves onsite vegetation and biodiversity, and provides public open space for future residents.
- The proposal provides for access and egress, pedestrianism, infrastructure consistent with the Bunyip Township Strategy, engineering standards and community expectations.

The proposal provides an excellent opportunity for further residential development in a well serviced location and in an area designated for residential growth in Bunyip.

The constraints and considerations of the subject site have been appropriately responded to in the design process, and the proposal integrates into the surrounding subdivision pattern and street network, and warrants Councils support.

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8 Wattletree Road, Bunyip

Stormwater Management Strategy

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-  Design Development
-  Project Management
-  Civil Engineering
-  Urban Development
-  Storm Water Management
-  Construction Management

DPM REF: 3193/M/C

23rd of April 2025

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16.07.2024	Development Plan Version 6 – Nobelius Land Surveyors

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1.0 Introduction

1.1 Background

- 1.1.1. DPM Consulting Group (DPM) have been engaged by Nobelius Land Surveyors (the client) to prepare a Stormwater Management Strategy (SWMS) for the proposed development located at 8, Wattletree Road, Bunyip.

1.2 Objectives

- 1.2.1. The purpose of this document is to set out a high-level stormwater management strategy for the subject development site, which will entail:
- Delineating the site's internal and external drainage catchments.
 - Identifying the flood mitigation measures that need to be put in place;
 - Recognising the key drainage infrastructure required to help meet these objectives.
- 1.2.2. The Stormwater Management Strategy will investigate the viability of stormwater quality treatment to Best Practice Environmental Management (BPEM) objectives.
- 1.2.3. Additionally, this report aims to develop a strategy to identify, prioritise and investigate Integrated Water Management (IWM) opportunities in accordance with the Integrated Water Management Framework for Victoria and the Integrated Water Management Plan (2014) prepared by Cardinia Shire Council.
- 1.2.4. The objectives of this document are as follows:
- Providing a stormwater strategy for the peak flows generated by a 20% Annual Exceedance Probability (AEP) event and a 1% AEP event;
 - Promoting the safe conveyance of the peak flows downstream to the future drainage scheme assets as per Bunyip West Development Services Scheme (DSS)
 - Considering the delivery of a Temporary Retarding Basin (TRB) for the attenuation of the post-developed flows to pre-developed conditions;
 - Identifying and leveraging opportunities to optimise the outcomes of the water cycle;
 - Pursue new approaches which contribute to conserve water resources as well as protecting the environment.

1.3 Stormwater Management Strategy

- 1.3.1. DPM have prepared a SWMS for the proposed residential development based on the latest approach to urban stormwater management.
- 1.3.2. This is based on retention and conveyance of stormwater runoff to meet multi-purpose design objectives, that enhance liveability of urban areas, mitigate flood nuisance and avoid damage to property and loss of life.
- 1.3.3. This SWMS incorporates two classes of stormwater management infrastructure in accordance with the latest Australian Rainfall & Runoff 2019 (ARR19): conveyance systems and volume management.

Conveyance Systems

- 1.3.4. Conveyance systems allow runoff to be conveyed through urban areas and provide connections through the catchment.
- 1.3.5. This SWMS also incorporates the traditional approach to stormwater management which involves a minor and major event management philosophy.
- 1.3.6. Minor flows up to the 20% Annual Exceedance Probability (AEP) will be conveyed in an underground pipe network to their ultimate discharge point.
- 1.3.7. Major flows up to the 1% AEP, meeting specific safety requirements, can flow in an overland flow path, along road reserves and constructed waterways and to their ultimate discharge point. Both the Minor and Major drainage strategies for the site have been discussed in this SWMS.

Volume Management

- 1.3.8. Volume management includes measures and solutions which can store runoff for a period of time, promote infiltration and potentially stored harvested stormwater for beneficial uses.
- 1.3.9. Volume management is a key element of stormwater management and flood control which has a fundamental importance in achieving a range of hydrological and water quality objectives within these facilities.
- 1.3.10. Additionally, DPM's SWMS aims to achieve the water quality targets in accordance with the Best Practice Environmental Management Guidelines (BPEMG) which requires the treatment of stormwater runoff to achieve 80% reduction in Total Suspended Solids (TSS), 45% reduction in Total Phosphorous (TP) and 45% reduction in Total Nitrogen (TN).
- 1.3.11. As part of the Victoria Planning Provision Clause 56.07, developers are required to minimise stormwater quality and quantity related impacts. Typically, these pollutant targets are achieved through the implementation of WSUD practices, such as wetlands and bio-retention systems.

- 1.3.12. DPM also intends for these stormwater management assets to be multi-functional, whereby rather than just serving as a treatment mechanism for stormwater, their presence will provide public amenity, an opportunity for communities to engage with their environment and beautification of the site's existing natural features.

1.4 Integrated Water Management

- 1.4.1. Urban stormwater runoff and associated stormwater responses are part of the urban water cycle, which includes not only stormwater quality and quantity, but also water supply, sewerage, urban form and waterway.
- 1.4.2. Urban runoff design and investigation techniques can be used to achieve better economic, social and environmental outcomes.
- 1.4.3. Urban runoff management is successfully achieved when it is integrated with the complete management of the urban cycle.
- 1.4.4. In accordance with the Integrated Water Management Plan prepared by Cardinia Shire Council, DPM aim to realise integrated opportunities through collaboration and communication with relevant stakeholders in order to identify, coordinate and priorities areas that would most benefit from IWM applications.



Figure 1 – Drivers for Council's IWMP

- 1.4.5. DPM understand the importance of creating greater value to the community by focusing on improving and enhancing the water cycle planning and management within the Cardinia Shire Council.

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- 1.4.6. DPM continuously thrive to seek opportunities and foster innovation to provide efficient and successful economic and liveability outcomes, pursuing new approaches which would contribute to conserve water resources as well as protecting the environment.
- 1.4.7. It is understood that the overall objective of IWMP published by the Cardinia Shire Council is to deliver a framework that will guide Council towards a more sustainable integrated approach to water management to reduce reliance on potable water and enhance ecological health of receiving waterways (Westernport Bay).
- 1.4.8. In addition, to achieve the overall aim of the council's IWMP the six main IWMP's objectives with respect to Stormwater, Potable Water, Alternative Water Sources, Groundwater, Wastewater and Waterways was understood.
- 1.4.9. This SWMS will aim to address the Cardinia Shire City Council's IWMP's main objectives with regards to Stormwater and Waterways

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2.0 Property Description

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2.1 Property location

- 2.1.1. The proposed development site is located at 8 Wattletree Road, Bunyip VIC approximately 90 km Southeast of Melbourne's CBD.
- 2.1.2. The site consists of undeveloped Greenfield land and a total area of approximately 4.09 ha (see Figure 2).



Figure 2 – Locality plan of the proposed development (Nearmap, 2022)

- 2.1.3. The site's current and past uses are largely pastoral with no history of contamination.
- 2.1.4. The site has been categorized as a General Residential Zone by Victorian Planning Authority.
- 2.1.5. The site is within the municipality of Cardinia Shire Council.

2.2 Site Description

2.2.1. Table 1 below summarises the general site characteristics.

Table 1 Site Summary

Gross Area		The total site area is 4.09 ha approximately
Existing Lots		The existing site is greenfield
Topography		The site has a slope of approximately 1 in 12 across land from the northern boundary of the site to the Southern boundary of the site. The highest elevation of the site is found to be at 72m at the Northern boundary and the lowest elevation of 54m at the Southern boundary.
Boundaries	North	Wattletree Road
	East	Existing Residential land/ Undeveloped greenfield
	West	Undeveloped Greenfield
	South	Petty Road
Access		Wattletree Road/ Petty Road

2.2.2. The project consists of a staged subdivision, and it includes the delivery of the entire associated infrastructure.

2.2.3. Access to the site is permanently provided from Wattletree Road from the North and from Petty Road from the south of the site. (Refer Figure 3 and Appendix B – Development Concept Layout Plan).

2.2.4. It is understood that the proposed concept layout plan can make the conveyance of the flow challenging. However, it should be noted that the proposed layout for the internal road within the development is based on the discussion with the Council to protect the maintain trees with significant values along the western lots of the proposed development.

2.2.5. DPM have proposed the strategy to convey the flows from the proposed development safely which is discussed in Section 3.5.19 and Section 5.1.1.

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Figure 3 – Development context plan

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2.3 Existing Topography

2.3.1. The site generally features good fall gravitating North to South direction (Refer Figure 4 and Figure 5).



Figure 4 – Three-dimension view of the topography of the site and surrounding



Figure 5 – Existing site topography (DPM, 2022)

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- 2.3.2. The existing land is undeveloped Greenfield and there is little sign of any significant earthworks, mounds or deposited fill.
- 2.3.3. Additionally, there is an existing dam towards to south of the site.
- 2.3.4. The site covers a heavy vegetation area of approximately 1.28 ha. However, this area is remained to be untouched during the development.

2.4 Existing Constraints

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- 2.4.1. There is an existing dam with approximately 1460m³ of available storage located within the southern part of the site (Figure 6).



Figure 6 – Existing dam located along the south boundary of the proposed development site.

- 2.4.2. According to the existing site topography, the stormwater generated from the site is draining to the open drain located along Petty Road.



Figure 7 – Predevelopment catchment plan

- 2.4.3. Correspondingly, stormwater generated by sub catchments 1 and 2 (depicted by green and purple colours) is conveying to the open drain located along Petty Road. Stormwater originated by sub catchment 2 (illustrated by orange colour) is conveying to the existing dam located within the site and an attenuated flow is conveying out to the existing open drain along Petty Road.
- 2.4.4. Additionally, the open drain located south to the site, along Petty Road has been identified as the Legal Point of Discharge (LPD) for the proposed development.



Figure 8 – Legal Point of Discharge (LPD)

3.0 Drainage Strategy

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3.1 Background

- 3.1.1. The proposed development falls under the municipality of Cardinia Shire Council and Melbourne Water Catchment Management Authority. It is understood that the Drainage Scheme is currently active.
- 3.1.2. DPM have received pre-development advice from Melbourne Water dated 13 August 2023 which is included in Appendix C.

3.2 Context to the Bunyip West DSS

- 3.2.1. The proposed development forms part of the broader Bunyip West DSS, administered by Melbourne Water (see Figure 9).



Figure 9 – Extract of the Bunyip West DSS (Melbourne Water, 2017)

- 3.2.2. As mentioned in the Pre-development Advice from MW, the current base rate hydraulic contribution of \$121,407/ha and base rate of 18,876/ha water quality reduction for onsite treatment for a total of \$140,283/ha for the proposed residential development.
- 3.2.3. According to the Pre-development Advice, the permit area ultimately relies on delivery of the following drainage scheme assets:

- **D1 – A8:** Drainage scheme pipeline to service 20% AEP flows developed by the upstream catchment and conveyed through the proposed development
- **A6 – A10A:** Drainage scheme pipeline for conveying the post developed flows from the proposed development to downstream.
- **C3 – A8:** Drainage scheme pipeline to service 20% AEP flows developed by the upstream catchment and conveyed through the proposed development
- **A10 A – A18:** Constructed waterway
- **WL1/RB1:** Retarding basin and water quality asset which has the function of attenuating the peak flows from the upstream catchment to pre-developed conditions and achieve BPEMG.

3.3 Works proposed as part of 8, Wattletree Road, Bunyip Development

- 3.3.1. The development will be proposed to be delivered in accordance with Appendix B – Development Concept Layout Plan
- 3.3.2. A post-developed catchment plan has been created considering the site topography.



Figure 10 – Post-developed catchment plan

- 3.3.3. Further, the existing dam is proposed to be utilized to achieve the desired flood attenuation requirement under the temporary strategy as outlined within section 3.5.1.

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- 3.3.4. Accordingly, a temporary strategy has been considered for the development whereby the site will convey the post-developed flows to a temporary retarding asset (dam) located to the south of the development and the attenuated flows will be conveyed to the existing open drain located to southeast corner of the site.
- 3.3.5. Correspondingly, DPM propose to convey the post developed flows generated by sub catchment 1 (SUB -01) to be conveyed directly into the existing open drain along Petty Road, following the existing conditions.
- 3.3.6. This is deemed reasonable as no development is expected to be delivered within the heavy vegetation area.
- 3.3.7. The post developed flows generated from (SUB-02) will be conveyed into the existing open drain along Petty Road Petty Road.
- 3.3.8. On the other hand, the post developed flows generated by the remaining part of the development (SUB-03 and 04) will be conveyed to the existing dam for attenuation and the attenuated flows will be conveyed to the existing open drain located along Petty Road.
- 3.3.9. It is noted that the existing dam will be subject to remediation works and further investigations might be required to confirm the suitability of the dam to cater for the developed flows.
- 3.3.10. As discussed during the meeting with MW on the 20.03.2024, if further information and investigation on the dam will be required, those will be included as a condition to the planning permit.
- 3.3.11. The TRB will be decommissioned once the future drainage infrastructure downstream of the site (i.e. RB1/WL1) will be delivered.
- 3.3.12. DPM acknowledge that no water quality treatment asset has to be delivered with the proposed development. However, the TRB will be providing temporary sediment control, reducing the pollution load downstream of the site.
- 3.3.13. Additionally, as part of the proposed development and in accordance with the DSS, the following drainage scheme assets are expected to be constructed:
- **C3 – A7:** 93 m council pipe to cater for 20% AEP flow
 - **A6 – A7:** 110 m council pipe to cater for 20% AEP flow
 - **A7 – A8:** 55 m council pipe to cater for 20% AEP flow
 - **D1 – D2:** 125 m council pipe to cater for 20% AEP flow
 - **D2 – A8:** 83 m council pipe to cater for 20% AEP flow
- 3.3.14. It is noted that MW preference for **D1 – D2** drainage scheme pipe is to be constructed at the gravel section of Petty Road to align with the DSS and to avoid any impacts on vegetation within the proposed bushland reserve and the Petty Road reserve.

- 3.3.15. The correspondence with the MW regarding the preferred location of **D1 – D2** pipe is included in Appendix G.
- 3.3.16. Further details of the TRB will be discussed with Council at appropriate phases of the design.

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3.4 Hydrological Modelling

Introduction

- 3.4.1. As stated in section 1.3.6, the minor drainage system of the proposed development must be sized for the developed 20% AEP flows.
- 3.4.2. The major drainage system must be designed to convey the maximum developed 1% AEP flow.
- 3.4.3. The critical 1% AEP event that produces the maximum peak flow must be defined against the proposed road reserve geometry to confirm that the Melbourne Water floodway safety criteria are fulfilled.

Design Flows

- 3.4.4. In accordance with the Australian Rainfall and Runoff 2019 (AR&R19), the calculation of the peak flows for catchments reasonably small (area smaller than 10 ha) can be undertaken with the use of the rational method.
- 3.4.5. No external catchments have been considered in the calculation of the peak flows.
- 3.4.6. The time of concentration has been calculated by using an average of a range of methods for flow length estimate, Bransby Williams and Pillgrim & McDermott.
- 3.4.7. The flow length estimate uses a constant velocity of 2.5 m/s to calculate the time of concentration for a 20% AEP event.
- 3.4.8. The flow length estimate uses a constant velocity of 1.5 m/s to calculate the time of concentration for a 1% AEP event.
- 3.4.9. The pre- and post-development flow originated by the proposed development site have been included in Table 2.

Table 2 Peak flows at the outfall of the proposed development

Flow Type:	Symbol	Storm Duration	Peak Flow Rate [m ³ /s]
Pre-developed Maximum Flow	1% AEP	12 minutes	0.311
Developed Major Flow	1% AEP	11 minutes	0.839
Developed Minor Flow	20% AEP	8 minutes	0.404

- 3.4.10. The flows in Table 2 have been calculated in line with the Cardinia Shire Council Planning Scheme and using the Rational Method, considered appropriate for a small catchment, as noted at 3.4.4

- 3.4.11. It is expected that upstream developments will be responsible for the delivery of TRB, within their sites, until the future drainage infrastructure for the Bunyip West DSS is delivered.
- 3.4.12. Further details of the flow calculation are attached in Appendix E – Drainage Computation.
- 3.4.13. Note that the Developed Minor Flow (20% AEP) serves as an indication only based on an overall estimate and must be revisited during the detailed design phase of the proposed development.
- 3.4.14. As mentioned within section 3.3.8, the peak flow generated from sub catchments 3 and 4 will be conveyed downstream to the TRB located within the existing dam along the south boundary of the site and the attenuated peak flow will be conveyed to the existing open drain along Petty road.

Flow Conveyance

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- 3.4.15. The minor drainage system of the proposed development must be sized for the peak 20% AEP event flow (20% AEP)
- 3.4.16. The access to the site and the other areas must be designed to avoid excessive pooling of water and to convey these flows into the minor system.
- 3.4.17. The major drainage system must be sized for the peak 1% AEP event flow (1% AEP) and may utilise the road surface to convey flows above the capacity of the minor drainage system to the legal point of discharge (LPOD), provided that freeboard and Melbourne Water flow safety limits are adhered to.
- 3.4.18. The 1% AEP event flow will be conveyed via road network to the TRB located to the south-west corner of the site.
- 3.4.19. A temporary flood attenuation strategy has been outlined within the next section which shows how the attenuation of the peak flows will be delivered within the proposed development.
- 3.4.20. Section 3.2.3 outlined the list of the drainage scheme assets that the permit area ultimately relies on under ultimate condition.
- 3.4.21. However, as discussed in the meeting between MW, the client, and DPM on 20 March 2024 and due to the proposed temporary attenuation asset within the development, DPM propose that the developer will be responsible for the delivery and construction of the drainage scheme assets as outlined in Section 3.3.13.

Flow Attenuation

- 3.5.1. Due to the relatively small and uniform catchment, as previously stated, the Rational Method is considered an acceptable flow calculation method for both predeveloped flows and developed flows.

- 3.5.2. A plan of the overall catchment contributing post – developed flows has been included in Appendix D – Catchment Plan.
- 3.5.3. Boyd's Method (Boyd et al. 1994) and the modified rational method have been used to estimate the required storage for attenuation purposes at the downstream end of the site.
- 3.5.4. Boyd's method estimates the storage using the rational method calculated peak flow rate.
- 3.5.5. The modified rational method uses longer duration storms that produce smaller flow rates to verify that the storage capacity of the retarding basin is not exceeded (see Figure 11).

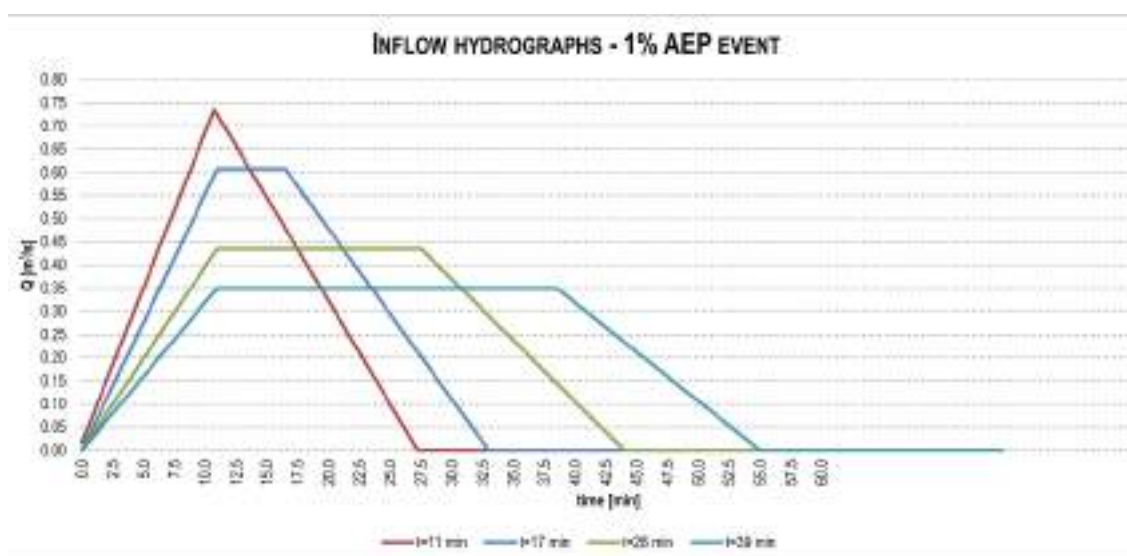


Figure 11 – Inflow hydrographs for different storm durations

- 3.5.6. Table 3 outlines the storage volume required based on the different durations of the storm event.

Table 3 Summary of the results: storage required for different storm events

Storm Duration [min]	1% AEP [m³/s]	Storage required [m³]
11 minutes	0.744	371
17 minutes	0.615	419
28 minutes	0.441	413
39 minutes	0.355	395

- 3.5.7. The critical AEP 1% storm that maximises the volume of the detention system is the 17-minute duration storm that produces a peak flow of 0.607 m³/s and requires an attenuation storage of approximately 419 m³.
- 3.5.8. The provision of approximately 419 m³ of storage will be required for the temporary attenuation of the post-developed flows to pre-developed condition until the ultimate drainage infrastructure to the southwest of the site is delivered.
- 3.5.9. As mentioned in Section 3.3.7, the post-development flows from SUB-02 will not be directed into the TRB. Instead, DPM has designed the TRB to over-attenuate the flows from other catchments, allowing the flows from SUB-02 to leave the site without attenuation. As a result, the combined unattenuated flows from SUB-02 and the attenuated flows from the rest of the site are lower than the pre-development flows from the entire site.

- 3.5.10. Accordingly, it is proposed that the **existing dam** along the south boundary of the site to be utilised for the temporary attenuation of the post-developed flows to pre-developed condition until the ultimate drainage infrastructure is delivered.
- 3.5.11. As discussed in Section 2.4.1, the existing dam has an approximately 1460m³ of **available** storage. Therefore, the required attenuation (TRB) can be provided within the existing dam.
- 3.5.12. It is understood that a dam assessment might need to be undertaken and submitted to Melbourne Water. However, as confirmed by MW during the meeting on the 20.03.2024, this will be included as a condition to the planning permit, should be deemed necessary.
- 3.5.13. A concept design of the temporary asset is shown in Figure 12. The following figure only illustrates a concept design for the TRB in the interim condition. Nevertheless, a detailed design has to be carried out at the design phase of the project.



Figure 12 – Drainage alignment in the interim condition showing the concept design of the temporary retarding basin

- 3.5.14. The ultimate drainage alignment for the proposed development is shown in Figure 13.

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Figure 13 – Drainage alignment in the ultimate condition

- 3.5.15. DPM propose to develop 28 lots out of total 30 as the stage 1 of the development until the ultimate infrastructure is delivered and the TRB can be decommissioned, leading to the full completion and delivery of the development.
- 3.5.16. Additionally, DN 525 pipe is proposed to be laid with a grade of 1 in 182 to service the attenuated flows from the proposed development to the existing open drain located along Petty Road.
- 3.5.17. Refer Figure 12 for the drainage assets proposed to be delivered within the stage 1 of the development.
- 3.5.18. The following strategy has been driven by the amended layout that has been requested by Council in order to protect the maintain trees with significant values along the western lots as mentioned in 2.2.4.
- 3.5.19. DPM have proposed a drainage pit and a lateral easement at the common boundary of Lots 212 and 214 (as shown in Figure 12) to convey the 1% AEP flow from upstream to the TRB.
- 3.5.20. It should be noted that after the decommission of the TRB in the ultimate post-developed condition, the proposed easement will be extended and eventually will be connected to the proposed bubble up pit before connecting to the drainage scheme 20% AEP pipe as shown in Figure 13.
- 3.5.21. The bubble up pit will leave the gap flow within the Petty Road.

- 3.5.22. It is noted that the size of the TRB can be reduced with the provision of Rainwater tanks and upsizing the underground pipe network.
- 3.5.23. For instance, assuming a 28-dwelling development, each provided with a 2kL Rainwater tank, using a 50% of the tank capacity would reduce the required storage volume of the TRB approximately 345 m³. Additionally, a further reduction of the required capacity of the TRB can be achieved by upsizing the underground pipe network.
- 3.5.24. In relation to the delivery of the ultimate infrastructure servicing the overall Bunyip DSS, DPM understand that the landowners of 735 Railway Avenue and Bunyip Meadow Estate have expressed the possibility to deliver the ultimate drainage infrastructure for the DSS.
- 3.5.25. This would facilitate further developments within the area. DPM and the client welcome any further discussion which may help MW in the delivery of the required infrastructure.
- 3.5.26. As mentioned in Section 3.3.14, and in accordance with MW request the drainage scheme pipe (D1 – D2) will be constructed south to within the gravel section of Petty Road to protect the vegetation in the proposed bushland reserve and the Petty Road reserve.
- 3.5.27. Figure 12 and Figure 13 show the updated location for D1 – D2 drainage scheme pipe.

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4.0 Integrated Water Management

4.1 Introduction

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- 4.1.1 DPM have investigated the possibility to deliver innovative solutions within the proposed development to contribute and align with the objectives of Cardinia Shire City Council's 2018-2028 Integrated Water Management Plan.
- 4.1.2 For a development of this size, identifying opportunities that target for fit-for-purpose water usage, cooler greener microclimates and improved water quality for cleaner and healthy waterways would be well suited. The Developer is open to exploring opportunities that help achieve this with Council.
- 4.1.3 As mentioned within section 1.3.11, as part of the Victoria Planning Provision Clause 56.07, developers are required to achieve the water quality stormwater quality targets of
 - 80% Total Suspended Solids (TSS) load reduction
 - 45% Total Phosphorous (TP) load reduction
 - 45% Total Nitrogen (TN) load reduction
 - 75% Gross Pollutants (AKA Litter) reduction
- 4.1.4 Further discussion with Council and the Melbourne Water will need to be entertained to understand the feasibility of the integrated water management solutions proposed and the advantageous impact on the future drainage scheme assets downstream.

4.2 Stormwater treatment

- 4.2.1. DPM have prepared a MUSIC model of the proposed development to evaluate the treatment train effectiveness of the temporary retarding basin (see Figure 14).



Figure 14 – Music model proposed for the development

4.2.2. As discussed in Section 3.3.7, the post-developed flows generated from (SUB-02) will not drain to the temporary retarding basin.

4.2.3. The provision of the temporary retarding basin achieves the following results:

Table 4 Summary of the MUSIC results

	Proposed Development	BPEMG
TSS reduction [%]	84.9	80%
TP reduction [%]	59.8	45%
TN reduction [%]	21.6	45%

4.2.4. The results outlined in the above Table 4 highlight that the proposed temporary retarding basin is able to offer satisfying treatment train effectiveness, even though the Water Sensitive Urban Design (WSUD) solution does not achieve Best Practice.

4.2.5. The reductions of Total Suspended Solid, Total Phosphorous are above the threshold, while the reduction of Total Nitrogen is below the threshold, according to the reductions required by the Victoria Planning Provision Clause 56.07.

4.2.6. However, as previously stated, in accordance with the Bunyip west DSS, no water quality treatment is expected to be provided for this site.

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- 4.2.7. As discussed, the proposed TRB does not achieve the best practice for total Nitrogen. However, it does achieve the State Environment Protection Policy (SEPP) requirements. The Policy requires the treatment effectiveness results for TSS to not to exceed the 90th percentile of 80 mg/l. Figure 15 shows the MUSIC result for TSS daily concentration.

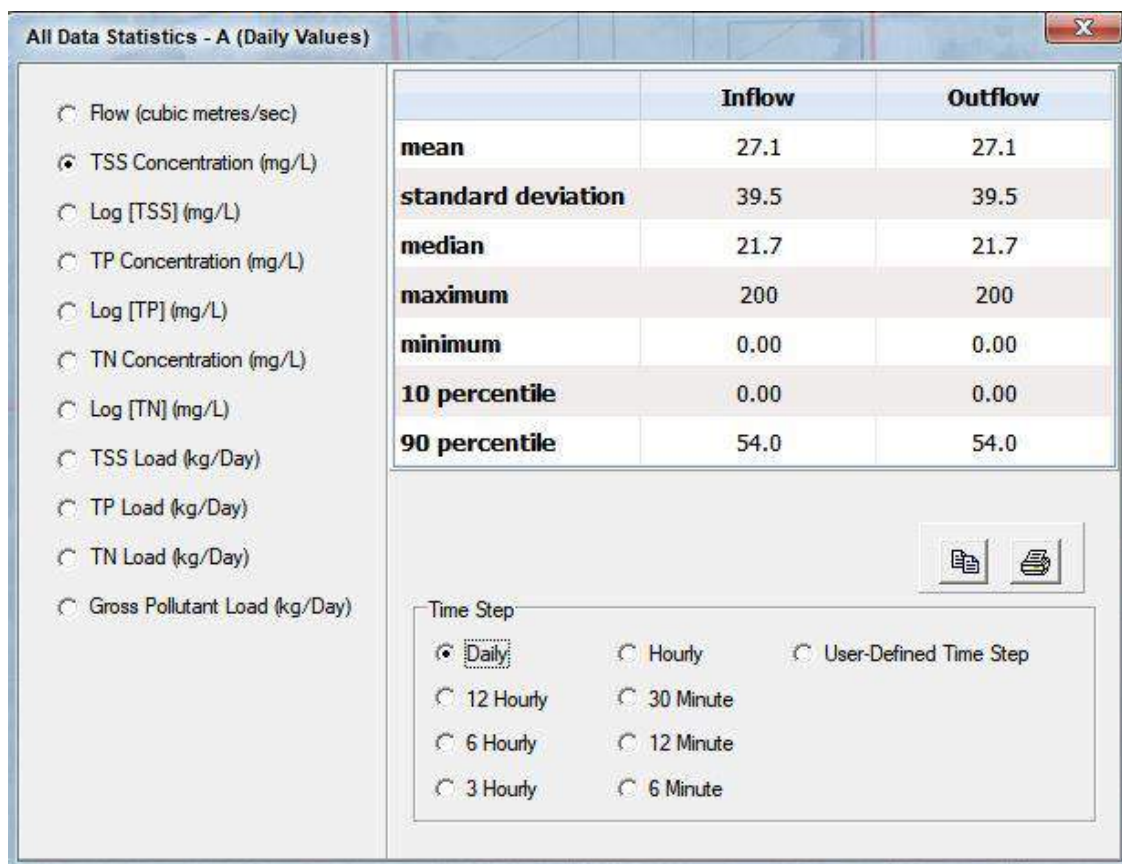


Figure 15: MUSIC result for TSS daily concentration

- 4.2.8. As shown in Figure 15 the 90 percentiles of TSS daily concentration for the TRB is 54 mg/l and does not exceed 80mg/l.

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5.0 Overland Flow Passage

- 5.1.1 As discussed in Section 2.2.4 the proposed internal road layout is based on the discussion with the Council in order to protect the ecosystem of the existing tree reserve located west of the subject site.
- 5.1.2 Figure 16 shows the main overland flow paths within the proposed development.



Figure 16 – Overland flow path of the proposed development

- 5.1.3 As highlighted in Figure 16, the overland flow originated from the proposed development (excluding the 6 Lots located at southeast of the subject site) is conveyed to the temporary retarding storage via a proposed stormwater pit and a lateral easement and for the attenuation of the peak flows to pre-developed conditions.
- 5.1.4 The overland flow generated from the 6 Lots at southeast of the subject site (SUB-02 in Figure 10) will be conveyed to the existing open drain along Petty Road.
- 5.1.5 The final outfall of the proposed development is represented by the open drain to the south of the site.
- 5.1.6 Figure 16 shows the main critical section for which the overland flow capacity verification has been undertaken.
- 5.1.7 Further investigation will need to be undertaken during detail design to confirm the overland flow paths to achieve the Melbourne Water floodway safety criteria.

- 5.1.8 Figure 16 highlights the flow from the catchment contributing to the overland flow at Section A.
- 5.1.9 As shown in Appendix F – Overland Flow, the Melbourne Water's Floodway Safety Criteria are met.


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6.0 Conclusion

- 6.1.1 DPM Consulting Group have completed a Stormwater Management Strategy for the proposed development at 8 Wattletree Road, Bunyip, and have confirmed via assessment of the site's topography and subdivisional layout that the proposed development can achieve the key objectives required by the Cardinia Shire Council and Melbourne Water.
- 6.1.2 The report has identified the Legal Point of Discharge to be the drainage scheme pipe as per DSS.
- 6.1.3 Attenuation of the post-developed peak flows ($0.615\text{m}^3/\text{s}$ - which maximises the size of the required storage) to pre-developed conditions is proposed to be achieved by delivering a Temporary Retarding Basin (TRB) with a capacity of 419m^3 .
- 6.1.4 Stormwater Quality modelling using MUSIC has demonstrated that the temporary retarding basin partially meets the BPIMG of Victoria Planning Provision Clause 56.07. No water quality treatment is expected within the proposed development in consideration of the delivery of the future drainage scheme asset WL/RB1, in accordance with the Bunyip west DSS.
- 6.1.5 It is proposed that the developer will construct the following drainage scheme pipes which are within the subject site:
- C3 – A7
 - A6 – A7
 - A7 – A8
 - D1 – D2
 - D2 – A8
- 6.1.6 In accordance with MW request, the D1– D2 drainage scheme pipe will be constructed along the gravel section of Petty Road to avoid impacting the protected vegetation within the reserves.
- 6.1.7 Critical locations for overland flow passage have been identified and it has been confirmed via hydraulic computations that Melbourne Water's floodway safety criteria are achieved.
- 6.1.8 The Development proponent aims to achieve the objectives with respect to the Stormwater and constructed Waterways (Objectives 1) of Cardinia Shire City Council's IWMP.

All further enquiries can be made directly to:-



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Bibliography

Babister, M., Trim, A., Testoni, I. & Retallick, M. 2016. The Australian Rainfall & Runoff Datahub, 37th Hydrology and Water Resources Symposium Queenstown NZ

Cardinia Shire City Council, Integrated Water Management Plan - 2014

The State of Victoria Department of Environment, Land, Water and Planning 2017 Integrated Water Management Framework for Victoria

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Appendix A - Existing Site Survey

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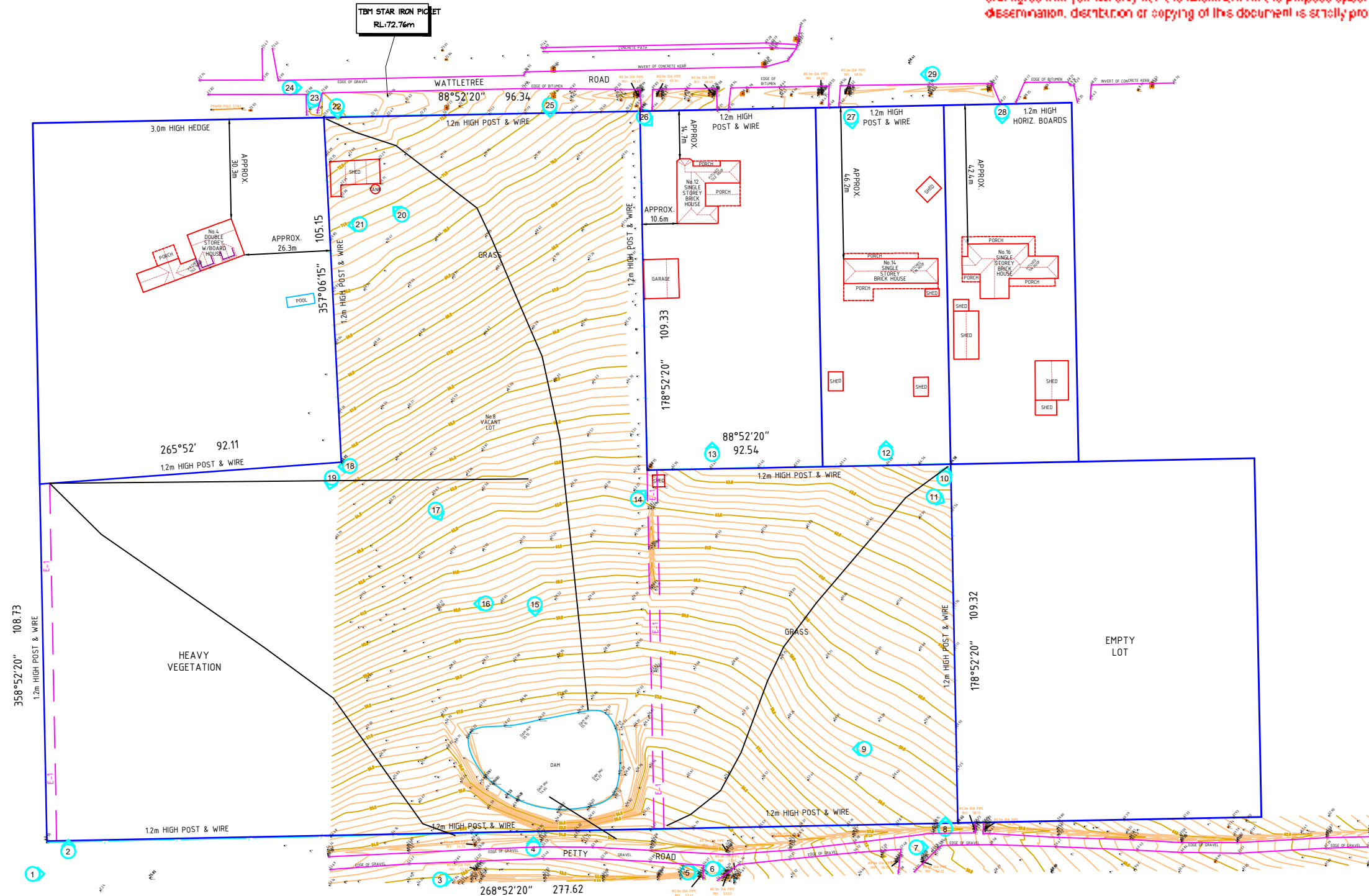
SCALE 1:1500 (A3)

- DENOTES FIRST FLOOR
BUILDING LINE

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LEGEND

-  - GRATE
-  - VALVE
-  - PIT
-  - TELSTRA PIT
-  - POWER POLE
-  - SIGN
-  - HYDRANT
-  - DRAINAGE PIT
-  - ELEC. PIT
-  - PHOTO POSITION
& DIRECTION



MG494
ZONE 55

NOTE:

- THIS PLAN IS TO BE READ IN CONJUNCTION WITH THE 'RECORD OF HAVING RE-ESTABLISHED A PARCEL'. INFORMATION REGARDING TITLE BOUNDARIES AND/OR EASEMENTS SHOULD BE TAKEN FROM RE-ESTABLISHMENT PLAN.

THIS IS A CADASTRAL PLAN PREPARED UNDER THE
SUPERVISION OF A LICENSED SURVEYOR.

NOTE:

- LEVELS SHOWN ON THIS PLAN ARE TO A.H.D BASED ON DROUIN WEST PM 5 (R.L. 47.232)
- TITLE & BUILDING POSITIONS OFF SUBJECT SITE ARE DISPLAYED FOR INDICATION PURPOSES, USE QUOTED SETBACKS ONLY
- E1 - DENOTES 3m WIDE DRAINAGE EASEMENT

DRAWN BY : DUSTIN NGUYEN

CHECKED : T.F

DATE OF SURVEY : 12/12/2022

SURV. REF. NO. 20857

NOBELIUS LAND SURVEYORS

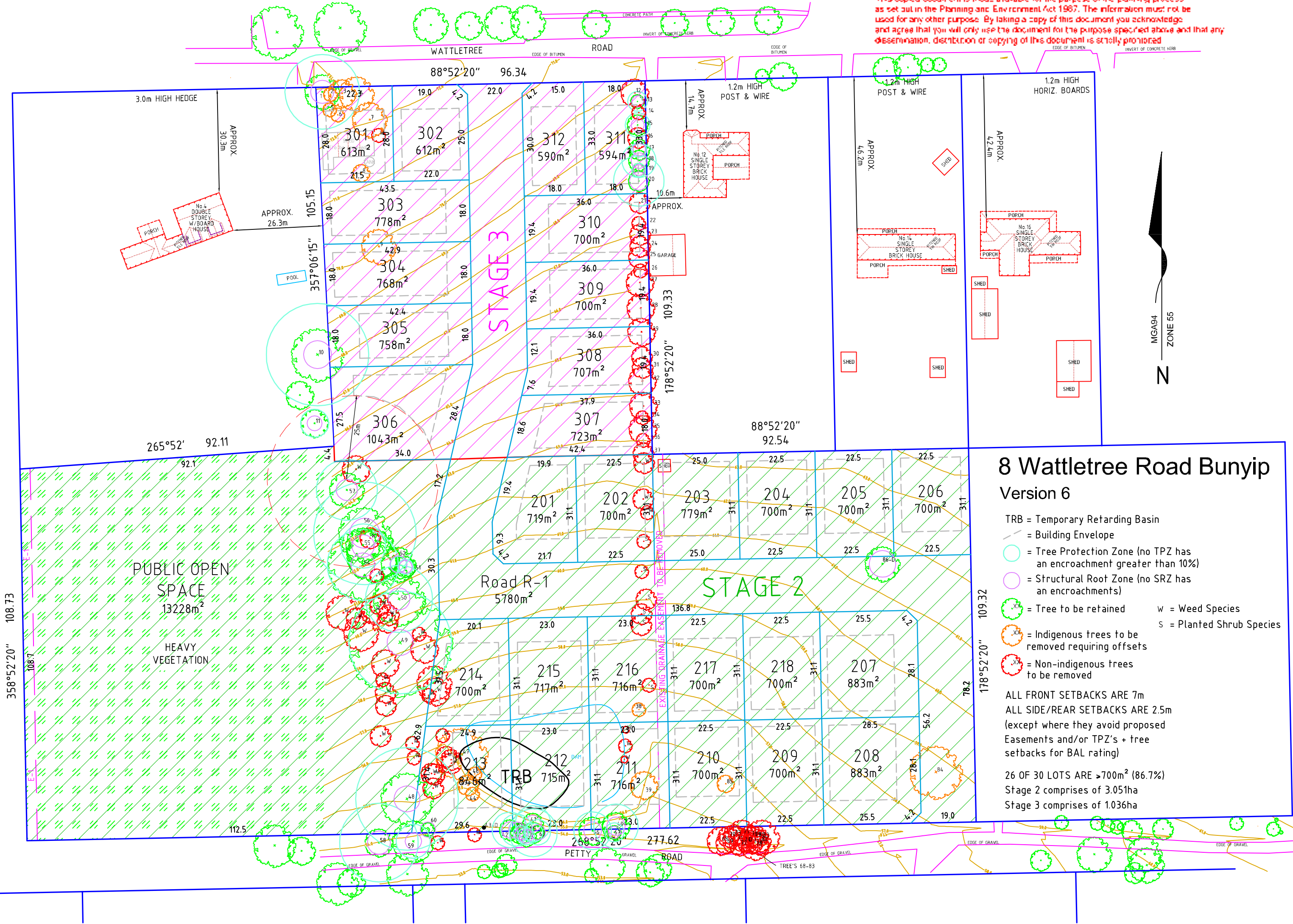
P.O. BOX 461
PAKENHAM 3810
Ph 03 5941 4112
Fax 03 5941 7359
mail@nobelius.com.au

A3

Appendix B – Development Concept Layout Plan

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8 Wattletree Road Bunyip Version 6

- TRB = Temporary Retarding Basin
- = Building Envelope
- = Tree Protection Zone (no TPZ has an encroachment greater than 10%)
- = Structural Root Zone (no SRZ has an encroachments)
- = Tree to be retained
- = Indigenous trees to be removed requiring offsets
- = Non-indigenous trees to be removed
- w = Weed Species
- s = Planted Shrub Species

ALL FRONT SETBACKS ARE 7m
ALL SIDE/REAR SETBACKS ARE 2.5m
(except where they avoid proposed Easements and/or TPZ's + tree setbacks for BAL rating)

26 OF 30 LOTS ARE >700m² (86.7%)
Stage 2 comprises of 3.051ha
Stage 3 comprises of 1.036ha

Appendix C – Pre-development Advice from Melbourne Water

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Proposal: Pre-development advice

Site location: Lot No 2, 8 WATTLETREE ROAD BUNYIP 3815

Melbourne Water reference: MWA-1284532

Date referred: 10/03/2023

Development Services Scheme: Bunyip West DS, Cardinia Shire (Western Port Catchment), Cardinia Shire (Western Port Catchment), Cardinia Shire (Western Port Catchment)

Thank you for your application requesting pre-development information for the above mentioned property. The following development advice is applicable to the property :

Drainage Agreement

Prior to the issue of a Statement of Compliance, the Owner must enter into and comply with an agreement with Melbourne Water Corporation, under the Water Act 1989, for the provision of drainage works and the acceptance of surface and storm water from the subject land directly or indirectly into Melbourne Water's drainage system. The agreement may include the following components.

Drainage Contributions

A drainage agreement usually includes the payment of drainage contributions, where a property is being developed. These contributions are used to recover the cost of constructing drainage works such as:

- Main drains, retarding basins, waterway improvements and flood mitigation works that will mitigate hydraulic impacts of the development/subdivision.
- Wetlands and Water Sensitive Urban Design WSUD elements to mitigate stormwater quality risks to Melbourne Water's drainage system.

The contributions are based on the increased load to the drainage system created by the development.

The site in question is located within Melbourne Water's Bunyip West DS, Cardinia Shire (Western Port Catchment), Cardinia Shire (Western Port Catchment), Cardinia Shire (Western Port Catchment) Development Services Scheme.

Melbourne Water advises that the current residential contribution rates are:

- 140,283/Ha, comprising of a hydraulic charge of 121,407 /Ha and a stormwater quality charge of 18,876 /Ha

The stormwater quality charge can be reduced or removed by providing on-site treatment works, in-line with Melbourne Water's 'Stormwater Quality Offset Policy'. Please see the 'Stormwater Quality' section below.

It should be noted that contribution rates are subject to periodical review and hence the future contribution rate may be higher than the current rate provided here. For registered users, two months' notice of any change in rates is provided via email and on the Planning and Building page on Melbourne Water's website. Contributions payable will be calculated upon receipt of an application for ['Drainage conditions for a site'](#) along with a council referred/certified plan of subdivision.

Stormwater Quality SWQ

The Urban Stormwater Best Practice Environmental Management Guidelines require that runoff from all new developments (including redevelopments) are treated to comply with the following targets:

- 80% Total Suspended Solids reduction
- 45% Total Phosphorus reduction
- 45% Total Nitrogen reduction

Stormwater quality performance (targets) is assessed by using specialist software. Usually the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) is used for developments within schemes. Please refer to the end of this document for links to Melbourne Water's guidelines for the use of MUSIC.

Non-compliance with best practice objectives for stormwater quality will require the payment of a stormwater quality offset. Contributions collected for stormwater quality, can be applied for as a grant from Melbourne Water by council's to construct stormwater quality works elsewhere in the catchment.

Drainage Scheme Works

A drainage agreement usually requires the construction of permanent works in conjunction with the development as outlined by the appropriate Development Services Scheme. A review of the Bunyip West DS, Cardinia Shire (Western Port Catchment), Cardinia Shire (Western Port Catchment), Cardinia Shire (Western Port Catchment) Development Services Scheme has identified that there are permanent Melbourne Water works to be constructed on this property.

Such works may require that several land surveys be undertaken to determine the most efficient and environmentally friendly design outcomes. These may include, but are not limited to, a Flora & Fauna Assessment and an Archaeological Investigation, which would guide the most appropriate design. Design approval from Melbourne Water and any other relevant authorities will be required prior to commencement of the drainage works.

Please refer to the attached plans for a layout of the proposed works and any overland flow paths, which must be catered for by the development. The following table details the expected drainage works and design criteria for their sizing.



Node Ref.	Length(m)	Comments/Ownership
A4 - A5	19	5% AEP pipe - 525mm Council pipe
A5 - A6	37	5% AEP pipe - 525mm Council pipe
A6 - A7	110	5% AEP pipe - 525mm Council pipe
A7 - A8	55	5% AEP pipe - 600mm Council pipe
A8 - A9	16	5% AEP pipe - 600mm Council pipe
A10 - A10A	163	5% AEP Pipe - 600mm Council pipe
F17A-A14	225	1% AEP Channel - Council pipe
A14 - A15A	110	1% AEP Channel - Melbourne Water
A15A - A16		1% AEP - Culvert Melbourne Water
A16 - A17A	50	1% AEP - Channel Melbourne Water
A17A - A18	157	1% AEP Channel Melbourne Water
WL1		Wetland - Melbourne Water
RB1		Retarding Basin - Melbourne Water

Please be advised that this information may be refined and/or modified upon any application for a works or Non-works offer.

Specific Property Advice

- To achieve appropriate outfall for this development, temporary works will/may be required as part of the drainage agreement. If the development proceeds out of sequence then the developer must fund the costs of these temporary works.
- The developer must negotiate any temporary works with downstream landowner(s) to obtain a free draining outfall solution through their property/ies. Approval must be granted and forwarded to Melbourne Water before construction of the drainage works commences.

Overland Flow Paths

Melbourne Water expects that upon any application for certification of any subdivision plan associated with the property, due consideration must be given to the alignment of roads and reserves with any adjoining estates, to ensure continuity and provide uninterrupted conveyance of overland flows. These overland flow paths must be designed in accordance with the safety criteria outlined in the Standards and Specifications section on the Planning and Building of Melbourne Water's website.

Before starting any works, a separate application, direct to Melbourne Water, must be made for any new or modified storm water connection to Melbourne Water's drains or watercourses. Before accepting an application, evidence must be provided demonstrating that council has considered that it is not feasible to connect to the local drainage system.

Water Sensitive Urban Design WSUD

WSUD is a design process that enables localised collection and treatment of stormwater runoff. Melbourne Water acknowledges the potential for WSUD to be incorporated into the development to enable sustainable management of stormwater across the property and to compliment the social and environmental values of the area.

Melbourne Water recommends that initiatives such as sediment ponds, bio-filtration systems, grassed swales, grey water re-use, rainwater tanks and porous soils be considered in the design of the development. Stormwater runoff from paved areas can also be a valuable resource for irrigating trees, grassed areas and landscaped garden beds.

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Offer Application

Prior to any application for an offer of drainage conditions, Melbourne Water requests that you forward a drainage strategy demonstrating that the proposed drainage plan for the property coincides with the intent of Melbourne Water's Bunyip West DS, Cardinia Shire (Western Port Catchment), Cardinia Shire (Western Port Catchment), Cardinia Shire (Western Port Catchment) Development Services Scheme and the local Precinct Structure Plan, if relevant.

The following information should be included within the strategy:

- General site information
- Options for the proposed drainage of the property
- Consideration for Water Sensitive Urban Design

Advice Links

For further information on Melbourne Water's role in planning please refer to the following links:

- **Contribution Rates:** <https://www.melbournewater.com.au/planning-and-building/developer-guides-and-resources/drainage-schemes-and-contribution-rates-0-2>
- **Drainage Schemes:** <https://www.melbournewater.com.au/planning-and-building/developer-guides-and-resources/drainage-schemes-and-contribution-rates>
- **Water Sensitive Urban Design-** <https://www.melbournewater.com.au/planning-and-building/stormwater-management/introduction-wsud>
- **Reducing Water Quality Contributions/Stormwater Offset Rate review -** <https://www.melbournewater.com.au/planning-and-building/developer-guides-and-resources/drainage-schemes-and-contribution-rates-0-3>
- **Overland Flow Paths** (These overland flow paths will need to be designed in accordance with the safety criteria outlined in the Standards and Specifications section of Melbourne Water's Planning and Building website found on <https://www.melbournewater.com.au/planning-and-building/developer-guides-and-resources/standards-and-specifications>)
- **Working near or Connection to MW assets-** <https://www.melbournewater.com.au/planning-and-building/work-or-build-near-our-assets-or-easements>
- **Stormwater Quality:** The Urban Stormwater Best Practice Environmental Management Guidelines require that runoff from all new developments (including redevelopments) be treated to comply with the following, 'Best Practice' standards criteria: Removal of 80% of the suspended solid annual load, 45% of total phosphorus and 45% of total nitrogen annual loads. <http://www.publish.csiro.au/book/2190>

Disclaimers

The feasibility information provided in this email is conceptual/indicative only and must be used in conjunction with an informed catchment analysis when undertaking the detailed design.

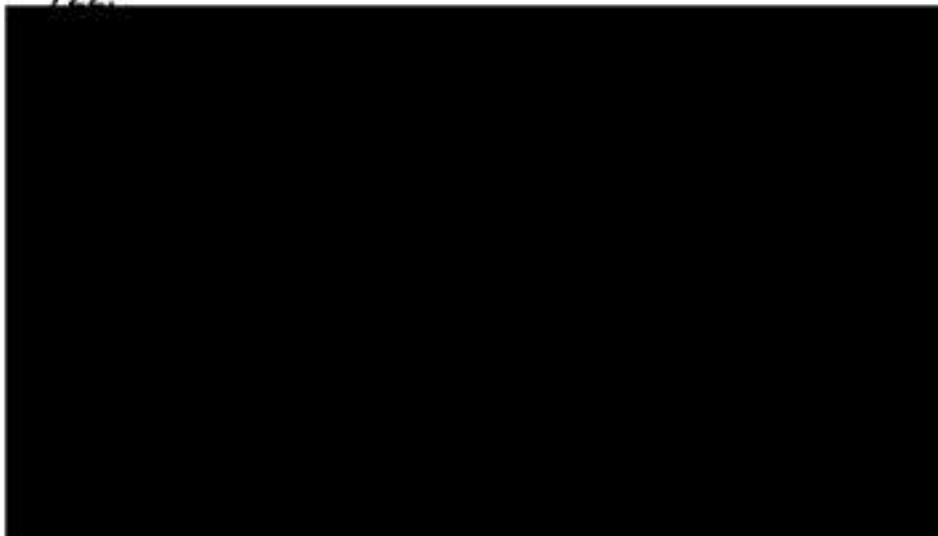
Under the QA process the consultant is required to perform their own informed catchment analysis and calculations for the design of scheme assets which reflects the actual development and on ground conditions. As a part of the functional

design process your calculations, assumptions, models and catchment analysis are to be submitted for our acceptance/records.

Please note that as schemes develop and Melbourne Water receives additional information, the conceptual/indicative advice you have been provided as part of the feasibility request may now be outdated. Under the QA process it is the responsibility of the consultant to certify that all information provided to Melbourne Water is correct having completed their own detailed catchment analysis.

This information is preliminary and forms no contractual agreement between your company and Melbourne Water. Melbourne Water reserves the right to alter any or all of the information provide in this letter.

For general development enquiries contact our Customer Service Centre on 131 722.



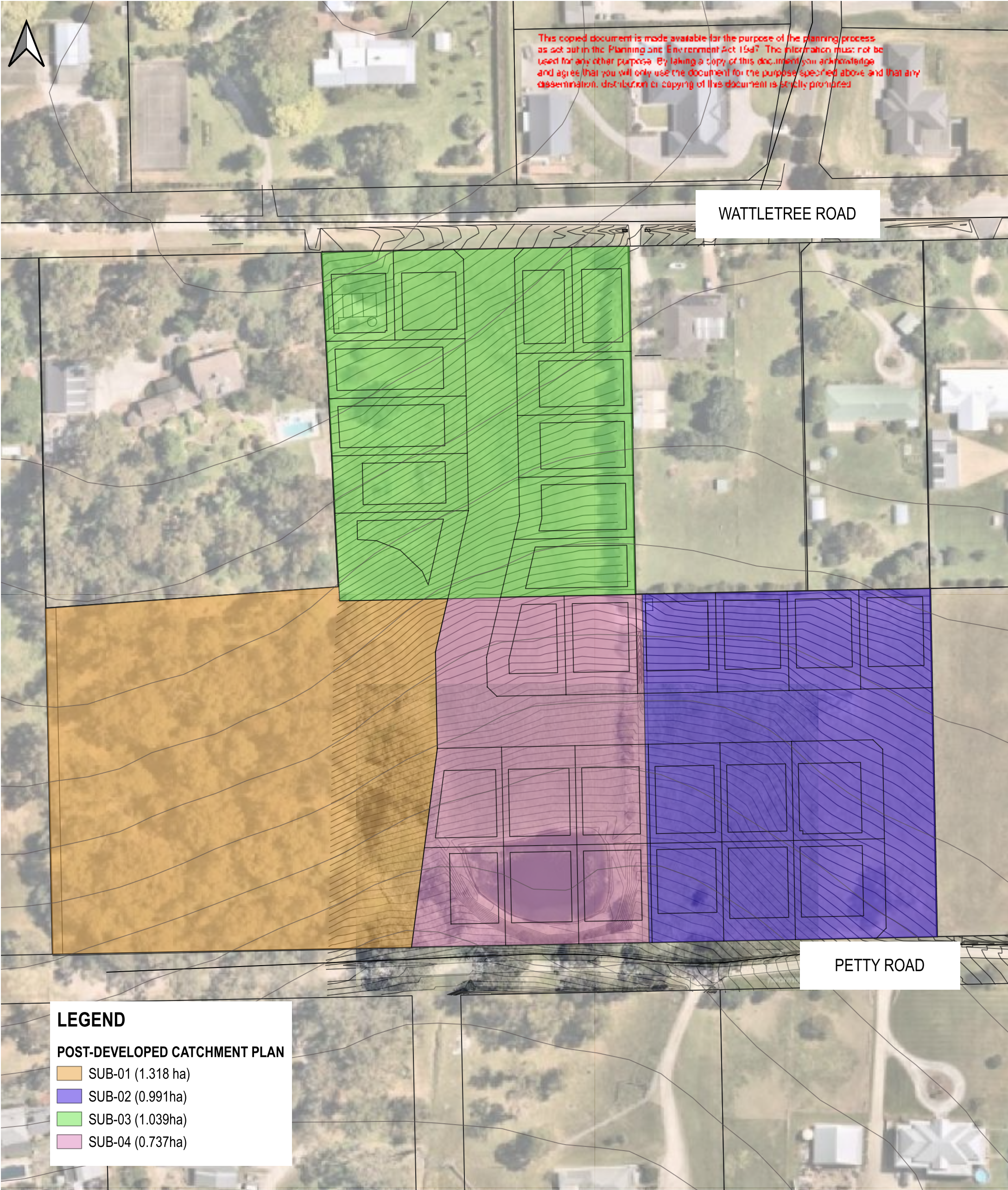
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Appendix D – Catchment Plans

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8 WATTLETREEROAD, BUNYIP



8 WATTLETREEROAD, BUNYIP

0 50 100 m

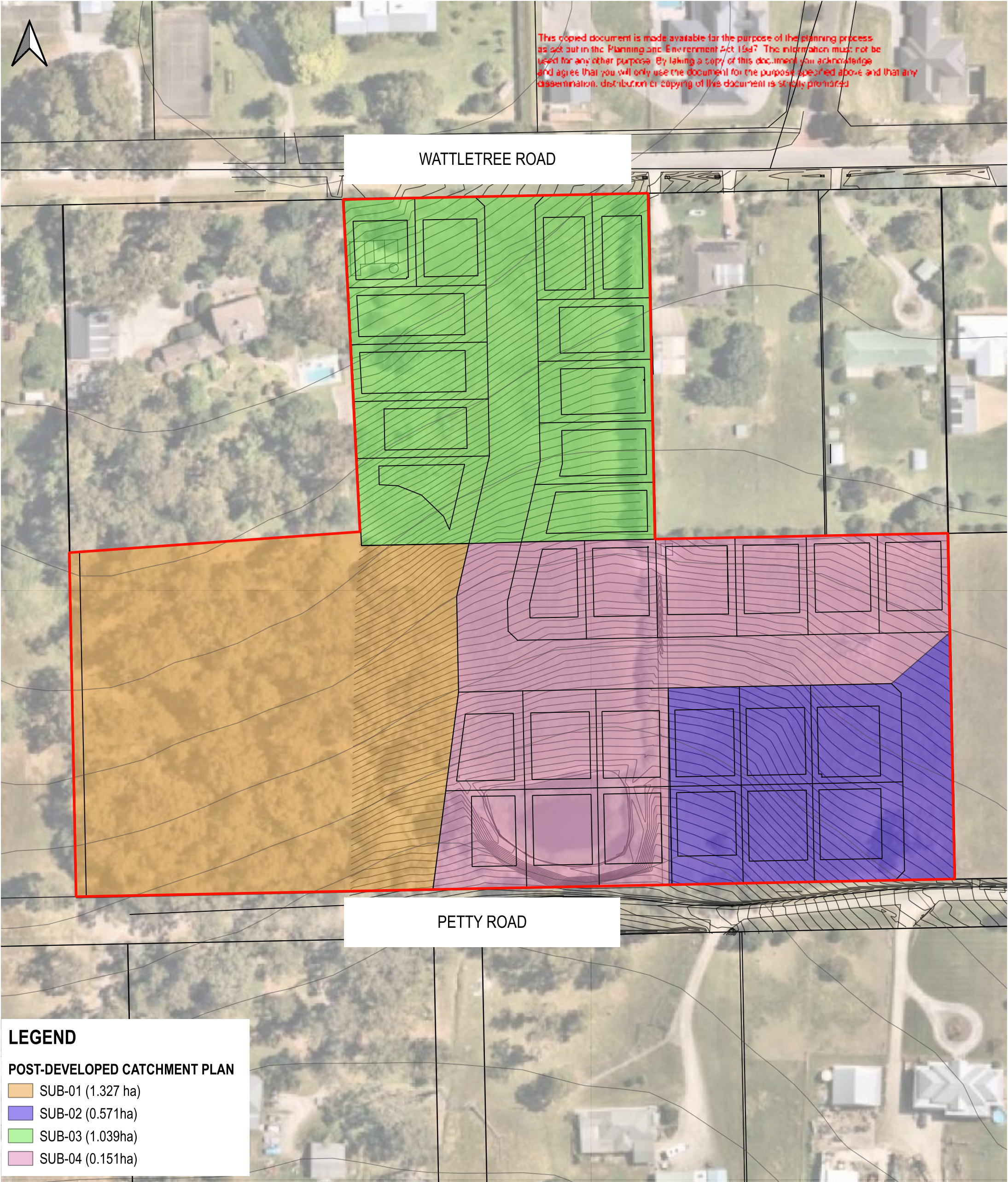
Post-Developed Catchment Plan


Job Number: 3193/M/C
Revision: P1
Designed: SK
Checked: DM
Project Manager: DM
Date: 16.07.2024

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: GDA2020, MGA 55



8 WATTLETREE ROAD, BUNYIP - ULTIMATE DRAINAGE STRATEGY



8 WATTLETREE ROAD, BUNYIP		<div>050100 m</div> <div><div></div></div>
Post-developed Catchment Plan	Job Number: 3193/M/C Revision: P3 Designed: SK Checked: DM Project Manager: DM Date: 09.08.2024	<div>Map Projection: Transverse Mercator Horizontal Datum: Geocentric Datum of Australia Vertical Datum: Australia Height Datum Grid: GDA2020, MGA 55</div> <div></div>



Appendix E – Drainage Computation

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v [m/s] 1 pipe
 i_{10} [mm/hr] 27.1 2.5
 C_{10} 0.12793

8 WATTLETREE ROAD, BUNYIP - PRE-DEVELOPED CATCHMENT - FLOW CALCULATIONS

Catchment	Area [ha]	L [m]	H _{UP-STREAM} [m]	H _{DOWN-STREAM} [m]	S [m/km]	S [%]	Flow-length	Pilgrim & McDermott	Bransby Williams	Average	Pipe	Φ	C_s	C_{100}	i_s [mm/hr]	i_{100} [mm/hr]	Q_{100} [m³/s]	Q_2 [m³/s]	Q_{200} [m³/s]
							Tc [min]	Tc [min]	Tc [min]	Tc [min]	Tc [min]								
SUB-01	1.317	166.14	68.0	54.0	84.27	8.43%	9.77	6.06	8.80	8.21	8.11	0.1	0.195	0.246	70.5	133.0	0.120	0.050	0.070
SUB-02	1.031	142.22	66.6	54.6	84.24	8.42%	9.37	5.45	8.02	7.61	7.95	0.1	0.195	0.246	70.5	133.0	0.094	0.039	0.054
SUB-03	1.746	211.91	73.0	56.3	78.90	7.89%	10.53	7.45	9.79	9.26	8.41	0.1	0.195	0.246	70.5	127.0	0.1517	0.0667	0.0851
OVERALL CATCHMENT	4.09	211.90	73.0	56.3	78.91	7.89%	10.53	6.28	13.54	12.04	8.41	0.1	0.195	0.246	70.5	111.0	0.311	0.156	0.155

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IFS Design Rainfall Depth (mm)

Annual Exceedance Probability (AEP)

Storm	10%	5%	2%	1%	0.5%	0.2%	0.1%
10 min	1.41	1.89	2.51	3.10	3.77	4.50	5.27
15 min	1.91	2.61	3.51	4.29	5.10	5.99	6.91
20 min	2.31	3.19	4.21	5.09	5.99	6.91	7.91
30 min	2.81	3.89	5.01	5.99	6.91	7.91	8.91
45 min	3.41	4.69	5.91	6.91	7.91	8.91	9.91
60 min	4.01	5.39	6.71	7.71	8.71	9.71	10.71
90 min	4.71	6.19	7.51	8.51	9.51	10.51	11.51
120 min	5.41	6.99	8.31	9.31	10.31	11.31	12.31
150 min	6.11	7.69	9.01	10.01	11.01	12.01	13.01
180 min	6.81	8.39	9.71	10.71	11.71	12.71	13.71
210 min	7.51	9.09	10.41	11.41	12.41	13.41	14.41
240 min	8.21	9.79	11.11	12.11	13.11	14.11	15.11
270 min	8.91	10.49	11.81	12.81	13.81	14.81	15.81
300 min	9.61	11.19	12.51	13.51	14.51	15.51	16.51
330 min	10.31	11.89	13.21	14.21	15.21	16.21	17.21
360 min	11.01	12.59	13.91	14.91	15.91	16.91	17.91
390 min	11.71	13.29	14.61	15.61	16.61	17.61	18.61
420 min	12.41	13.99	15.31	16.31	17.31	18.31	19.31
450 min	13.11	14.69	16.01	17.01	18.01	19.01	20.01
480 min	13.81	15.39	16.71	17.71	18.71	19.71	20.71
510 min	14.51	16.09	17.41	18.41	19.41	20.41	21.41
540 min	15.21	16.79	18.11	19.11	20.11	21.11	22.11
570 min	15.91	17.49	18.81	19.81	20.81	21.81	22.81
600 min	16.61	18.19	19.51	20.51	21.51	22.51	23.51
630 min	17.31	18.89	20.21	21.21	22.21	23.21	24.21
660 min	18.01	19.59	20.91	21.91	22.91	24.21	25.21
690 min	18.71	20.29	21.61	22.61	23.61	25.21	26.21
720 min	19.41	20.99	22.31	23.31	24.31	26.21	27.21
750 min	20.11	21.69	23.01	24.01	25.01	27.21	28.21
780 min	20.81	22.39	23.71	24.71	25.71	28.21	29.21
810 min	21.51	23.09	24.41	25.41	26.41	29.21	30.21
840 min	22.21	23.79	25.11	26.11	27.11	30.21	31.21
870 min	22.91	24.49	25.81	26.81	27.81	31.21	32.21
900 min	23.61	25.19	26.51	27.51	28.51	32.21	33.21
930 min	24.31	25.89	27.21	28.21	29.21	33.21	34.21
960 min	25.01	26.59	27.91	28.91	30.21	34.21	35.21
990 min	25.71	27.29	28.61	29.61	31.21	35.21	36.21
1020 min	26.41	27.99	29.31	30.31	32.21	36.21	37.21
1050 min	27.11	28.69	30.01	31.01	33.21	37.21	38.21
1080 min	27.81	29.39	30.71	31.71	34.21	38.21	39.21
1110 min	28.51	30.09	31.41	32.41	35.21	39.21	40.21
1140 min	29.21	30.79	32.11	33.11	36.21	40.21	41.21
1170 min	29.91	31.49	32.81	33.81	37.21	41.21	42.21
1200 min	30.61	32.19	33.51	34.51	38.21	42.21	43.21

3D Design Rainfall Intensity (mm/hr)

Annual Exceedance Probability (AEP)

Storm	10%	5%	2%	1%	0.5%	0.2%	0.1%
10 min	1.41	1.89	2.51	3.10	3.77	4.50	5.27
15 min	1.91	2.61	3.51	4.29	5.10	5.99	6.91
20 min	2.31	3.19	4.21	5.09	5.99	6.91	7.91
30 min	2.81	3.89	5.01	5.99	6.91	7.91	8.91
45 min	3.41	4.69	5.91	6.91	7.91	8.91	9.91
60 min	4.01	5.39	6.71	7.71	8.71	9.71	10.71
90 min	4.71	6.19	7.51	8.51	9.51	10.51	11.51
120 min	5.41	6.99	8.31	9.31	10.31	11.31	12.31
150 min	6.11	7.69	9.01	10.01	11.01	12.01	13.01
180 min	6.81	8.39	9.71	10.71	11.71	12.71	13.71
210 min	7.51	9.09	10.41	11.41	12.41	13.41	14.41
240 min	8.21	9.79	11.11	12.11	13.11	14.11	15.11
270 min	8.91	10.49	11.81	12.81	13.81	14.81	15.81
300 min	9.61	11.19	12.51	13.51	14.51	15.51	16.51
330 min	10.31	11.89	13.21	14.21	15.21	16.21	17.21
360 min	11.01	12.59	13.91	14.91	15.91	16.91	17.91
390 min	11.71	13.29	14.61	15.61	16.61	17.61	18.61
420 min	12.41	13.99	15.31	16.31	17.31	18.31	19.31
450 min	13.11	14.69	16.01	17.01	18.01	19.01	20.01
480 min	13.81	15.39	16.71	17.71	18.71	19.71	20.71
510 min	14.51	16.09	17.41	18.41	19.41	20.41	21.41
540 min	15.21	16.79	18.11	19.11	20.11	21.11	22.11
570 min	15.91	17.49	18.81	19.81	20.81	21.81	22.81
600 min	16.61	18.19	19.51	20.51	21.51	22.51	23.51
630 min	17.31	18.89	20.21	21.21	22.21	23.21	24.21
660 min	18.01	19.59	20.91	21.91	22.91	24.21	25.21
690 min	18.71	20.29	21.61	22.61	23.61	25.21	26.21
720 min	19.41	20.99	22.31	23.31	24.31	26.21	27.21
750 min	20.11	21.69	23.01	24.01	25.01	27.21	28.21
780 min	20.81	22.39	23.71	24.71	25.71	28.21	29.21
810 min	21.51	23.09	24.41	25.41	26.41	29.21	30.21
840 min	22.21	23.79	25.11	26.11	27.11	30.21	31.21
870 min	22.91	24.49	25.81	26.81	27.81	31.21	32.21
900 min	23.61	25.19	26.51	27.51	28.51	32.21	33.21
930 min	24.31	25.89	27.21	28.21	29.21	33.21	34.21
960 min	25.01	26.59	27.91	28.91	30.21	34.21	35.21
990 min	25.71	27.29	28.61	29.61	31.21	35.21	36.21
1020 min	26.41	27.99	29.31	30.31	32.21	36.21	37.21
1050 min	27.11	28.69	30.01	31.01	33.21	37.21	38.21
1080 min	27.81	29.39	30.71	31.71	34.21	38.21	39.21
1110 min	28.51	30.09	31.41	32.41	35.21	39.21	40.21
1140 min	29.21	30.79	32.11	33.11	36.21	40.21	41.21
1170 min	29.91	31.49	32.81	33.81	37.21	41.21	42.21
1200 min	30.61	32.19	33.51	34.51	38.21	42.21	43.21



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v [m/s] 1.5
 i_{10} [mm/hr] 27.1
 C_{10} 0.12793

pipe
 2.5

8 WATTLETREE ROAD, BUNYIP - POST-DEVELOPED CATCHMENT - FLOW CALCULATIONS

Catchment	Area [ha]	L [m]	$H_{UPSTREAM}$ [m]	$H_{DOWNSTREAM}$ [m]	S [m/km]	S [%]	Flow-length	Pilgrim & McDermott	Bransby Williams	Average	Pipe	Φ	C_c	C_{100}	i_c [mm/hr]	i_{100} [mm/hr]	Q_{100} [m³/s]	Q_c [m³/s]	$Q_{0.05}$ [m³/s]
							Tc [min]	Tc [min]	Tc [min]	Tc [min]	Tc [min]								
SUB-01	1.287	156.59	68.4	54.00	91.96	9.20%	8.74		8.72	8.73	8.04	0.1	0.195	0.246	70.5	127	0.112	0.049	0.063
SUB-02	0.990	163.77	62.4	54.6	47.63	4.76%	8.82		7.89	8.36	8.09	0.6	0.562	0.709	70.5	133	0.260	0.109	0.151
SUB-03	1.039	116.79	72	63	77.06	7.71%	8.30		8.04	8.17	7.78	0.6	0.562	0.709	70.5	133	0.273	0.114	0.158
SUB-04	0.778	116.30	63.00	54.00	77.39	7.74%	8.29		7.20	7.75	7.78	0.6	0.562	0.709	70.5	133	0.204	0.086	0.118
OVERALL CATCHMENT	4.09	228.46	72.00	54.00	78.79	7.88%	9.54		13.54	11.54	8.52	0.52	0.503	0.635	70.5	116	0.839	0.404	0.435
A5-A6 Catchment	6.0	600.00	70.00	62.71	12.15	1.22%	13.67		15.66	14.66	11.00	0.75	0.672	0.848	66.8	127	1.797	0.748	1.049

1.044105



IFD Design Rainfall Depth (mm)

Annual Exceedance Probability (AEP)

Return Period	10%	5%	2%	1%	0.5%	0.2%	0.1%
1 Year	1.81	2.81	3.81	4.81	5.81	6.81	7.81
2 Years	2.81	3.81	4.81	5.81	6.81	7.81	8.81
5 Years	3.81	4.81	5.81	6.81	7.81	8.81	9.81
10 Years	4.81	5.81	6.81	7.81	8.81	9.81	10.81
20 Years	5.81	6.81	7.81	8.81	9.81	10.81	11.81
50 Years	7.81	8.81	9.81	10.81	11.81	12.81	13.81
100 Years	8.81	9.81	10.81	11.81	12.81	13.81	14.81
200 Years	9.81	10.81	11.81	12.81	13.81	14.81	15.81
500 Years	11.81	12.81	13.81	14.81	15.81	16.81	17.81
1000 Years	12.81	13.81	14.81	15.81	16.81	17.81	18.81
2000 Years	13.81	14.81	15.81	16.81	17.81	18.81	19.81
5000 Years	14.81	15.81	16.81	17.81	18.81	19.81	20.81
10000 Years	15.81	16.81	17.81	18.81	19.81	20.81	21.81
20000 Years	16.81	17.81	18.81	19.81	20.81	21.81	22.81
50000 Years	17.81	18.81	19.81	20.81	21.81	22.81	23.81
100000 Years	18.81	19.81	20.81	21.81	22.81	23.81	24.81
200000 Years	19.81	20.81	21.81	22.81	23.81	24.81	25.81
500000 Years	20.81	21.81	22.81	23.81	24.81	25.81	26.81
1000000 Years	21.81	22.81	23.81	24.81	25.81	26.81	27.81
2000000 Years	22.81	23.81	24.81	25.81	26.81	27.81	28.81
5000000 Years	23.81	24.81	25.81	26.81	27.81	28.81	29.81
10000000 Years	24.81	25.81	26.81	27.81	28.81	29.81	30.81
20000000 Years	25.81	26.81	27.81	28.81	29.81	30.81	31.81
50000000 Years	26.81	27.81	28.81	29.81	30.81	31.81	32.81
100000000 Years	27.81	28.81	29.81	30.81	31.81	32.81	33.81
200000000 Years	28.81	29.81	30.81	31.81	32.81	33.81	34.81
500000000 Years	29.81	30.81	31.81	32.81	33.81	34.81	35.81
1000000000 Years	30.81	31.81	32.81	33.81	34.81	35.81	36.81
2000000000 Years	31.81	32.81	33.81	34.81	35.81	36.81	37.81
5000000000 Years	32.81	33.81	34.81	35.81	36.81	37.81	38.81
10000000000 Years	33.81	34.81	35.81	36.81	37.81	38.81	39.81
20000000000 Years	34.81	35.81	36.81	37.81	38.81	39.81	40.81
50000000000 Years	35.81	36.81	37.81	38.81	39.81	40.81	41.81
100000000000 Years	36.81	37.81	38.81	39.81	40.81	41.81	42.81
200000000000 Years	37.81	38.81	39.81	40.81	41.81	42.81	43.81
500000000000 Years	38.81	39.81	40.81	41.81	42.81	43.81	44.81
1000000000000 Years	39.81	40.81	41.81	42.81	43.81	44.81	45.81
2000000000000 Years	40.81	41.81	42.81	43.81	44.81	45.81	46.81
5000000000000 Years	41.81	42.81	43.81	44.81	45.81	46.81	47.81
10000000000000 Years	42.81	43.81	44.81	45.81	46.81	47.81	48.81
20000000000000 Years	43.81	44.81	45.81	46.81	47.81	48.81	49.81
50000000000000 Years	44.81	45.81	46.81	47.81	48.81	49.81	50.81
100000000000000 Years	45.81	46.81	47.81	48.81	49.81	50.81	51.81
200000000000000 Years	46.81	47.81	48.81	49.81	50.81	51.81	52.81
500000000000000 Years	47.81	48.81	49.81	50.81	51.81	52.81	53.81
1000000000000000 Years	48.81	49.81	50.81	51.81	52.81	53.81	54.81
2000000000000000 Years	49.81	50.81	51.81	52.81	53.81	54.81	55.81
5000000000000000 Years	50.81	51.81	52.81	53.81	54.81	55.81	56.81
10000000000000000 Years	51.81	52.81	53.81	54.81	55.81	56.81	57.81
20000000000000000 Years	52.81	53.81	54.81	55.81	56.81	57.81	58.81
50000000000000000 Years	53.81	54.81	55.81	56.81	57.81	58.81	59.81
100000000000000000 Years	54.81	55.81	56.81	57.81	58.81	59.81	60.81
200000000000000000 Years	55.81	56.81	57.81	58.81	59.81	60.81	61.81
500000000000000000 Years	56.81	57.81	58.81	59.81	60.81	61.81	62.81
1000000000000000000 Years	57.81	58.81	59.81	60.81	61.81	62.81	63.81
2000000000000000000 Years	58.81	59.81	60.81	61.81	62.81	63.81	64.81
5000000000000000000 Years	59.81	60.81	61.81	62.81	63.81	64.81	65.81
10000000000000000000 Years	60.81	61.81	62.81	63.81	64.81	65.81	66.81
20000000000000000000 Years	61.81	62.81	63.81	64.81	65.81	66.81	67.81
50000000000000000000 Years	62.81	63.81	64.81	65.81	66.81	67.81	68.81
100000000000000000000 Years	63.81	64.81	65.81	66.81	67.81	68.81	69.81
200000000000000000000 Years	64.81	65.81	66.81	67.81	68.81	69.81	70.81
500000000000000000000 Years	65.81	66.81	67.81	68.81	69.81	70.81	71.81
1000000000000000000000 Years	66.81	67.81	68.81	69.81	70.81	71.81	72.81
2000000000000000000000 Years	67.81	68.81	69.81	70.81	71.81	72.81	73.81
5000000000000000000000 Years	68.81	69.81	70.81	71.81	72.81	73.81	74.81
10000000000000000000000 Years	69.81	70.81	71.81	72.81	73.81	74.81	75.81
20000000000000000000000 Years	70.81	71.81	72.81	73.81	74.81	75.81	76.81
50000000000000000000000 Years	71.81	72.81	73.81	74.81	75.81	76.81	77.81
100000000000000000000000 Years	72.81	73.81	74.81	75.81	76.81	77.81	78.81
200000000000000000000000 Years	73.81	74.81	75.81	76.81	77.81	78.81	79.81
500000000000000000000000 Years	74.81	75.81	76.81	77.81	78.81	79.81	80.81
1000000000000000000000000 Years	75.81	76.81	77.81	78.81	79.81	80.81	81.81
2000000000000000000000000 Years	76.81	77.81	78.81	79.81	80.81	81.81	82.81
5000000000000000000000000 Years	77.81	78.81	79.81	80.81	81.81	82.81	83.81
10000000000000000000000000 Years	78.81	79.81	80.81	81.81	82.81	83.81	84.81
20000000000000000000000000 Years	79.81	80.81	81.81	82.81	83.81	84.81	85.81
50000000000000000000000000 Years	80.81	81.81	82.81	83.81	84.81	85.81	86.81
100000000000000000000000000 Years	81.81	82.81	83.81	84.81	85.81	86.81	87.81
200000000000000000000000000 Years	82.81	83.81	84.81	85.81	86.81	87.81	88.81
500000000000000000000000000 Years	83.81	84.81	85.81	86.81	87.81	88.81	89.81
1000000000000000000000000000 Years	84.81	85.81	86.81	87.81	88.81	89.81	90.81
2000000000000000000000000000 Years	85.81	86.81	87.81	88.81	89.81	90.81	91.81
5000000000000000000000000000 Years	86.81	87.81	88.81	89.81	90.81	91.81	92.81
10000000000000000000000000000 Years	87.81	88.81	89.81	90.81	91.81	92.81	93.81
20000000000000000000000000000 Years	88.81	89.81	90.81	91.81	92.81	93.81	94.81
50000000000000000000000000000 Years	89.81	90.81	91.81	92.81	93.81	94.81	95.81
100000000000000000000000000000 Years	90.81	91.81	92.81	93.81	94.81	95.81	96.81
200000000000000000000000000000 Years	91.81	92.81	93.81	94.81	95.81	96.81	97.81
500000000000000000000000000000 Years	92.81	93.81	94.81	95.81	96.81	97.81	98.81
1000000000000000000000000000000 Years	93.81	94.81	95.81	96.81	97.81	98.81	99.81
2000000000000000000000000000000 Years	94.81	95.81	96.81	97.81	98.81	99.81	100.81
5000000000000000000000000000000 Years	95.81	96.81	97.81	98.81	99.81	100.81	101.81
10000000000000000000000000000000 Years	96.81	97.81	98.81	99.81	100.81	101.81	102.81
20000000000000000000000000000000 Years	97.81	98.81	99.81	100.81	101.81	102.81	103.81
50000000000000000000000000000000 Years	98.81	99.81	100.81	101.81	102.81	103.81	104.81
100000000000000000000000000000000 Years	99.81	100.81	101.81	102.81	103.81	104.81	105.81
200000000000000000000000000000000 Years	100.81	101.81	102.81	103.81	104.81	105.81	106.81
500000000000000000000000000000000 Years	101.81	102.81	103.81	104.81	105.81	106.81	107.81
1000000000000000000000000000000000 Years	102.81	103.81	104.81	105.81	106.81	107.81	108.81
2000000000000000000000000000000000 Years	103.81	104.81	105.81	106.81	107.81	108.81	109.81
5000000000000000000000000000000000 Years	104.81	105.81	106.81	107.81	108.81	109.81	110.81
10000000000000000000000000000000000 Years	105.81	106.81	107.81	108.81	109.81	110.81	111.81
20000000000000000000000000000000000 Years	106.81	107.81	108.81	109.81	110.81	111.81	112.81
50000000000000000000000000000000000 Years	107.81	108.81	109.81	110.81	111.81	112.81	113.81
100000000000000000000000000000000000 Years	108.81	109.81	110.81	111.81	112.81	113.81	114.81
200000000000000000000000000000000000 Years	109.81	110.81	111.81	112.81	113.81	114.81	115.81
500000000000000000000000000000000000 Years	110.81	111.81	112.81	113.81	114.81	115.81	116.81
1000000000000000000000000000000000000 Years	111.81	112.81	113.81	114.81	115.81	116.81	117.81
2000000000000000000000000000000000000 Years	112.81	113.81	114.81	115.81	116.81	117.81	118.81
5000000000000000000000000000000000000 Years	113.81	114.81	115.81	116.81	117.81	118.81	11

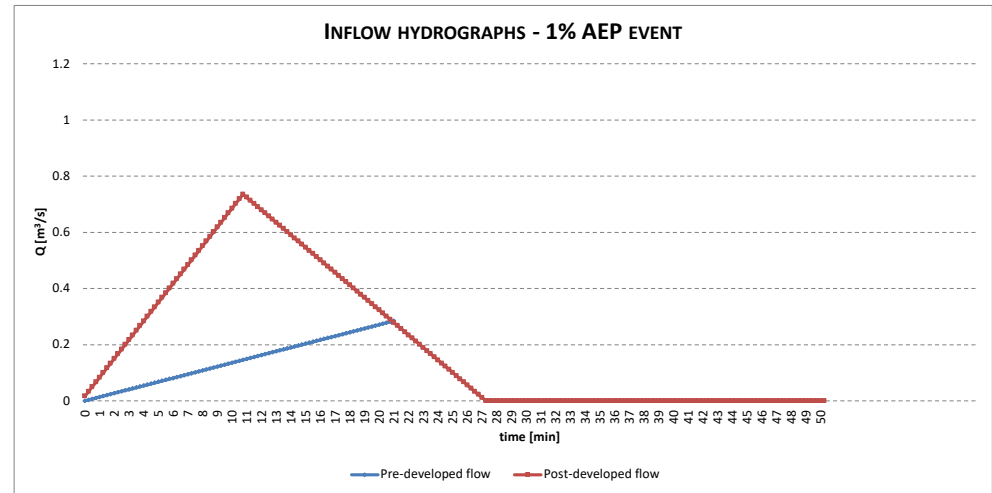
Detention Volume - sizing - 1% AEP storm event

Pre-developed			
t [sec]	t [min]	Q [m³/s]	V [m³]
0	0	0	0
15	0.25	0.003393	0.050893
30	0.5	0.006786	0.152679
45	0.75	0.010179	0.305357
60	1	0.013571	0.508929
75	1.25	0.016964	0.763393
90	1.5	0.020357	1.06875
105	1.75	0.02375	1.425
120	2	0.027143	1.832143
135	2.25	0.030536	2.290179
150	2.5	0.033929	2.799107
165	2.75	0.037321	3.358929
180	3	0.040714	3.969643
195	3.25	0.044107	4.63125
210	3.5	0.0475	5.34375
225	3.75	0.050893	6.107143
240	4	0.054286	6.921429
255	4.25	0.057679	7.786607
270	4.5	0.061071	8.702679
285	4.75	0.064464	9.669643
300	5	0.067857	10.6875
315	5.25	0.07125	11.75625
330	5.5	0.074643	12.87589
345	5.75	0.078036	14.04643
360	6	0.081429	15.26786
375	6.25	0.084821	16.54018
390	6.5	0.088214	17.86339
405	6.75	0.091607	19.2375
420	7	0.095	20.6625
435	7.25	0.098393	22.13839
450	7.5	0.101786	23.66518
465	7.75	0.105179	25.24286
480	8	0.108571	26.87143
495	8.25	0.111964	28.55089
510	8.5	0.115357	30.28125
525	8.75	0.11875	32.0625
540	9	0.122143	33.89464
555	9.25	0.125536	35.77768
570	9.5	0.128929	37.71161
585	9.75	0.132321	39.69643
600	10	0.135714	41.73214
615	10.25	0.139107	43.81875
630	10.5	0.1425	45.95625
645	10.75	0.145893	48.14464
660	11	0.149286	50.38393
675	11.25	0.152679	52.67411
690	11.5	0.156071	55.01518
705	11.75	0.159464	57.40714
720	12	0.162857	59.85
735	12.25	0.16625	62.34375
750	12.5	0.169643	64.88839
765	12.75	0.173036	67.48393
780	13	0.176429	70.13036
795	13.25	0.179821	72.82768
810	13.5	0.183214	75.57589
825	13.75	0.186607	78.375
840	14	0.19	81.225
855	14.25	0.193393	84.12589

Post-developed			
t [sec]	t [min]	Q [m³/s]	V [m³]
0	0	0	0
15	0.25	0.016715	0.25073
30	0.5	0.033431	0.75219
45	0.75	0.050146	1.50438
60	1	0.066861	2.5073
75	1.25	0.083577	3.76095
90	1.5	0.100292	5.265329
105	1.75	0.117007	7.020439
120	2	0.133723	9.026279
135	2.25	0.150438	11.28285
150	2.5	0.167153	13.79015
165	2.75	0.183869	16.54818
180	3	0.200584	19.55694
195	3.25	0.217299	22.81643
210	3.5	0.234015	26.32665
225	3.75	0.25073	30.0876
240	4	0.267445	34.09928
255	4.25	0.284161	38.36169
270	4.5	0.300876	42.87482
285	4.75	0.317591	47.63869
300	5	0.334307	52.65329
315	5.25	0.351022	57.91862
330	5.5	0.367737	63.43468
345	5.75	0.384453	69.20147
360	6	0.401168	75.21899
375	6.25	0.417883	81.48724
390	6.5	0.434599	88.00622
405	6.75	0.451314	94.77593
420	7	0.468029	101.7964
435	7.25	0.484745	109.0675
450	7.5	0.50146	116.5894
465	7.75	0.518175	124.3621
480	8	0.534891	132.3854
495	8.25	0.551606	140.6595
510	8.5	0.568321	149.1843
525	8.75	0.585037	157.9599
540	9	0.601752	166.9862
555	9.25	0.618467	176.2632
570	9.5	0.635183	185.7909
585	9.75	0.651898	195.5694
600	10	0.668613	205.5986
615	10.25	0.685329	215.8785
630	10.5	0.702044	226.4092
645	10.75	0.718759	237.1906
660	11	0.735475	248.2227
675	11.25	0.724331	259.0876
690	11.5	0.713187	269.7854
705	11.75	0.702044	280.3161
720	12	0.6909	290.6796
735	12.25	0.679757	300.876
750	12.5	0.668613	310.9052
765	12.75	0.65747	320.7672
780	13	0.646326	330.4621
795	13.25	0.635183	339.9898
810	13.5	0.624039	349.3504
825	13.75	0.612895	358.5439
840	14	0.601752	367.5701
855	14.25	0.590608	376.4293

Detention tank
V [m³]
0
0.200
0.600
1.199
1.998
2.998
4.197
5.595
7.194
8.993
10.991
13.189
15.587
18.185
20.983
23.980
27.178
30.575
34.172
37.969
41.966
46.162
50.559
55.155
59.951
64.947
70.143
75.538
81.134
86.929
92.924
99.119
105.514
112.109
118.903
125.897
133.092
140.485
148.079
155.873
163.866
172.060
180.453
189.046
197.839
206.414
214.770
222.909
230.830
238.532
246.017
253.283
260.332
267.162
273.775
280.169
286.345
292.303

		Δt [sec]	15
Q ₁₀₀ [m³/s]	0.285	Pre-developed	Q ₁₀₀ [m³/s] 0.735 Developed
T _c [min]	21.00	peak flow	T _c [min] 11.00 peak flow
T _c [sec]	1260		T _c [sec] 660
	0.000226		0.001114
T [min]	27.5	end simulation	T [min] 27.5 end simulation
T [sec]	1650		T [sec] 1650
	0.000731		0.000743
Detention volume [m³]	371		



870	14.5	0.196786	87.07768
885	14.75	0.200179	90.08036
900	15	0.203571	93.13393
915	15.25	0.206964	96.23839
930	15.5	0.210357	99.39375
945	15.75	0.21375	102.6
960	16	0.217143	105.8571
975	16.25	0.220536	109.1652
990	16.5	0.223929	112.5241
1005	16.75	0.227321	115.9339
1020	17	0.230714	119.3946
1035	17.25	0.234107	122.9063
1050	17.5	0.2375	126.4688
1065	17.75	0.240893	130.0821
1080	18	0.244286	133.7464
1095	18.25	0.247679	137.4616
1110	18.5	0.251071	141.2277
1125	18.75	0.254464	145.0446
1140	19	0.257857	148.9125
1155	19.25	0.26125	152.8313
1170	19.5	0.264643	156.8009
1185	19.75	0.268036	160.8214
1200	20	0.271429	164.8929
1215	20.25	0.274821	169.0152
1230	20.5	0.278214	173.1884
1245	20.75	0.281607	177.4125
1260	21	0.285	181.6875

870	14.5	0.579465	385.1212	298.044
885	14.75	0.568321	393.6461	303.566
900	15	0.557178	402.0037	308.870
915	15.25	0.546034	410.1942	313.956
930	15.5	0.534891	418.2176	318.824
945	15.75	0.523747	426.0738	323.474
960	16	0.512603	433.7628	327.906
975	16.25	0.50146	441.2847	332.120
990	16.5	0.490316	448.6395	336.115
1005	16.75	0.479173	455.8271	339.893
1020	17	0.468029	462.8475	343.453
1035	17.25	0.456886	469.7008	346.795
1050	17.5	0.445742	476.3869	349.918
1065	17.75	0.434599	482.9059	352.824
1080	18	0.423455	489.2577	355.511
1095	18.25	0.412312	495.4424	357.981
1110	18.5	0.401168	501.4599	360.232
1125	18.75	0.390024	507.3103	362.266
1140	19	0.378881	512.9935	364.081
1155	19.25	0.367737	518.5096	365.678
1170	19.5	0.356594	523.8585	367.058
1185	19.75	0.34545	529.0402	368.219
1200	20	0.334307	534.0548	369.162
1215	20.25	0.323163	538.9023	369.887
1230	20.5	0.31202	543.5826	370.394
1245	20.75	0.300876	548.0957	370.683
1260	21	0.289732	552.4417	370.754
1275	21.25	0.278589	556.6205	
1290	21.5	0.267445	560.6322	
1305	21.75	0.256302	564.4767	
1320	22	0.245158	568.1541	
1335	22.25	0.234015	571.6643	
1350	22.5	0.222871	575.0074	
1365	22.75	0.211728	578.1833	
1380	23	0.200584	581.1921	
1395	23.25	0.18944	584.0337	
1410	23.5	0.178297	586.7081	
1425	23.75	0.167153	589.2154	
1440	24	0.15601	591.5556	
1455	24.25	0.144866	593.7286	
1470	24.5	0.133723	595.7344	
1485	24.75	0.122579	597.5731	
1500	25	0.111436	599.2446	
1515	25.25	0.100292	600.749	
1530	25.5	0.089148	602.0862	
1545	25.75	0.078005	603.2563	
1560	26	0.066861	604.2592	
1575	26.25	0.055718	605.095	
1590	26.5	0.044574	605.7636	
1605	26.75	0.033431	606.2651	
1620	27	0.022287	606.5994	
1635	27.25	0.011144	606.7665	
1650	27.5	0	606.7665	
1665	27.75	0	606.7665	
1680	28	0	606.7665	
1695	28.25	0	606.7665	
1710	28.5	0	606.7665	
1725	28.75	0	606.7665	
1740	29	0	606.7665	
1755	29.25	0	606.7665	
1770	29.5	0	606.7665	
1785	29.75	0	606.7665	
1800	30	0	606.7665	
1815	30.25	0	606.7665	

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1830	30.5	0	606.7665
1845	30.75	0	606.7665
1860	31	0	606.7665
1875	31.25	0	606.7665
1890	31.5	0	606.7665
1905	31.75	0	606.7665
1920	32	0	606.7665
1935	32.25	0	606.7665
1950	32.5	0	606.7665
1965	32.75	0	606.7665
1980	33	0	606.7665
1995	33.25	0	606.7665
2010	33.5	0	606.7665
2025	33.75	0	606.7665
2040	34	0	606.7665
2055	34.25	0	606.7665
2070	34.5	0	606.7665
2085	34.75	0	606.7665
2100	35	0	606.7665
2115	35.25	0	606.7665
2130	35.5	0	606.7665
2145	35.75	0	606.7665
2160	36	0	606.7665
2175	36.25	0	606.7665
2190	36.5	0	606.7665
2205	36.75	0	606.7665
2220	37	0	606.7665
2235	37.25	0	606.7665
2250	37.5	0	606.7665
2265	37.75	0	606.7665
2280	38	0	606.7665
2295	38.25	0	606.7665
2310	38.5	0	606.7665
2325	38.75	0	606.7665
2340	39	0	606.7665
2355	39.25	0	606.7665
2370	39.5	0	606.7665
2385	39.75	0	606.7665
2400	40	0	606.7665
2415	40.25	0	606.7665
2430	40.5	0	606.7665
2445	40.75	0	606.7665
2460	41	0	606.7665
2475	41.25	0	606.7665
2490	41.5	0	606.7665
2505	41.75	0	606.7665
2520	42	0	606.7665
2535	42.25	0	606.7665
2550	42.5	0	606.7665
2565	42.75	0	606.7665
2580	43	0	606.7665
2595	43.25	0	606.7665
2610	43.5	0	606.7665
2625	43.75	0	606.7665
2640	44	0	606.7665
2655	44.25	0	606.7665
2670	44.5	0	606.7665
2685	44.75	0	606.7665
2700	45	0	606.7665
2715	45.25	0	606.7665
2730	45.5	0	606.7665
2745	45.75	0	606.7665
2760	46	0	606.7665
2775	46.25	0	606.7665

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2790	46.5	0	606.7665
2805	46.75	0	606.7665
2820	47	0	606.7665
2835	47.25	0	606.7665
2850	47.5	0	606.7665
2865	47.75	0	606.7665
2880	48	0	606.7665
2895	48.25	0	606.7665
2910	48.5	0	606.7665
2925	48.75	0	606.7665
2940	49	0	606.7665
2955	49.25	0	606.7665
2970	49.5	0	606.7665
2985	49.75	0	606.7665
3000	50	0	606.7665
3015	50.25	0	606.7665
3030	50.5	0	606.7665

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Detention Volume - sizing - 1% AEP event - OPTION 1

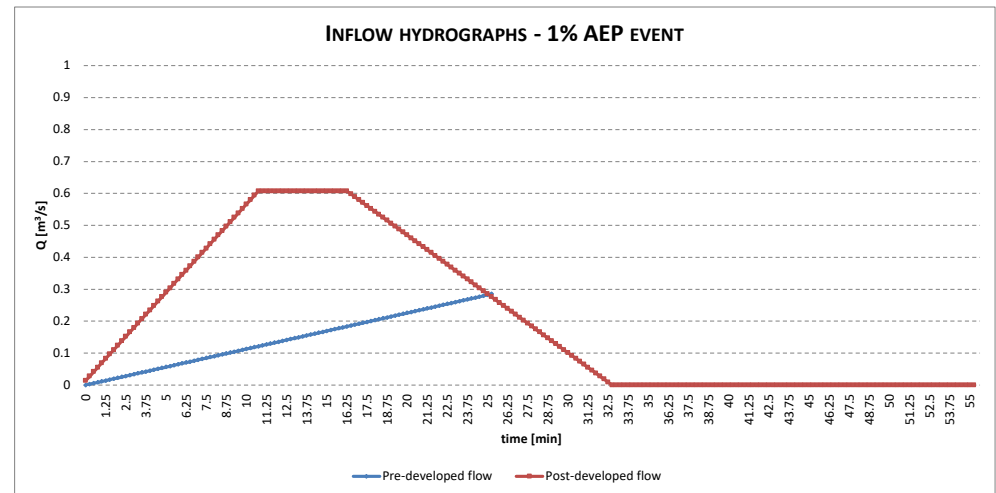
Pre-developed			
t [sec]	t [min]	Q [m³/s]	V [m³]
0	0	0	0
15	0.25	0.002822	0.042327
30	0.5	0.005644	0.12698
45	0.75	0.008465	0.25396
60	1	0.011287	0.423267
75	1.25	0.014109	0.634901
90	1.5	0.016931	0.888861
105	1.75	0.019752	1.185149
120	2	0.022574	1.523762
135	2.25	0.025396	1.904703
150	2.5	0.028218	2.32797
165	2.75	0.03104	2.793564
180	3	0.033861	3.301485
195	3.25	0.036683	3.851733
210	3.5	0.039505	4.444307
225	3.75	0.042327	5.079208
240	4	0.045149	5.756436
255	4.25	0.04797	6.47599
270	4.5	0.050792	7.237871
285	4.75	0.053614	8.042079
300	5	0.056436	8.888614
315	5.25	0.059257	9.777475
330	5.5	0.062079	10.70866
345	5.75	0.064901	11.68218
360	6	0.067723	12.69802
375	6.25	0.070545	13.75619
390	6.5	0.073366	14.85668
405	6.75	0.076188	15.9995
420	7	0.07901	17.18465
435	7.25	0.081832	18.41213
450	7.5	0.084653	19.68193
465	7.75	0.087475	20.99406
480	8	0.090297	22.34851
495	8.25	0.093119	23.7453
510	8.5	0.095941	25.18441
525	8.75	0.098762	26.66584
540	9	0.101584	28.1896
555	9.25	0.104406	29.75569
570	9.5	0.107228	31.36411
585	9.75	0.11005	33.01485
600	10	0.112871	34.70792
615	10.25	0.115693	36.44332
630	10.5	0.118515	38.22104
645	10.75	0.121337	40.04109
660	11	0.124158	41.90347
675	11.25	0.12698	43.80817
690	11.5	0.129802	45.7552
705	11.75	0.132624	47.74455
720	12	0.135446	49.77624
735	12.25	0.138267	51.85025
750	12.5	0.141089	53.96658
765	12.75	0.143911	56.12525
780	13	0.146733	58.32624
795	13.25	0.149554	60.56955
810	13.5	0.152376	62.8552
825	13.75	0.155198	65.18317
840	14	0.15802	67.55347
855	14.25	0.160842	69.96609

Post-developed			
t [sec]	t [min]	Q [m³/s]	V [m³]
0	0	0	0
15	0.25	0.013805	0.207068
30	0.5	0.027609	0.621205
45	0.75	0.041414	1.24241
60	1	0.055218	2.070684
75	1.25	0.069023	3.106026
90	1.5	0.082827	4.348436
105	1.75	0.096632	5.797914
120	2	0.110436	7.454461
135	2.25	0.124241	9.318077
150	2.5	0.138046	11.38876
165	2.75	0.15185	13.66651
180	3	0.165655	16.15133
195	3.25	0.179459	18.84322
210	3.5	0.193264	21.74218
225	3.75	0.207068	24.8482
240	4	0.220873	28.1613
255	4.25	0.234677	31.68146
270	4.5	0.248482	35.40869
285	4.75	0.262287	39.34299
300	5	0.276091	43.48436
315	5.25	0.289896	47.83279
330	5.5	0.3037	52.3883
345	5.75	0.317505	57.15087
360	6	0.331309	62.12051
375	6.25	0.345114	67.29722
390	6.5	0.358919	72.681
405	6.75	0.372723	78.27184
420	7	0.386528	84.06976
435	7.25	0.400332	90.07474
450	7.5	0.414137	96.28679
465	7.75	0.427941	102.7059
480	8	0.441746	109.3321
495	8.25	0.45555	116.1654
510	8.5	0.469355	123.2057
525	8.75	0.48316	130.4531
540	9	0.496964	137.9075
555	9.25	0.510769	145.5691
570	9.5	0.524573	153.4377
585	9.75	0.538378	161.5133
600	10	0.552182	169.7961
615	10.25	0.565987	178.2859
630	10.5	0.579791	186.9827
645	10.75	0.593596	195.8867
660	11	0.607401	204.9977
675	11.25	0.607401	214.1087
690	11.5	0.607401	223.2197
705	11.75	0.607401	232.3307
720	12	0.607401	241.4417
735	12.25	0.607401	250.5527
750	12.5	0.607401	259.6637
765	12.75	0.607401	268.7747
780	13	0.607401	277.8858
795	13.25	0.607401	286.9968
810	13.5	0.607401	296.1078
825	13.75	0.607401	305.2188
840	14	0.607401	314.3298
855	14.25	0.607401	323.4408

Detention tank	
V [m³]	
0	0
0.165	0.165
0.494	0.494
0.988	0.988
1.647	1.647
2.471	2.471
3.460	3.460
4.613	4.613
5.931	5.931
7.413	7.413
9.061	9.061
10.873	10.873
12.850	12.850
14.991	14.991
17.298	17.298
19.769	19.769
22.405	22.405
25.205	25.205
28.171	28.171
31.301	31.301
34.596	34.596
38.055	38.055
41.680	41.680
45.469	45.469
49.422	49.422
53.541	53.541
57.824	57.824
62.272	62.272
66.885	66.885
71.663	71.663
76.605	76.605
81.712	81.712
86.984	86.984
92.420	92.420
98.021	98.021
103.787	103.787
109.718	109.718
115.813	115.813
122.074	122.074
128.498	128.498
135.088	135.088
141.843	141.843
148.762	148.762
155.846	155.846
163.094	163.094
170.301	170.301
177.465	177.465
184.586	184.586
191.665	191.665
198.702	198.702
205.697	205.697
212.649	212.649
219.560	219.560
226.427	226.427
233.253	233.253
240.036	240.036
246.776	246.776
253.475	253.475

Q ₁₀₀ [m³/s]		0.285	Pre-developed	Q ₁₀₀ [m³/s]	0.607	Developed
T _c [min]	25.25	peak flow	T _c [min]	11.00	peak flow	
T _c [sec]	1515		T _c [sec]	660		
	0.000188			0.00092		
T _c [min]			T _c [min]	16.50	end of storm	
T _c [sec]			T _c [sec]	990		
T [min]	33	end simulation	T [min]	33	end simulation	
T [sec]	1980		T [sec]	1980		
	0.000144			0.000614		

Detention volume [m³] 419



870	14.5	0.163663	72.42104	870	14.5	0.607401	332.5518	260.131
885	14.75	0.166485	74.91832	885	14.75	0.607401	341.6628	266.744
900	15	0.169307	77.45792	900	15	0.607401	350.7738	273.316
915	15.25	0.172129	80.03985	915	15.25	0.607401	359.8848	279.845
930	15.5	0.17495	82.66411	930	15.5	0.607401	368.9958	286.332
945	15.75	0.177772	85.33069	945	15.75	0.607401	378.1068	292.776
960	16	0.180594	88.0396	960	16	0.607401	387.2179	299.178
975	16.25	0.183416	90.79084	975	16.25	0.607401	396.3289	305.538
990	16.5	0.186238	93.58441	990	16.5	0.607401	405.4399	311.855
1005	16.75	0.189059	96.4203	1005	16.75	0.598198	414.4128	317.993
1020	17	0.191881	99.29851	1020	17	0.588994	423.2478	323.949
1035	17.25	0.194703	102.2191	1035	17.25	0.579791	431.9446	329.726
1050	17.5	0.197525	105.1819	1050	17.5	0.570588	440.5035	335.322
1065	17.75	0.200347	108.1871	1065	17.75	0.561385	448.9242	340.737
1080	18	0.203168	111.2347	1080	18	0.552182	457.207	345.972
1095	18.25	0.20599	114.3245	1095	18.25	0.542979	465.3517	351.027
1110	18.5	0.208812	117.4567	1110	18.5	0.533776	473.3583	355.902
1125	18.75	0.211634	120.6312	1125	18.75	0.524573	481.2269	360.596
1140	19	0.214455	123.848	1140	19	0.51537	488.9574	365.109
1155	19.25	0.217277	127.1072	1155	19.25	0.506167	496.55	369.443
1170	19.5	0.220099	130.4087	1170	19.5	0.496964	504.0044	373.596
1185	19.75	0.222921	133.7525	1185	19.75	0.487761	511.3208	377.568
1200	20	0.225743	137.1386	1200	20	0.478558	518.4992	381.361
1215	20.25	0.228564	140.5671	1215	20.25	0.469355	525.5395	384.972
1230	20.5	0.231386	144.0379	1230	20.5	0.460152	532.4418	388.404
1245	20.75	0.234208	147.551	1245	20.75	0.450949	539.206	391.655
1260	21	0.23703	151.1064	1260	21	0.441746	545.8322	394.726
1275	21.25	0.239851	154.7042	1275	21.25	0.432543	552.3204	397.616
1290	21.5	0.242673	158.3443	1290	21.5	0.42334	558.6705	400.326
1305	21.75	0.245495	162.0267	1305	21.75	0.414137	564.8825	402.856
1320	22	0.248317	165.7515	1320	22	0.404934	570.9565	405.205
1335	22.25	0.251139	169.5186	1335	22.25	0.395731	576.8925	407.374
1350	22.5	0.25396	173.328	1350	22.5	0.386528	582.6904	409.362
1365	22.75	0.256782	177.1797	1365	22.75	0.377325	588.3503	411.171
1380	23	0.259604	181.0738	1380	23	0.368122	593.8721	412.798
1395	23.25	0.262426	185.0101	1395	23.25	0.358919	599.2559	414.246
1410	23.5	0.265248	188.9889	1410	23.5	0.349715	604.5016	415.513
1425	23.75	0.268069	193.0099	1425	23.75	0.340512	609.6093	416.599
1440	24	0.270891	197.0733	1440	24	0.331309	614.5789	417.506
1455	24.25	0.273713	201.179	1455	24.25	0.322106	619.4105	418.232
1470	24.5	0.276535	205.327	1470	24.5	0.312903	624.1041	418.777
1485	24.75	0.279356	209.5173	1485	24.75	0.3037	628.6596	419.142
1500	25	0.282178	213.75	1500	25	0.294497	633.077	419.327
1515	25.25	0.285	218.025	1515	25.25	0.285294	637.3564	419.331
				1530	25.5	0.276091	641.4978	
				1545	25.75	0.266888	645.5011	
				1560	26	0.257685	649.3664	
				1575	26.25	0.248482	653.0936	
				1590	26.5	0.239279	656.6828	
				1605	26.75	0.230076	660.134	
				1620	27	0.220873	663.4471	
				1635	27.25	0.21167	666.6221	
				1650	27.5	0.202467	669.6591	
				1665	27.75	0.193264	672.5581	
				1680	28	0.184061	675.319	
				1695	28.25	0.174858	677.9419	
				1710	28.5	0.165655	680.4267	
				1725	28.75	0.156452	682.7734	
				1740	29	0.147249	684.9822	
				1755	29.25	0.138046	687.0529	
				1770	29.5	0.128843	688.9855	
				1785	29.75	0.11964	690.7801	
				1800	30	0.110436	692.4366	
				1815	30.25	0.101233	693.9551	

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1830	30.5	0.09203	695.3356
1845	30.75	0.082827	696.578
1860	31	0.073624	697.6824
1875	31.25	0.064421	698.6487
1890	31.5	0.055218	699.477
1905	31.75	0.046015	700.1672
1920	32	0.036812	700.7194
1935	32.25	0.027609	701.1335
1950	32.5	0.018406	701.4096
1965	32.75	0.009203	701.5476
1980	33	0	701.5476
1995	33.25	0	701.5476
2010	33.5	0	701.5476
2025	33.75	0	701.5476
2040	34	0	701.5476
2055	34.25	0	701.5476
2070	34.5	0	701.5476
2085	34.75	0	701.5476
2100	35	0	701.5476
2115	35.25	0	701.5476
2130	35.5	0	701.5476
2145	35.75	0	701.5476
2160	36	0	701.5476
2175	36.25	0	701.5476
2190	36.5	0	701.5476
2205	36.75	0	701.5476
2220	37	0	701.5476
2235	37.25	0	701.5476
2250	37.5	0	701.5476
2265	37.75	0	701.5476
2280	38	0	701.5476
2295	38.25	0	701.5476
2310	38.5	0	701.5476
2325	38.75	0	701.5476
2340	39	0	701.5476
2355	39.25	0	701.5476
2370	39.5	0	701.5476
2385	39.75	0	701.5476
2400	40	0	701.5476
2415	40.25	0	701.5476
2430	40.5	0	701.5476
2445	40.75	0	701.5476
2460	41	0	701.5476
2475	41.25	0	701.5476
2490	41.5	0	701.5476
2505	41.75	0	701.5476
2520	42	0	701.5476
2535	42.25	0	701.5476
2550	42.5	0	701.5476
2565	42.75	0	701.5476
2580	43	0	701.5476
2595	43.25	0	701.5476
2610	43.5	0	701.5476
2625	43.75	0	701.5476
2640	44	0	701.5476
2655	44.25	0	701.5476
2670	44.5	0	701.5476
2685	44.75	0	701.5476
2700	45	0	701.5476
2715	45.25	0	701.5476
2730	45.5	0	701.5476
2745	45.75	0	701.5476
2760	46	0	701.5476
2775	46.25	0	701.5476

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2790	46.5	0	701.5476
2805	46.75	0	701.5476
2820	47	0	701.5476
2835	47.25	0	701.5476
2850	47.5	0	701.5476
2865	47.75	0	701.5476
2880	48	0	701.5476
2895	48.25	0	701.5476
2910	48.5	0	701.5476
2925	48.75	0	701.5476
2940	49	0	701.5476
2955	49.25	0	701.5476
2970	49.5	0	701.5476
2985	49.75	0	701.5476
3000	50	0	701.5476
3015	50.25	0	701.5476
3030	50.5	0	701.5476
3045	50.75	0	701.5476
3060	51	0	701.5476
3075	51.25	0	701.5476
3090	51.5	0	701.5476
3105	51.75	0	701.5476
3120	52	0	701.5476
3135	52.25	0	701.5476
3150	52.5	0	701.5476
3165	52.75	0	701.5476
3180	53	0	701.5476
3195	53.25	0	701.5476
3210	53.5	0	701.5476
3225	53.75	0	701.5476
3240	54	0	701.5476
3255	54.25	0	701.5476
3270	54.5	0	701.5476
3285	54.75	0	701.5476
3300	55	0	701.5476
3315	55.25	0	701.5476
3330	55.5	0	701.5476

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Detention Volume - sizing - 1% AEP event - OPTION 2

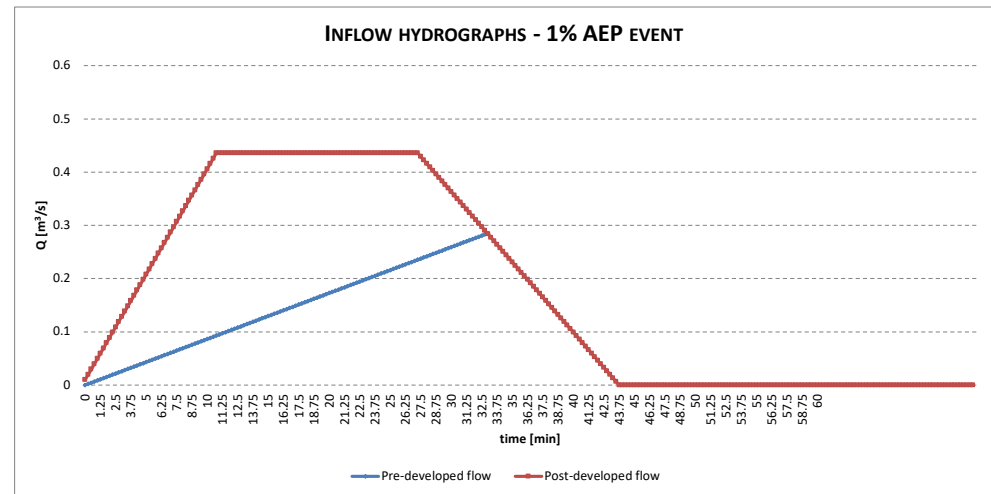
Pre-developed			
t [sec]	t [min]	Q [m³/s]	V [m³]
0	0	0	0
15	0.25	0.002159	0.032386
30	0.5	0.004318	0.097159
45	0.75	0.006477	0.194318
60	1	0.008636	0.323864
75	1.25	0.010795	0.485795
90	1.5	0.012955	0.680114
105	1.75	0.015114	0.906818
120	2	0.017273	1.165909
135	2.25	0.019432	1.457386
150	2.5	0.021591	1.78125
165	2.75	0.02375	2.1375
180	3	0.025909	2.526136
195	3.25	0.028068	2.947159
210	3.5	0.030227	3.400568
225	3.75	0.032386	3.886364
240	4	0.034545	4.404545
255	4.25	0.036705	4.955114
270	4.5	0.038864	5.538068
285	4.75	0.041023	6.153409
300	5	0.043182	6.801136
315	5.25	0.045341	7.48125
330	5.5	0.0475	8.19375
345	5.75	0.049659	8.938636
360	6	0.051818	9.715909
375	6.25	0.053977	10.52557
390	6.5	0.056136	11.36761
405	6.75	0.058295	12.24205
420	7	0.060455	13.14886
435	7.25	0.062614	14.08807
450	7.5	0.064773	15.05966
465	7.75	0.066932	16.06364
480	8	0.069091	17.1
495	8.25	0.07125	18.16875
510	8.5	0.073409	19.26989
525	8.75	0.075568	20.40341
540	9	0.077727	21.56932
555	9.25	0.079886	22.76761
570	9.5	0.082045	23.9983
585	9.75	0.084205	25.26136
600	10	0.086364	26.55682
615	10.25	0.088523	27.88466
630	10.5	0.090682	29.24489
645	10.75	0.092841	30.6375
660	11	0.095	32.0625
675	11.25	0.097159	33.51989
690	11.5	0.099318	35.00966
705	11.75	0.101477	36.53182
720	12	0.103636	38.08636
735	12.25	0.105795	39.6733
750	12.5	0.107955	41.29261
765	12.75	0.110114	42.94432
780	13	0.112273	44.62841
795	13.25	0.114432	46.34489
810	13.5	0.116591	48.09375
825	13.75	0.11875	49.875
840	14	0.120909	51.68864
855	14.25	0.123068	53.53466

Post-developed			
t [sec]	t [min]	Q [m³/s]	V [m³]
0	0	0	0
15	0.25	0.0099	0.148493
30	0.5	0.019799	0.445478
45	0.75	0.029699	0.890956
60	1	0.039598	1.484927
75	1.25	0.049498	2.22739
90	1.5	0.059397	3.118346
105	1.75	0.069297	4.157795
120	2	0.079196	5.345736
135	2.25	0.089096	6.68217
150	2.5	0.098995	8.167096
165	2.75	0.108895	9.800516
180	3	0.118794	11.58243
195	3.25	0.128694	13.51283
210	3.5	0.138593	15.59173
225	3.75	0.148493	17.81912
240	4	0.158392	20.195
255	4.25	0.168292	22.71938
270	4.5	0.178191	25.39225
285	4.75	0.188091	28.21361
300	5	0.19799	31.18346
315	5.25	0.20789	34.30181
330	5.5	0.217789	37.56864
345	5.75	0.227689	40.98398
360	6	0.237588	44.5478
375	6.25	0.247488	48.26012
390	6.5	0.257387	52.12092
405	6.75	0.267287	56.13023
420	7	0.277186	60.28802
435	7.25	0.287086	64.59431
450	7.5	0.296985	69.04909
465	7.75	0.306885	73.65236
480	8	0.316784	78.40413
495	8.25	0.326684	83.30438
510	8.5	0.336583	88.35313
525	8.75	0.346483	93.55038
540	9	0.356382	98.89611
555	9.25	0.366282	104.3903
570	9.5	0.376181	110.0331
585	9.75	0.386081	115.8243
600	10	0.39598	121.764
615	10.25	0.40588	127.8522
630	10.5	0.415779	134.0889
645	10.75	0.425679	140.4741
660	11	0.435578	147.0077
675	11.25	0.435578	153.5414
690	11.5	0.435578	160.0751
705	11.75	0.435578	166.6088
720	12	0.435578	173.1424
735	12.25	0.435578	179.6761
750	12.5	0.435578	186.2098
765	12.75	0.435578	192.7435
780	13	0.435578	199.2772
795	13.25	0.435578	205.8108
810	13.5	0.435578	212.3445
825	13.75	0.435578	218.8782
840	14	0.435578	225.4119
855	14.25	0.435578	231.9455

Detention tank
V [m³]
0
0.116
0.348
0.697
1.161
1.742
2.438
3.251
4.180
5.225
6.386
7.663
9.056
10.566
12.191
13.933
15.790
17.764
19.854
22.060
24.382
26.821
29.375
32.045
34.832
37.735
40.753
43.888
47.139
50.506
53.989
57.589
61.304
65.136
69.083
73.147
77.327
81.623
86.035
90.563
95.207
99.968
104.844
109.837
114.945
120.022
125.065
130.077
135.056
140.003
144.917
149.799
154.649
159.466
164.251
169.003
173.723
178.411

			Δt [sec]	15	
Q ₁₀₀ [m³/s]	0.285	Pre-developed	Q ₁₀₀ [m³/s]	0.436	Developed
T _c [min]	33.00	peak flow	T _c [min]	11.00	peak flow
T _c [sec]	1980		T _c [sec]	660	
	0.000144			0.00066	
T _c [min]			T _c [min]	27.50	end of storm
T _c [sec]			T _c [sec]	1650	
T [min]	44	end simulation	T [min]	44	end simulation
T [sec]	2640		T [sec]	2640	
	0.000108			0.00044	

Detention volume [m³] 413



870	14.5	0.125227	55.41307	870	14.5	0.435578	238.4792	183.066
885	14.75	0.127386	57.32386	885	14.75	0.435578	245.0129	187.689
900	15	0.129545	59.26705	900	15	0.435578	251.5466	192.280
915	15.25	0.131705	61.24261	915	15.25	0.435578	258.0802	196.838
930	15.5	0.133864	63.25057	930	15.5	0.435578	264.6139	201.363
945	15.75	0.136023	65.29091	945	15.75	0.435578	271.1476	205.857
960	16	0.138182	67.36364	960	16	0.435578	277.6813	210.318
975	16.25	0.140341	69.46875	975	16.25	0.435578	284.215	214.746
990	16.5	0.1425	71.60625	990	16.5	0.435578	290.7486	219.142
1005	16.75	0.144659	73.77614	1005	16.75	0.435578	297.2823	223.506
1020	17	0.146818	75.97841	1020	17	0.435578	303.816	227.838
1035	17.25	0.148977	78.21307	1035	17.25	0.435578	310.3497	232.137
1050	17.5	0.151136	80.48011	1050	17.5	0.435578	316.8833	236.403
1065	17.75	0.153295	82.77955	1065	17.75	0.435578	323.417	240.637
1080	18	0.155455	85.11136	1080	18	0.435578	329.9507	244.839
1095	18.25	0.157614	87.47557	1095	18.25	0.435578	336.4844	249.009
1110	18.5	0.159773	89.87216	1110	18.5	0.435578	343.0181	253.146
1125	18.75	0.161932	92.30114	1125	18.75	0.435578	349.5517	257.251
1140	19	0.164091	94.7625	1140	19	0.435578	356.0854	261.323
1155	19.25	0.16625	97.25625	1155	19.25	0.435578	362.6191	265.363
1170	19.5	0.168409	99.78239	1170	19.5	0.435578	369.1528	269.370
1185	19.75	0.170568	102.3409	1185	19.75	0.435578	375.6864	273.346
1200	20	0.172727	104.9318	1200	20	0.435578	382.2201	277.288
1215	20.25	0.174886	107.5551	1215	20.25	0.435578	388.7538	281.199
1230	20.5	0.177045	110.2108	1230	20.5	0.435578	395.2875	285.077
1245	20.75	0.179205	112.8989	1245	20.75	0.435578	401.8211	288.922
1260	21	0.181364	115.6193	1260	21	0.435578	408.3548	292.736
1275	21.25	0.183523	118.3722	1275	21.25	0.435578	414.8885	296.516
1290	21.5	0.185682	121.1574	1290	21.5	0.435578	421.4222	300.265
1305	21.75	0.187841	123.975	1305	21.75	0.435578	427.9559	303.981
1320	22	0.19	126.825	1320	22	0.435578	434.4895	307.665
1335	22.25	0.192159	129.7074	1335	22.25	0.435578	441.0232	311.316
1350	22.5	0.194318	132.6222	1350	22.5	0.435578	447.5569	314.935
1365	22.75	0.196477	135.5693	1365	22.75	0.435578	454.0906	318.521
1380	23	0.198636	138.5489	1380	23	0.435578	460.6242	322.075
1395	23.25	0.200795	141.5608	1395	23.25	0.435578	467.1579	325.597
1410	23.5	0.202955	144.6051	1410	23.5	0.435578	473.6916	329.086
1425	23.75	0.205114	147.6818	1425	23.75	0.435578	480.2253	332.543
1440	24	0.207273	150.7909	1440	24	0.435578	486.759	335.968
1455	24.25	0.209432	153.9324	1455	24.25	0.435578	493.2926	339.360
1470	24.5	0.211591	157.1063	1470	24.5	0.435578	499.8263	342.720
1485	24.75	0.21375	160.3125	1485	24.75	0.435578	506.36	346.047
1500	25	0.215909	163.5511	1500	25	0.435578	512.8937	349.343
1515	25.25	0.218068	166.8222	1515	25.25	0.435578	519.4273	352.605
1530	25.5	0.220227	170.1256	1530	25.5	0.435578	525.961	355.835
1545	25.75	0.222386	173.4614	1545	25.75	0.435578	532.4947	359.033
1560	26	0.224545	176.8295	1560	26	0.435578	539.0284	362.199
1575	26.25	0.226705	180.2301	1575	26.25	0.435578	545.562	365.332
1590	26.5	0.228864	183.6631	1590	26.5	0.435578	552.0957	368.433
1605	26.75	0.231023	187.1284	1605	26.75	0.435578	558.6294	371.501
1620	27	0.233182	190.6261	1620	27	0.435578	565.1631	374.537
1635	27.25	0.235341	194.1563	1635	27.25	0.435578	571.6968	377.541
1650	27.5	0.2375	197.7188	1650	27.5	0.435578	578.2304	380.512
1665	27.75	0.239659	201.3136	1665	27.75	0.428979	584.6651	383.351
1680	28	0.241818	204.9409	1680	28	0.422379	591.0008	386.060
1695	28.25	0.243977	208.6006	1695	28.25	0.415779	597.2375	388.637
1710	28.5	0.246136	212.2926	1710	28.5	0.40918	603.3752	391.083
1725	28.75	0.248295	216.017	1725	28.75	0.40258	609.4139	393.397
1740	29	0.250455	219.7739	1740	29	0.39598	615.3536	395.580
1755	29.25	0.252614	223.5631	1755	29.25	0.389381	621.1943	397.631
1770	29.5	0.254773	227.3847	1770	29.5	0.382781	626.936	399.551
1785	29.75	0.256932	231.2386	1785	29.75	0.376181	632.5787	401.340
1800	30	0.259091	235.125	1800	30	0.369582	638.1225	402.997
1815	30.25	0.26125	239.0438	1815	30.25	0.362982	643.5672	404.523

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1830	30.5	0.263409	242.9949
1845	30.75	0.265568	246.9784
1860	31	0.267727	250.9943
1875	31.25	0.269886	255.0426
1890	31.5	0.272045	259.1233
1905	31.75	0.274205	263.2364
1920	32	0.276364	267.3818
1935	32.25	0.278523	271.5597
1950	32.5	0.280682	275.7699
1965	32.75	0.282841	280.0125
1980	33	0.285	284.2875

1830	30.5	0.356382	648.9129	405.918
1845	30.75	0.349783	654.1597	407.181
1860	31	0.343183	659.3074	408.313
1875	31.25	0.336583	664.3562	409.314
1890	31.5	0.329984	669.3059	410.183
1905	31.75	0.323384	674.1567	410.920
1920	32	0.316784	678.9085	411.527
1935	32.25	0.310185	683.5612	412.002
1950	32.5	0.303585	688.115	412.345
1965	32.75	0.296985	692.5698	412.557
1980	33	0.290386	696.9256	412.638
1995	33.25	0.283786	701.1824	
2010	33.5	0.277186	705.3402	
2025	33.75	0.270587	709.399	
2040	34	0.263987	713.3588	
2055	34.25	0.257387	717.2196	
2070	34.5	0.250788	720.9814	
2085	34.75	0.244188	724.6442	
2100	35	0.237588	728.208	
2115	35.25	0.230989	731.6729	
2130	35.5	0.224389	735.0387	
2145	35.75	0.217789	738.3055	
2160	36	0.21119	741.4734	
2175	36.25	0.20459	744.5422	
2190	36.5	0.19799	747.5121	
2205	36.75	0.191391	750.3829	
2220	37	0.184791	753.1548	
2235	37.25	0.178191	755.8277	
2250	37.5	0.171592	758.4015	
2265	37.75	0.164992	760.8764	
2280	38	0.158392	763.2523	
2295	38.25	0.151793	765.5292	
2310	38.5	0.145193	767.7071	
2325	38.75	0.138593	769.786	
2340	39	0.131993	771.7659	
2355	39.25	0.125394	773.6468	
2370	39.5	0.118794	775.4287	
2385	39.75	0.112194	777.1116	
2400	40	0.105595	778.6955	
2415	40.25	0.098995	780.1805	
2430	40.5	0.092395	781.5664	
2445	40.75	0.085796	782.8533	
2460	41	0.079196	784.0413	
2475	41.25	0.072596	785.1302	
2490	41.5	0.065997	786.1202	
2505	41.75	0.059397	787.0111	
2520	42	0.052797	787.8031	
2535	42.25	0.046198	788.496	
2550	42.5	0.039598	789.09	
2565	42.75	0.032998	789.585	
2580	43	0.026399	789.981	
2595	43.25	0.019799	790.278	
2610	43.5	0.013199	790.4759	
2625	43.75	0.0066	790.5749	
2640	44	0	790.5749	
2655	44.25	0	790.5749	
2670	44.5	0	790.5749	
2685	44.75	0	790.5749	
2700	45	0	790.5749	
2715	45.25	0	790.5749	
2730	45.5	0	790.5749	
2745	45.75	0	790.5749	
2760	46	0	790.5749	
2775	46.25	0	790.5749	

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2895	48.25	0	790.5749
2910	48.5	0	790.5749
2925	48.75	0	790.5749
2940	49	0	790.5749
2955	49.25	0	790.5749
2970	49.5	0	790.5749
2985	49.75	0	790.5749
3000	50	0	790.5749
3015	50.25	0	790.5749
3030	50.5	0	790.5749
3045	50.75	0	790.5749
3060	51	0	790.5749
3075	51.25	0	790.5749
3090	51.5	0	790.5749
3105	51.75	0	790.5749
3120	52	0	790.5749
3135	52.25	0	790.5749
3150	52.5	0	790.5749
3165	52.75	0	790.5749
3180	53	0	790.5749
3195	53.25	0	790.5749
3210	53.5	0	790.5749
3225	53.75	0	790.5749
3240	54	0	790.5749
3255	54.25	0	790.5749
3270	54.5	0	790.5749
3285	54.75	0	790.5749
3300	55	0	790.5749
3315	55.25	0	790.5749
3330	55.5	0	790.5749
3345	55.75	0	790.5749
3360	56	0	790.5749
3375	56.25	0	790.5749
3390	56.5	0	790.5749
3405	56.75	0	790.5749
3420	57	0	790.5749
3435	57.25	0	790.5749
3450	57.5	0	790.5749
3465	57.75	0	790.5749
3480	58	0	790.5749
3495	58.25	0	790.5749
3510	58.5	0	790.5749
3525	58.75	0	790.5749
3540	59	0	790.5749
3555	59.25	0	790.5749
3570	59.5	0	790.5749
3585	59.75	0	790.5749
3600	60	0	790.5749
3615	60.25	0	790.5749
3630	60.5	0	790.5749
3645	60.75	0	790.5749
3660	61	0	790.5749
3675	61.25	0	790.5749
3690	61.5	0	790.5749
3705	61.75	0	790.5749
3720	62	0	790.5749
3735	62.25	0	790.5749

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3750	62.5	0	790.5749
3765	62.75	0	790.5749
3780	63	0	790.5749
3795	63.25	0	790.5749
3810	63.5	0	790.5749
3825	63.75	0	790.5749
3840	64	0	790.5749
3855	64.25	0	790.5749
3870	64.5	0	790.5749
3885	64.75	0	790.5749
3900	65	0	790.5749
3915	65.25	0	790.5749
3930	65.5	0	790.5749
3945	65.75	0	790.5749
3960	66	0	790.5749
3975	66.25	0	790.5749
3990	66.5	0	790.5749
4005	66.75	0	790.5749
4020	67	0	790.5749
4035	67.25	0	790.5749
4050	67.5	0	790.5749
4065	67.75	0	790.5749
4080	68	0	790.5749
4095	68.25	0	790.5749
4110	68.5	0	790.5749
4125	68.75	0	790.5749
4140	69	0	790.5749
4155	69.25	0	790.5749
4170	69.5	0	790.5749
4185	69.75	0	790.5749
4200	70	0	790.5749
4215	70.25	0	790.5749
4230	70.5	0	790.5749
4245	70.75	0	790.5749
4260	71	0	790.5749
4275	71.25	0	790.5749
4290	71.5	0	790.5749
4305	71.75	0	790.5749
4320	72	0	790.5749
4335	72.25	0	790.5749
4350	72.5	0	790.5749
4365	72.75	0	790.5749
4380	73	0	790.5749
4395	73.25	0	790.5749
4410	73.5	0	790.5749
4425	73.75	0	790.5749
4440	74	0	790.5749
4455	74.25	0	790.5749
4470	74.5	0	790.5749
4485	74.75	0	790.5749

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Detention Volume - sizing - 1% AEP event - OPTION 3

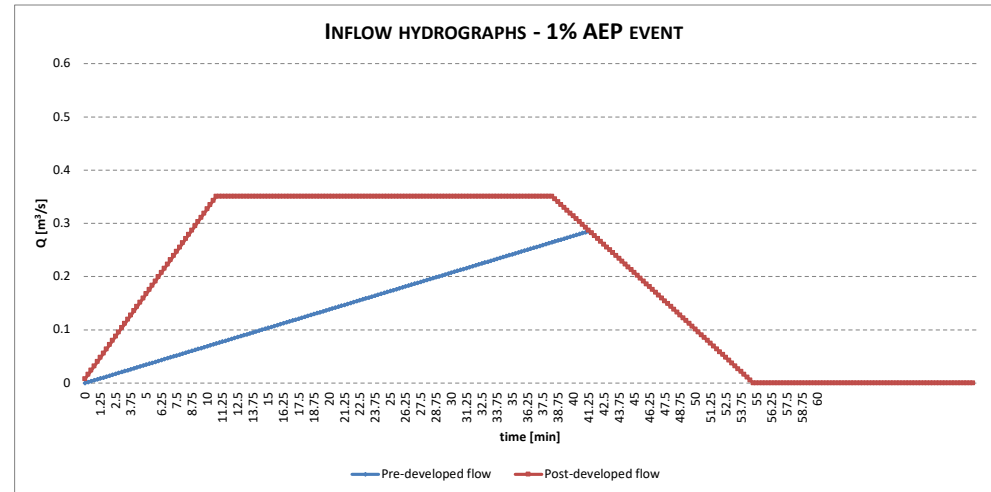
Pre-developed			
t [sec]	t [min]	Q [m³/s]	V [m³]
0	0	0	0
15	0.25	0.001727	0.025909
30	0.5	0.003455	0.077727
45	0.75	0.005182	0.155455
60	1	0.006909	0.259091
75	1.25	0.008636	0.388636
90	1.5	0.010364	0.544091
105	1.75	0.012091	0.725455
120	2	0.013818	0.932727
135	2.25	0.015545	1.165909
150	2.5	0.017273	1.425
165	2.75	0.019	1.71
180	3	0.020727	2.020909
195	3.25	0.022455	2.357727
210	3.5	0.024182	2.720455
225	3.75	0.025909	3.109091
240	4	0.027636	3.523636
255	4.25	0.029364	3.964091
270	4.5	0.031091	4.430455
285	4.75	0.032818	4.922727
300	5	0.034545	5.440909
315	5.25	0.036273	5.985
330	5.5	0.038	6.555
345	5.75	0.039727	7.150909
360	6	0.041455	7.772727
375	6.25	0.043182	8.420455
390	6.5	0.044909	9.094091
405	6.75	0.046636	9.793636
420	7	0.048364	10.51909
435	7.25	0.050091	11.27045
450	7.5	0.051818	12.04773
465	7.75	0.053545	12.85091
480	8	0.055273	13.68
495	8.25	0.057	14.535
510	8.5	0.058727	15.41591
525	8.75	0.060455	16.32273
540	9	0.062182	17.25545
555	9.25	0.063909	18.21409
570	9.5	0.065636	19.19864
585	9.75	0.067364	20.20909
600	10	0.069091	21.24545
615	10.25	0.070818	22.30773
630	10.5	0.072545	23.39591
645	10.75	0.074273	24.51
660	11	0.076	25.65
675	11.25	0.077727	26.81591
690	11.5	0.079455	28.00773
705	11.75	0.081182	29.22545
720	12	0.082909	30.46909
735	12.25	0.084636	31.73864
750	12.5	0.086364	33.03409
765	12.75	0.088091	34.35545
780	13	0.089818	35.70273
795	13.25	0.091545	37.07591
810	13.5	0.093273	38.475
825	13.75	0.095	39.9
840	14	0.096727	41.35091
855	14.25	0.098455	42.82773

Post-developed			
t [sec]	t [min]	Q [m³/s]	V [m³]
0	0	0	0
15	0.25	0.007969	0.119529
30	0.5	0.015937	0.358587
45	0.75	0.023906	0.717174
60	1	0.031874	1.19529
75	1.25	0.039843	1.792935
90	1.5	0.047812	2.51011
105	1.75	0.05578	3.346813
120	2	0.063749	4.303045
135	2.25	0.071717	5.378806
150	2.5	0.079686	6.574097
165	2.75	0.087655	7.888916
180	3	0.095623	9.323264
195	3.25	0.103592	10.87714
210	3.5	0.11156	12.55055
225	3.75	0.119529	14.34348
240	4	0.127498	16.25595
255	4.25	0.135466	18.28794
270	4.5	0.143435	20.43946
285	4.75	0.151403	22.71052
300	5	0.159372	25.1011
315	5.25	0.167341	27.61121
330	5.5	0.175309	30.24084
345	5.75	0.183278	32.99001
360	6	0.191246	35.85871
375	6.25	0.199215	38.84693
390	6.5	0.207184	41.95469
405	6.75	0.215152	45.18197
420	7	0.223121	48.52879
435	7.25	0.231089	51.99513
450	7.5	0.239058	55.581
465	7.75	0.247027	59.2864
480	8	0.254995	63.11133
495	8.25	0.262964	67.05579
510	8.5	0.270932	71.11977
525	8.75	0.278901	75.30329
540	9	0.28687	79.60633
555	9.25	0.294838	84.02891
570	9.5	0.302807	88.57101
585	9.75	0.310775	93.23264
600	10	0.318744	98.0138
615	10.25	0.326713	102.9145
630	10.5	0.334681	107.9347
645	10.75	0.34265	113.0745
660	11	0.350618	118.3337
675	11.25	0.350618	123.593
690	11.5	0.350618	128.8523
705	11.75	0.350618	134.1116
720	12	0.350618	139.3708
735	12.25	0.350618	144.6301
750	12.5	0.350618	149.8894
765	12.75	0.350618	155.1487
780	13	0.350618	160.408
795	13.25	0.350618	165.6672
810	13.5	0.350618	170.9265
825	13.75	0.350618	176.1858
840	14	0.350618	181.4451
855	14.25	0.350618	186.7043

Detention tank	
V [m³]	
0	0
0.094	0.094
0.281	0.281
0.562	0.562
0.936	0.936
1.404	1.404
1.966	1.966
2.621	2.621
3.370	3.370
4.213	4.213
5.149	5.149
6.179	6.179
7.302	7.302
8.519	8.519
9.830	9.830
11.234	11.234
12.732	12.732
14.324	14.324
16.009	16.009
17.788	17.788
19.660	19.660
21.626	21.626
23.686	23.686
25.839	25.839
28.086	28.086
30.426	30.426
32.861	32.861
35.388	35.388
38.010	38.010
40.725	40.725
43.533	43.533
46.435	46.435
49.431	49.431
52.521	52.521
55.704	55.704
58.981	58.981
62.351	62.351
65.815	65.815
69.372	69.372
73.024	73.024
76.768	76.768
80.607	80.607
84.539	84.539
88.564	88.564
92.684	92.684
96.777	96.777
100.845	100.845
104.886	104.886
108.902	108.902
112.891	112.891
116.855	116.855
120.793	120.793
124.705	124.705
128.591	128.591
132.452	132.452
136.286	136.286
140.094	140.094
143.877	143.877

Q ₁₀₀ [m³/s]		0.285	Pre-developed	Q ₁₀₀ [m³/s]	0.351	Developed
T _c [min]	41.25	peak flow	T _c [min]	11.00	peak flow	
T _c [sec]	2475		T _c [sec]	660		
	0.000115			0.000531		
T _c [min]			T _c [min]	38.50	end of storm	
T _c [sec]			T _c [sec]	2310		
T [min]	55	end simulation	T [min]	55	end simulation	
T [sec]	3300		T [sec]	3300		
	8.64E-05			0.000354		

Detention volume [m³] 395



870	14.5	0.100182	44.33045	870	14.5	0.350618	191.9636	147.633
885	14.75	0.101909	45.85909	885	14.75	0.350618	197.2229	151.364
900	15	0.103636	47.41364	900	15	0.350618	202.4822	155.069
915	15.25	0.105364	48.99409	915	15.25	0.350618	207.7415	158.747
930	15.5	0.107091	50.60045	930	15.5	0.350618	213.0007	162.400
945	15.75	0.108818	52.23273	945	15.75	0.350618	218.26	166.027
960	16	0.110545	53.89091	960	16	0.350618	223.5193	169.628
975	16.25	0.112273	55.575	975	16.25	0.350618	228.7786	173.204
990	16.5	0.114	57.285	990	16.5	0.350618	234.0378	176.753
1005	16.75	0.115727	59.02091	1005	16.75	0.350618	239.2971	180.276
1020	17	0.117455	60.78273	1020	17	0.350618	244.5564	183.774
1035	17.25	0.119182	62.57045	1035	17.25	0.350618	249.8157	187.245
1050	17.5	0.120909	64.38409	1050	17.5	0.350618	255.0749	190.691
1065	17.75	0.122636	66.22364	1065	17.75	0.350618	260.3342	194.111
1080	18	0.124364	68.08909	1080	18	0.350618	265.5935	197.504
1095	18.25	0.126091	69.98045	1095	18.25	0.350618	270.8528	200.872
1110	18.5	0.127818	71.89773	1110	18.5	0.350618	276.1121	204.214
1125	18.75	0.129545	73.84091	1125	18.75	0.350618	281.3713	207.530
1140	19	0.131273	75.81	1140	19	0.350618	286.6306	210.821
1155	19.25	0.133	77.805	1155	19.25	0.350618	291.8899	214.085
1170	19.5	0.134727	79.82591	1170	19.5	0.350618	297.1492	217.323
1185	19.75	0.136455	81.87273	1185	19.75	0.350618	302.4084	220.536
1200	20	0.138182	83.94545	1200	20	0.350618	307.6677	223.722
1215	20.25	0.139909	86.04409	1215	20.25	0.350618	312.927	226.883
1230	20.5	0.141636	88.16864	1230	20.5	0.350618	318.1863	230.018
1245	20.75	0.143364	90.31909	1245	20.75	0.350618	323.4456	233.126
1260	21	0.145091	92.49545	1260	21	0.350618	328.7048	236.209
1275	21.25	0.146818	94.69773	1275	21.25	0.350618	333.9641	239.266
1290	21.5	0.148545	96.92591	1290	21.5	0.350618	339.2234	242.297
1305	21.75	0.150273	99.18	1305	21.75	0.350618	344.4827	245.303
1320	22	0.152	101.46	1320	22	0.350618	349.7419	248.282
1335	22.25	0.153727	103.7659	1335	22.25	0.350618	355.0012	251.235
1350	22.5	0.155455	106.0977	1350	22.5	0.350618	360.2605	254.163
1365	22.75	0.157182	108.4555	1365	22.75	0.350618	365.5198	257.064
1380	23	0.158909	110.8391	1380	23	0.350618	370.779	259.940
1395	23.25	0.160636	113.2486	1395	23.25	0.350618	376.0383	262.790
1410	23.5	0.162364	115.6841	1410	23.5	0.350618	381.2976	265.614
1425	23.75	0.164091	118.1455	1425	23.75	0.350618	386.5569	268.411
1440	24	0.165818	120.6327	1440	24	0.350618	391.8162	271.183
1455	24.25	0.167545	123.1459	1455	24.25	0.350618	397.0754	273.930
1470	24.5	0.169273	125.685	1470	24.5	0.350618	402.3347	276.650
1485	24.75	0.171	128.25	1485	24.75	0.350618	407.594	279.344
1500	25	0.172727	130.8409	1500	25	0.350618	412.8533	282.012
1515	25.25	0.174455	133.4577	1515	25.25	0.350618	418.1125	284.655
1530	25.5	0.176182	136.1005	1530	25.5	0.350618	423.3718	287.271
1545	25.75	0.177909	138.7691	1545	25.75	0.350618	428.6311	289.862
1560	26	0.179636	141.4636	1560	26	0.350618	433.8904	292.427
1575	26.25	0.181364	144.1841	1575	26.25	0.350618	439.1497	294.966
1590	26.5	0.183091	146.9305	1590	26.5	0.350618	444.4089	297.478
1605	26.75	0.184818	149.7027	1605	26.75	0.350618	449.6682	299.965
1620	27	0.186545	152.5009	1620	27	0.350618	454.9275	302.427
1635	27.25	0.188273	155.325	1635	27.25	0.350618	460.1868	304.862
1650	27.5	0.19	158.175	1650	27.5	0.350618	465.446	307.271
1665	27.75	0.191727	161.0509	1665	27.75	0.350618	470.7053	309.654
1680	28	0.193455	163.9527	1680	28	0.350618	475.9646	312.012
1695	28.25	0.195182	166.8805	1695	28.25	0.350618	481.2239	314.343
1710	28.5	0.196909	169.8341	1710	28.5	0.350618	486.4831	316.649
1725	28.75	0.198636	172.8136	1725	28.75	0.350618	491.7424	318.929
1740	29	0.200364	175.8191	1740	29	0.350618	497.0017	321.183
1755	29.25	0.202091	178.8505	1755	29.25	0.350618	502.261	323.411
1770	29.5	0.203818	181.9077	1770	29.5	0.350618	507.5203	325.613
1785	29.75	0.205545	184.9909	1785	29.75	0.350618	512.7795	327.789
1800	30	0.207273	188.1	1800	30	0.350618	518.0388	329.939
1815	30.25	0.209	191.235	1815	30.25	0.350618	523.2981	332.063

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1830	30.5	0.210727	194.3959
1845	30.75	0.212455	197.5827
1860	31	0.214182	200.7955
1875	31.25	0.215909	204.0341
1890	31.5	0.217636	207.2986
1905	31.75	0.219364	210.5891
1920	32	0.221091	213.9055
1935	32.25	0.222818	217.2477
1950	32.5	0.224545	220.6159
1965	32.75	0.226273	224.01
1980	33	0.228	227.43
1995	33.25	0.229727	230.8759
2010	33.5	0.231455	234.3477
2025	33.75	0.233182	237.8455
2040	34	0.234909	241.3691
2055	34.25	0.236636	244.9186
2070	34.5	0.238364	248.4941
2085	34.75	0.240091	252.0955
2100	35	0.241818	255.7227
2115	35.25	0.243545	259.3759
2130	35.5	0.245273	263.055
2145	35.75	0.247	266.76
2160	36	0.248727	270.4909
2175	36.25	0.250455	274.2477
2190	36.5	0.252182	278.0305
2205	36.75	0.253909	281.8391
2220	37	0.255636	285.6736
2235	37.25	0.257364	289.5341
2250	37.5	0.259091	293.4205
2265	37.75	0.260818	297.3327
2280	38	0.262545	301.2709
2295	38.25	0.264273	305.235
2310	38.5	0.266	309.225
2325	38.75	0.267727	313.2409
2340	39	0.269455	317.2827
2355	39.25	0.271182	321.3505
2370	39.5	0.272909	325.4441
2385	39.75	0.274636	329.5636
2400	40	0.276364	333.7091
2415	40.25	0.278091	337.8805
2430	40.5	0.279818	342.0777
2445	40.75	0.281545	346.3009
2460	41	0.283273	350.55
2475	41.25	0.285	354.825

1830	30.5	0.350618	528.5574	334.161
1845	30.75	0.350618	533.8166	336.234
1860	31	0.350618	539.0759	338.280
1875	31.25	0.350618	544.3352	340.301
1890	31.5	0.350618	549.5945	342.296
1905	31.75	0.350618	554.8538	344.265
1920	32	0.350618	560.113	346.208
1935	32.25	0.350618	565.3723	348.125
1950	32.5	0.350618	570.6316	350.016
1965	32.75	0.350618	575.8909	351.881
1980	33	0.350618	581.1501	353.720
1995	33.25	0.350618	586.4094	355.534
2010	33.5	0.350618	591.6687	357.321
2025	33.75	0.350618	596.928	359.083
2040	34	0.350618	602.1872	360.818
2055	34.25	0.350618	607.4465	362.528
2070	34.5	0.350618	612.7058	364.212
2085	34.75	0.350618	617.9651	365.870
2100	35	0.350618	623.2244	367.502
2115	35.25	0.350618	628.4836	369.108
2130	35.5	0.350618	633.7429	370.688
2145	35.75	0.350618	639.0022	372.242
2160	36	0.350618	644.2615	373.771
2175	36.25	0.350618	649.5207	375.273
2190	36.5	0.350618	654.78	376.750
2205	36.75	0.350618	660.0393	378.200
2220	37	0.350618	665.2986	379.625
2235	37.25	0.350618	670.5579	381.024
2250	37.5	0.350618	675.8171	382.397
2265	37.75	0.350618	681.0764	383.744
2280	38	0.350618	686.3357	385.065
2295	38.25	0.350618	691.595	386.360
2310	38.5	0.350618	696.8542	387.629
2325	38.75	0.345306	702.0338	388.793
2340	39	0.339994	707.1337	389.851
2355	39.25	0.334681	712.154	390.804
2370	39.5	0.329369	717.0945	391.650
2385	39.75	0.324056	721.9553	392.392
2400	40	0.318744	726.7365	393.027
2415	40.25	0.313432	731.438	393.558
2430	40.5	0.308119	736.0598	393.982
2445	40.75	0.302807	740.6019	394.301
2460	41	0.297494	745.0643	394.514
2475	41.25	0.292182	749.447	394.622
2490	41.5	0.28687	753.7501	
2505	41.75	0.281557	757.9734	
2520	42	0.276245	762.1171	
2535	42.25	0.270932	766.1811	
2550	42.5	0.26562	770.1654	
2565	42.75	0.260308	774.07	
2580	43	0.254995	777.8949	
2595	43.25	0.249683	781.6402	
2610	43.5	0.24437	785.3057	
2625	43.75	0.239058	788.8916	
2640	44	0.233746	792.3978	
2655	44.25	0.228433	795.8243	
2670	44.5	0.223121	799.1711	
2685	44.75	0.217808	802.4382	
2700	45	0.212496	805.6257	
2715	45.25	0.207184	808.7334	
2730	45.5	0.201871	811.7615	
2745	45.75	0.196559	814.7099	
2760	46	0.191246	817.5786	
2775	46.25	0.185934	820.3676	

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2790	46.5	0.180622	823.0769
2805	46.75	0.175309	825.7065
2820	47	0.169997	828.2565
2835	47.25	0.164684	830.7268
2850	47.5	0.159372	833.1173
2865	47.75	0.15406	835.4282
2880	48	0.148747	837.6594
2895	48.25	0.143435	839.811
2910	48.5	0.138122	841.8828
2925	48.75	0.13281	843.8749
2940	49	0.127498	845.7874
2955	49.25	0.122185	847.6202
2970	49.5	0.116873	849.3733
2985	49.75	0.11156	851.0467
3000	50	0.106248	852.6404
3015	50.25	0.100936	854.1544
3030	50.5	0.095623	855.5888
3045	50.75	0.090311	856.9435
3060	51	0.084998	858.2184
3075	51.25	0.079686	859.4137
3090	51.5	0.074374	860.5293
3105	51.75	0.069061	861.5652
3120	52	0.063749	862.5215
3135	52.25	0.058436	863.398
3150	52.5	0.053124	864.1949
3165	52.75	0.047812	864.9121
3180	53	0.042499	865.5495
3195	53.25	0.037187	866.1073
3210	53.5	0.031874	866.5855
3225	53.75	0.026562	866.9839
3240	54	0.02125	867.3026
3255	54.25	0.015937	867.5417
3270	54.5	0.010625	867.7011
3285	54.75	0.005312	867.7808
3300	55	0	867.7808
3315	55.25	0	867.7808
3330	55.5	0	867.7808
3345	55.75	0	867.7808
3360	56	0	867.7808
3375	56.25	0	867.7808
3390	56.5	0	867.7808
3405	56.75	0	867.7808
3420	57	0	867.7808
3435	57.25	0	867.7808
3450	57.5	0	867.7808
3465	57.75	0	867.7808
3480	58	0	867.7808
3495	58.25	0	867.7808
3510	58.5	0	867.7808
3525	58.75	0	867.7808
3540	59	0	867.7808
3555	59.25	0	867.7808
3570	59.5	0	867.7808
3585	59.75	0	867.7808
3600	60	0	867.7808
3615	60.25	0	867.7808
3630	60.5	0	867.7808
3645	60.75	0	867.7808
3660	61	0	867.7808
3675	61.25	0	867.7808
3690	61.5	0	867.7808
3705	61.75	0	867.7808
3720	62	0	867.7808
3735	62.25	0	867.7808

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3750	62.5	0	867.7808
3765	62.75	0	867.7808
3780	63	0	867.7808
3795	63.25	0	867.7808
3810	63.5	0	867.7808
3825	63.75	0	867.7808
3840	64	0	867.7808
3855	64.25	0	867.7808
3870	64.5	0	867.7808
3885	64.75	0	867.7808
3900	65	0	867.7808
3915	65.25	0	867.7808
3930	65.5	0	867.7808
3945	65.75	0	867.7808
3960	66	0	867.7808
3975	66.25	0	867.7808
3990	66.5	0	867.7808
4005	66.75	0	867.7808
4020	67	0	867.7808
4035	67.25	0	867.7808
4050	67.5	0	867.7808
4065	67.75	0	867.7808
4080	68	0	867.7808
4095	68.25	0	867.7808
4110	68.5	0	867.7808
4125	68.75	0	867.7808
4140	69	0	867.7808
4155	69.25	0	867.7808
4170	69.5	0	867.7808
4185	69.75	0	867.7808
4200	70	0	867.7808
4215	70.25	0	867.7808
4230	70.5	0	867.7808
4245	70.75	0	867.7808
4260	71	0	867.7808
4275	71.25	0	867.7808
4290	71.5	0	867.7808
4305	71.75	0	867.7808
4320	72	0	867.7808
4335	72.25	0	867.7808
4350	72.5	0	867.7808
4365	72.75	0	867.7808
4380	73	0	867.7808
4395	73.25	0	867.7808
4410	73.5	0	867.7808
4425	73.75	0	867.7808
4440	74	0	867.7808
4455	74.25	0	867.7808
4470	74.5	0	867.7808
4485	74.75	0	867.7808

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Detention Volume - sizing - 1% AEP event - OPTION 4

Pre-developed			
t [sec]	t [min]	Q [m³/s]	V [m³]
0	0	0	0
15	0.25	0.001295	0.019432
30	0.5	0.002591	0.058295
45	0.75	0.003886	0.116591
60	1	0.005182	0.194318
75	1.25	0.006477	0.291477
90	1.5	0.007773	0.408068
105	1.75	0.009068	0.544091
120	2	0.010364	0.699545
135	2.25	0.011659	0.874432
150	2.5	0.012955	1.06875
165	2.75	0.01425	1.2825
180	3	0.015545	1.515682
195	3.25	0.016841	1.768295
210	3.5	0.018136	2.040341
225	3.75	0.019432	2.331818
240	4	0.020727	2.642727
255	4.25	0.022023	2.973068
270	4.5	0.023318	3.322841
285	4.75	0.024614	3.692045
300	5	0.025909	4.080682
315	5.25	0.027205	4.48875
330	5.5	0.0285	4.91625
345	5.75	0.029795	5.363182
360	6	0.031091	5.829545
375	6.25	0.032386	6.315341
390	6.5	0.033682	6.820568
405	6.75	0.034977	7.345227
420	7	0.036273	7.889318
435	7.25	0.037568	8.452841
450	7.5	0.038864	9.035795
465	7.75	0.040159	9.638182
480	8	0.041455	10.26
495	8.25	0.04275	10.90125
510	8.5	0.044045	11.56193
525	8.75	0.045341	12.24205
540	9	0.046636	12.94159
555	9.25	0.047932	13.66057
570	9.5	0.049227	14.39898
585	9.75	0.050523	15.15682
600	10	0.051818	15.93409
615	10.25	0.053114	16.7308
630	10.5	0.054409	17.54693
645	10.75	0.055705	18.3825
660	11	0.057	19.2375
675	11.25	0.058295	20.11193
690	11.5	0.059591	21.0058
705	11.75	0.060886	21.91909
720	12	0.062182	22.85182
735	12.25	0.063477	23.80398
750	12.5	0.064773	24.77557
765	12.75	0.066068	25.76659
780	13	0.067364	26.77705
795	13.25	0.068659	27.80693
810	13.5	0.069955	28.85625
825	13.75	0.07125	29.925
840	14	0.072545	31.01318
855	14.25	0.073841	32.1208

Post-developed			
t [sec]	t [min]	Q [m³/s]	V [m³]
0	0	0	0
15	0.25	0.006297	0.094456
30	0.5	0.012594	0.283368
45	0.75	0.018891	0.566736
60	1	0.025188	0.94456
75	1.25	0.031485	1.41684
90	1.5	0.037782	1.983577
105	1.75	0.044079	2.644769
120	2	0.050377	3.400417
135	2.25	0.056674	4.250521
150	2.5	0.062971	5.195082
165	2.75	0.069268	6.234098
180	3	0.075565	7.36757
195	3.25	0.081862	8.595499
210	3.5	0.088159	9.917883
225	3.75	0.094456	11.33472
240	4	0.100753	12.84602
255	4.25	0.10705	14.45177
270	4.5	0.113347	16.15198
285	4.75	0.119644	17.94665
300	5	0.125941	19.83577
315	5.25	0.132238	21.81934
330	5.5	0.138536	23.89738
345	5.75	0.144833	26.06986
360	6	0.15113	28.33681
375	6.25	0.157427	30.69821
390	6.5	0.163724	33.15407
405	6.75	0.170021	35.70438
420	7	0.176318	38.34915
435	7.25	0.182615	41.08837
450	7.5	0.188912	43.92205
465	7.75	0.195209	46.85019
480	8	0.201506	49.87278
495	8.25	0.207803	52.98983
510	8.5	0.2141	56.20134
525	8.75	0.220397	59.5073
540	9	0.226694	62.90772
555	9.25	0.232992	66.40259
570	9.5	0.239289	69.99192
585	9.75	0.245586	73.6757
600	10	0.251883	77.45395
615	10.25	0.25818	81.32664
630	10.5	0.264477	85.2938
645	10.75	0.270774	89.35541
660	11	0.277071	93.51147
675	11.25	0.277071	97.66754
690	11.5	0.277071	101.8236
705	11.75	0.277071	105.9797
720	12	0.277071	110.1357
735	12.25	0.277071	114.2918
750	12.5	0.277071	118.4479
765	12.75	0.277071	122.6039
780	13	0.277071	126.76
795	13.25	0.277071	130.9161
810	13.5	0.277071	135.0721
825	13.75	0.277071	139.2282
840	14	0.277071	143.3843
855	14.25	0.277071	147.5403

Detention tank	
V [m³]	
0	0
0.075	0.075
0.225	0.225
0.450	0.450
0.750	0.750
1.125	1.125
1.576	1.576
2.101	2.101
2.701	2.701
3.376	3.376
4.126	4.126
4.952	4.952
5.852	5.852
6.827	6.827
7.878	7.878
9.003	9.003
10.203	10.203
11.479	11.479
12.829	12.829
14.255	14.255
15.755	15.755
17.331	17.331
18.981	18.981
20.707	20.707
22.507	22.507
24.383	24.383
26.333	26.333
28.359	28.359
30.460	30.460
32.636	32.636
34.886	34.886
37.212	37.212
39.613	39.613
42.089	42.089
44.639	44.639
47.265	47.265
49.966	49.966
52.742	52.742
55.593	55.593
58.519	58.519
61.520	61.520
64.596	64.596
67.747	67.747
70.973	70.973
74.274	74.274
77.556	77.556
80.818	80.818
84.061	84.061
87.284	87.284
90.488	90.488
93.672	93.672
96.837	96.837
99.983	99.983
103.109	103.109
106.216	106.216
109.303	109.303
112.371	112.371
115.420	115.420

Δt [sec] 15

Q₁₀₀ [m³/s] 0.285 Pre-developed

Q₁₀₀ [m³/s] 0.277 Developed

T_c [min] 55.00 peak flow

T_c [min] 11.00 peak flow

T_c [sec] 3300
8.64E-05

T_c [sec] 660
0.00042

T_c [min]

T_c [min] 55.00 end of storm

T_c [sec]

T_c [sec] 3300

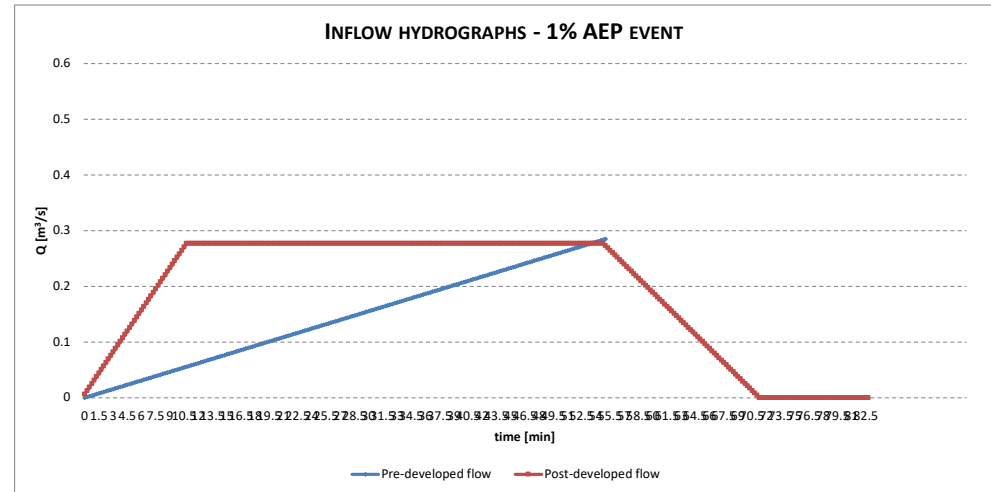
T [min] 71.5 end simulation

T [min] 71.5 end simulation

T [sec] 4290
6.64E-05

T [sec] 4290
0.00028

Detention volume [m³] 353



870	14.5	0.075136	33.24784	870	14.5	0.277071	151.6964	118.449
885	14.75	0.076432	34.39432	885	14.75	0.277071	155.8525	121.458
900	15	0.077727	35.56023	900	15	0.277071	160.0085	124.448
915	15.25	0.079023	36.74557	915	15.25	0.277071	164.1646	127.419
930	15.5	0.080318	37.95034	930	15.5	0.277071	168.3206	130.370
945	15.75	0.081614	39.17455	945	15.75	0.277071	172.4767	133.302
960	16	0.082909	40.41818	960	16	0.277071	176.6328	136.215
975	16.25	0.084205	41.68125	975	16.25	0.277071	180.7888	139.108
990	16.5	0.0855	42.96375	990	16.5	0.277071	184.9449	141.981
1005	16.75	0.086795	44.26568	1005	16.75	0.277071	189.101	144.835
1020	17	0.088091	45.58705	1020	17	0.277071	193.257	147.670
1035	17.25	0.089386	46.92784	1035	17.25	0.277071	197.4131	150.485
1050	17.5	0.090682	48.28807	1050	17.5	0.277071	201.5692	153.281
1065	17.75	0.091977	49.66773	1065	17.75	0.277071	205.7252	156.058
1080	18	0.093273	51.06682	1080	18	0.277071	209.8813	158.814
1095	18.25	0.094568	52.48534	1095	18.25	0.277071	214.0374	161.552
1110	18.5	0.095864	53.9233	1110	18.5	0.277071	218.1934	164.270
1125	18.75	0.097159	55.38068	1125	18.75	0.277071	222.3495	166.969
1140	19	0.098455	56.8575	1140	19	0.277071	226.5056	169.648
1155	19.25	0.09975	58.35375	1155	19.25	0.277071	230.6616	172.308
1170	19.5	0.101045	59.86943	1170	19.5	0.277071	234.8177	174.948
1185	19.75	0.102341	61.40455	1185	19.75	0.277071	238.9738	177.569
1200	20	0.103636	62.95909	1200	20	0.277071	243.1298	180.171
1215	20.25	0.104932	64.53307	1215	20.25	0.277071	247.2859	182.753
1230	20.5	0.106227	66.12648	1230	20.5	0.277071	251.442	185.315
1245	20.75	0.107523	67.73932	1245	20.75	0.277071	255.598	187.859
1260	21	0.108818	69.37159	1260	21	0.277071	259.7541	190.382
1275	21.25	0.110114	71.0233	1275	21.25	0.277071	263.9102	192.887
1290	21.5	0.111409	72.69443	1290	21.5	0.277071	268.0662	195.372
1305	21.75	0.112705	74.385	1305	21.75	0.277071	272.2223	197.837
1320	22	0.114	76.095	1320	22	0.277071	276.3783	200.283
1335	22.25	0.115295	77.82443	1335	22.25	0.277071	280.5344	202.710
1350	22.5	0.116591	79.5733	1350	22.5	0.277071	284.6905	205.117
1365	22.75	0.117886	81.34159	1365	22.75	0.277071	288.8465	207.505
1380	23	0.119182	83.12932	1380	23	0.277071	293.0026	209.873
1395	23.25	0.120477	84.93648	1395	23.25	0.277071	297.1587	212.222
1410	23.5	0.121773	86.76307	1410	23.5	0.277071	301.3147	214.552
1425	23.75	0.123068	88.60909	1425	23.75	0.277071	305.4708	216.862
1440	24	0.124364	90.47455	1440	24	0.277071	309.6269	219.152
1455	24.25	0.125659	92.35943	1455	24.25	0.277071	313.7829	221.424
1470	24.5	0.126955	94.26375	1470	24.5	0.277071	317.939	223.675
1485	24.75	0.12825	96.1875	1485	24.75	0.277071	322.0951	225.908
1500	25	0.129545	98.13068	1500	25	0.277071	326.2511	228.120
1515	25.25	0.130841	100.0933	1515	25.25	0.277071	330.4072	230.314
1530	25.5	0.132136	102.0753	1530	25.5	0.277071	334.5633	232.488
1545	25.75	0.133432	104.0768	1545	25.75	0.277071	338.7193	234.643
1560	26	0.134727	106.0977	1560	26	0.277071	342.8754	236.778
1575	26.25	0.136023	108.1381	1575	26.25	0.277071	347.0315	238.893
1590	26.5	0.137318	110.1978	1590	26.5	0.277071	351.1875	240.990
1605	26.75	0.138614	112.277	1605	26.75	0.277071	355.3436	243.067
1620	27	0.139909	114.3757	1620	27	0.277071	359.4997	245.124
1635	27.25	0.141205	116.4938	1635	27.25	0.277071	363.6557	247.162
1650	27.5	0.1425	118.6313	1650	27.5	0.277071	367.8118	249.181
1665	27.75	0.143795	120.7882	1665	27.75	0.277071	371.9679	251.180
1680	28	0.145091	122.9645	1680	28	0.277071	376.1239	253.159
1695	28.25	0.146386	125.1603	1695	28.25	0.277071	380.28	255.120
1710	28.5	0.147682	127.3756	1710	28.5	0.277071	384.4361	257.060
1725	28.75	0.148977	129.6102	1725	28.75	0.277071	388.5921	258.982
1740	29	0.150273	131.8643	1740	29	0.277071	392.7482	260.884
1755	29.25	0.151568	134.1378	1755	29.25	0.277071	396.9042	262.766
1770	29.5	0.152864	136.4308	1770	29.5	0.277071	401.0603	264.630
1785	29.75	0.154159	138.7432	1785	29.75	0.277071	405.2164	266.473
1800	30	0.155455	141.075	1800	30	0.277071	409.3724	268.297
1815	30.25	0.15675	143.4263	1815	30.25	0.277071	413.5285	270.102

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1830	30.5	0.158045	145.7969	1830	30.5	0.277071	417.6846	271.888
1845	30.75	0.159341	148.187	1845	30.75	0.277071	421.8406	273.654
1860	31	0.160636	150.5966	1860	31	0.277071	425.9967	275.400
1875	31.25	0.161932	153.0256	1875	31.25	0.277071	430.1528	277.127
1890	31.5	0.163227	155.474	1890	31.5	0.277071	434.3088	278.835
1905	31.75	0.164523	157.9418	1905	31.75	0.277071	438.4649	280.523
1920	32	0.165818	160.4291	1920	32	0.277071	442.621	282.192
1935	32.25	0.167114	162.9358	1935	32.25	0.277071	446.777	283.841
1950	32.5	0.168409	165.4619	1950	32.5	0.277071	450.9331	285.471
1965	32.75	0.169705	168.0075	1965	32.75	0.277071	455.0892	287.082
1980	33	0.171	170.5725	1980	33	0.277071	459.2452	288.673
1995	33.25	0.172295	173.1569	1995	33.25	0.277071	463.4013	290.244
2010	33.5	0.173591	175.7608	2010	33.5	0.277071	467.5574	291.797
2025	33.75	0.174886	178.3841	2025	33.75	0.277071	471.7134	293.329
2040	34	0.176182	181.0268	2040	34	0.277071	475.8695	294.843
2055	34.25	0.177477	183.689	2055	34.25	0.277071	480.0256	296.337
2070	34.5	0.178773	186.3706	2070	34.5	0.277071	484.1816	297.811
2085	34.75	0.180068	189.0716	2085	34.75	0.277071	488.3377	299.266
2100	35	0.181364	191.792	2100	35	0.277071	492.4938	300.702
2115	35.25	0.182659	194.5319	2115	35.25	0.277071	496.6498	302.118
2130	35.5	0.183955	197.2913	2130	35.5	0.277071	500.8059	303.515
2145	35.75	0.18525	200.07	2145	35.75	0.277071	504.9619	304.892
2160	36	0.186545	202.8682	2160	36	0.277071	509.118	306.250
2175	36.25	0.187841	205.6858	2175	36.25	0.277071	513.2741	307.588
2190	36.5	0.189136	208.5228	2190	36.5	0.277071	517.4301	308.907
2205	36.75	0.190432	211.3793	2205	36.75	0.277071	521.5862	310.207
2220	37	0.191727	214.2552	2220	37	0.277071	525.7423	311.487
2235	37.25	0.193023	217.1506	2235	37.25	0.277071	529.8983	312.748
2250	37.5	0.194318	220.0653	2250	37.5	0.277071	534.0544	313.989
2265	37.75	0.195614	222.9995	2265	37.75	0.277071	538.2105	315.211
2280	38	0.196909	225.9532	2280	38	0.277071	542.3665	316.413
2295	38.25	0.198205	228.9263	2295	38.25	0.277071	546.5226	317.596
2310	38.5	0.1995	231.9188	2310	38.5	0.277071	550.6787	318.760
2325	38.75	0.200795	234.9307	2325	38.75	0.277071	554.8347	319.904
2340	39	0.202091	237.962	2340	39	0.277071	558.9908	321.029
2355	39.25	0.203386	241.0128	2355	39.25	0.277071	563.1469	322.134
2370	39.5	0.204682	244.0831	2370	39.5	0.277071	567.3029	323.220
2385	39.75	0.205977	247.1727	2385	39.75	0.277071	571.459	324.286
2400	40	0.207273	250.2818	2400	40	0.277071	575.6151	325.333
2415	40.25	0.208568	253.4103	2415	40.25	0.277071	579.7711	326.361
2430	40.5	0.209864	256.5583	2430	40.5	0.277071	583.9272	327.369
2445	40.75	0.211159	259.7257	2445	40.75	0.277071	588.0833	328.358
2460	41	0.212455	262.9125	2460	41	0.277071	592.2393	329.327
2475	41.25	0.21375	266.1188	2475	41.25	0.277071	596.3954	330.277
2490	41.5	0.215045	269.3444	2490	41.5	0.277071	600.5515	331.207
2505	41.75	0.216341	272.5895	2505	41.75	0.277071	604.7075	332.118
2520	42	0.217636	275.8541	2520	42	0.277071	608.8636	333.009
2535	42.25	0.218932	279.1381	2535	42.25	0.277071	613.0196	333.882
2550	42.5	0.220227	282.4415	2550	42.5	0.277071	617.1757	334.734
2565	42.75	0.221523	285.7643	2565	42.75	0.277071	621.3318	335.567
2580	43	0.222818	289.1066	2580	43	0.277071	625.4878	336.381
2595	43.25	0.224114	292.4683	2595	43.25	0.277071	629.6439	337.176
2610	43.5	0.225409	295.8494	2610	43.5	0.277071	633.8	337.951
2625	43.75	0.226705	299.25	2625	43.75	0.277071	637.956	338.706
2640	44	0.228	302.67	2640	44	0.277071	642.1121	339.442
2655	44.25	0.229295	306.1094	2655	44.25	0.277071	646.2682	340.159
2670	44.5	0.230591	309.5683	2670	44.5	0.277071	650.4242	340.856
2685	44.75	0.231886	313.0466	2685	44.75	0.277071	654.5803	341.534
2700	45	0.233182	316.5443	2700	45	0.277071	658.7364	342.192
2715	45.25	0.234477	320.0615	2715	45.25	0.277071	662.8924	342.831
2730	45.5	0.235773	323.5981	2730	45.5	0.277071	667.0485	343.450
2745	45.75	0.237068	327.1541	2745	45.75	0.277071	671.2046	344.050
2760	46	0.238364	330.7295	2760	46	0.277071	675.3606	344.631
2775	46.25	0.239659	334.3244	2775	46.25	0.277071	679.5167	345.192

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2790 46.5 0.240955 337.9388
 2805 46.75 0.24225 341.5725
 2820 47 0.243545 345.2257
 2835 47.25 0.244841 348.8983
 2850 47.5 0.246136 352.5903
 2865 47.75 0.247432 356.3018
 2880 48 0.248727 360.0327
 2895 48.25 0.250023 363.7831
 2910 48.5 0.251318 367.5528
 2925 48.75 0.252614 371.342
 2940 49 0.253909 375.1507
 2955 49.25 0.255205 378.9788
 2970 49.5 0.2565 382.8263
 2985 49.75 0.257795 386.6932
 3000 50 0.259091 390.5795
 3015 50.25 0.260386 394.4853
 3030 50.5 0.261682 398.4106
 3045 50.75 0.262977 402.3552
 3060 51 0.264273 406.3193
 3075 51.25 0.265568 410.3028
 3090 51.5 0.266864 414.3058
 3105 51.75 0.268159 418.3282
 3120 52 0.269455 422.37
 3135 52.25 0.27075 426.4313
 3150 52.5 0.272045 430.5119
 3165 52.75 0.273341 434.612
 3180 53 0.274636 438.7316
 3195 53.25 0.275932 442.8706
 3210 53.5 0.277227 447.029
 3225 53.75 0.278523 451.2068
 3240 54 0.279818 455.4041
 3255 54.25 0.281114 459.6208
 3270 54.5 0.282409 463.8569
 3285 54.75 0.283705 468.1125
 3300 55 0.285 472.3875

2790 46.5 0.277071 683.6728 345.734
 2805 46.75 0.277071 687.8288 346.256
 2820 47 0.277071 691.9849 346.759
 2835 47.25 0.277071 696.141 347.243
 2850 47.5 0.277071 700.297 347.707
 2865 47.75 0.277071 704.4531 348.151
 2880 48 0.277071 708.6092 348.576
 2895 48.25 0.277071 712.7652 348.982
 2910 48.5 0.277071 716.9213 349.368
 2925 48.75 0.277071 721.0773 349.735
 2940 49 0.277071 725.2334 350.083
 2955 49.25 0.277071 729.3895 350.411
 2970 49.5 0.277071 733.5455 350.719
 2985 49.75 0.277071 737.7016 351.008
 3000 50 0.277071 741.8577 351.278
 3015 50.25 0.277071 746.0137 351.528
 3030 50.5 0.277071 750.1698 351.759
 3045 50.75 0.277071 754.3259 351.971
 3060 51 0.277071 758.4819 352.163
 3075 51.25 0.277071 762.638 352.335
 3090 51.5 0.277071 766.7941 352.488
 3105 51.75 0.277071 770.9501 352.622
 3120 52 0.277071 775.1062 352.736
 3135 52.25 0.277071 779.2623 352.831
 3150 52.5 0.277071 783.4183 352.906
 3165 52.75 0.277071 787.5744 352.962
 3180 53 0.277071 791.7305 352.999
 3195 53.25 0.277071 795.8865 353.016
 3210 53.5 0.277071 800.0426 353.014
 3225 53.75 0.277071 804.1987 352.992
 3240 54 0.277071 808.3547 352.951
 3255 54.25 0.277071 812.5108 352.890
 3270 54.5 0.277071 816.6669 352.810
 3285 54.75 0.277071 820.8229 352.710
 3300 55 0.277071 824.979 352.591
 3315 55.25 0.272873 829.0721
 3330 55.5 0.268675 833.1022
 3345 55.75 0.264477 837.0694
 3360 56 0.260279 840.9735
 3375 56.25 0.256081 844.8148
 3390 56.5 0.251883 848.593
 3405 56.75 0.247685 852.3083
 3420 57 0.243487 855.9606
 3435 57.25 0.239289 859.5499
 3450 57.5 0.235091 863.0762
 3465 57.75 0.230893 866.5396
 3480 58 0.226694 869.9401
 3495 58.25 0.222496 873.2775
 3510 58.5 0.218298 876.552
 3525 58.75 0.2141 879.7635
 3540 59 0.209902 882.912
 3555 59.25 0.205704 885.9976
 3570 59.5 0.201506 889.0202
 3585 59.75 0.197308 891.9798
 3600 60 0.19311 894.8764
 3615 60.25 0.188912 897.7101
 3630 60.5 0.184714 900.4808
 3645 60.75 0.180516 903.1886
 3660 61 0.176318 905.8333
 3675 61.25 0.17212 908.4151
 3690 61.5 0.167922 910.934
 3705 61.75 0.163724 913.3898
 3720 62 0.159526 915.7827
 3735 62.25 0.155328 918.1126

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3750	62.5	0.15113	920.3796
3765	62.75	0.146932	922.5835
3780	63	0.142734	924.7246
3795	63.25	0.138536	926.8026
3810	63.5	0.134337	928.8176
3825	63.75	0.130139	930.7697
3840	64	0.125941	932.6589
3855	64.25	0.121743	934.485
3870	64.5	0.117545	936.2482
3885	64.75	0.113347	937.9484
3900	65	0.109149	939.5856
3915	65.25	0.104951	941.1599
3930	65.5	0.100753	942.6712
3945	65.75	0.096555	944.1195
3960	66	0.092357	945.5049
3975	66.25	0.088159	946.8273
3990	66.5	0.083961	948.0867
4005	66.75	0.079763	949.2831
4020	67	0.075565	950.4166
4035	67.25	0.071367	951.4871
4050	67.5	0.067169	952.4946
4065	67.75	0.062971	953.4392
4080	68	0.058773	954.3208
4095	68.25	0.054575	955.1394
4110	68.5	0.050377	955.895
4125	68.75	0.046179	956.5877
4140	69	0.04198	957.2174
4155	69.25	0.037782	957.7842
4170	69.5	0.033584	958.2879
4185	69.75	0.029386	958.7287
4200	70	0.025188	959.1065
4215	70.25	0.02099	959.4214
4230	70.5	0.016792	959.6733
4245	70.75	0.012594	959.8622
4260	71	0.008396	959.9881
4275	71.25	0.004198	960.0511
4290	71.5	0	960.0511
4305	71.75	0	960.0511
4320	72	0	960.0511
4335	72.25	0	960.0511
4350	72.5	0	960.0511
4365	72.75	0	960.0511
4380	73	0	960.0511
4395	73.25	0	960.0511
4410	73.5	0	960.0511
4425	73.75	0	960.0511
4440	74	0	960.0511
4455	74.25	0	960.0511
4470	74.5	0	960.0511
4485	74.75	0	960.0511
4500	75	0	960.0511
4515	75.25	0	960.0511
4530	75.5	0	960.0511
4545	75.75	0	960.0511
4560	76	0	960.0511
4575	76.25	0	960.0511
4590	76.5	0	960.0511
4605	76.75	0	960.0511
4620	77	0	960.0511
4635	77.25	0	960.0511
4650	77.5	0	960.0511
4665	77.75	0	960.0511
4680	78	0	960.0511
4695	78.25	0	960.0511

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4710	78.5	0	960.0511
4725	78.75	0	960.0511
4740	79	0	960.0511
4755	79.25	0	960.0511
4770	79.5	0	960.0511
4785	79.75	0	960.0511
4800	80	0	960.0511
4815	80.25	0	960.0511
4830	80.5	0	960.0511
4845	80.75	0	960.0511
4860	81	0	960.0511
4875	81.25	0	960.0511
4890	81.5	0	960.0511
4905	81.75	0	960.0511
4920	82	0	960.0511
4935	82.25	0	960.0511
4950	82.5	0	960.0511
4965	82.75	0	960.0511
4980	83	0	960.0511

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Detention Volume - sizing - 1% AEP event - OPTION 4

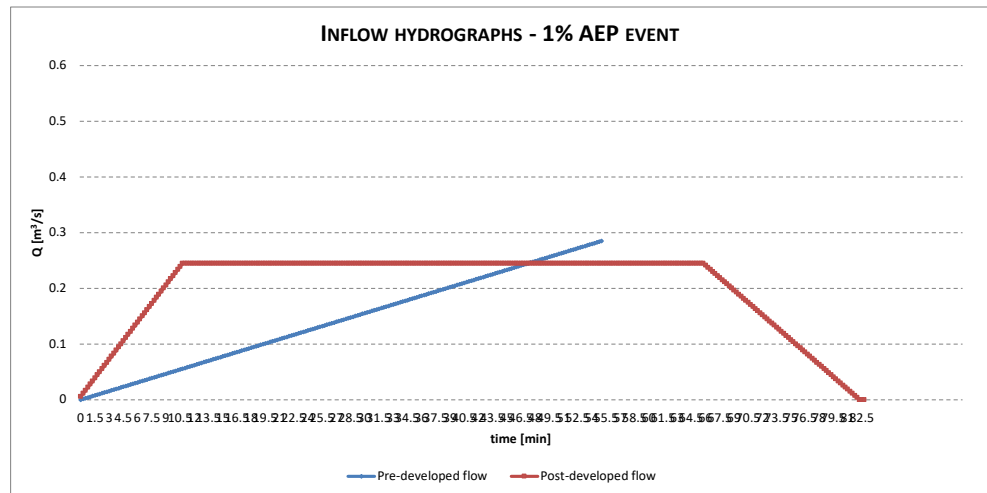
Pre-developed			
t [sec]	t [min]	Q [m³/s]	V [m³]
0	0	0	0
15	0.25	0.001295	0.019432
30	0.5	0.002591	0.058295
45	0.75	0.003886	0.116591
60	1	0.005182	0.194318
75	1.25	0.006477	0.291477
90	1.5	0.007773	0.408068
105	1.75	0.009068	0.544091
120	2	0.010364	0.699545
135	2.25	0.011659	0.874432
150	2.5	0.012955	1.06875
165	2.75	0.01425	1.2825
180	3	0.015545	1.515682
195	3.25	0.016841	1.768295
210	3.5	0.018136	2.040341
225	3.75	0.019432	2.331818
240	4	0.020727	2.642727
255	4.25	0.022023	2.973068
270	4.5	0.023318	3.322841
285	4.75	0.024614	3.692045
300	5	0.025909	4.080682
315	5.25	0.027205	4.48875
330	5.5	0.0285	4.91625
345	5.75	0.029795	5.363182
360	6	0.031091	5.829545
375	6.25	0.032386	6.315341
390	6.5	0.033682	6.820568
405	6.75	0.034977	7.345227
420	7	0.036273	7.889318
435	7.25	0.037568	8.452841
450	7.5	0.038864	9.035795
465	7.75	0.040159	9.638182
480	8	0.041455	10.26
495	8.25	0.04275	10.90125
510	8.5	0.044045	11.56193
525	8.75	0.045341	12.24205
540	9	0.046636	12.94159
555	9.25	0.047932	13.66057
570	9.5	0.049227	14.39898
585	9.75	0.050523	15.15682
600	10	0.051818	15.93409
615	10.25	0.053114	16.7308
630	10.5	0.054409	17.54693
645	10.75	0.055705	18.3825
660	11	0.057	19.2375
675	11.25	0.058295	20.11193
690	11.5	0.059591	21.0058
705	11.75	0.060886	21.91909
720	12	0.062182	22.85182
735	12.25	0.063477	23.80398
750	12.5	0.064773	24.77557
765	12.75	0.066068	25.76659
780	13	0.067364	26.77705
795	13.25	0.068659	27.80693
810	13.5	0.069955	28.85625
825	13.75	0.07125	29.925
840	14	0.072545	31.01318
855	14.25	0.073841	32.1208

Post-developed			
t [sec]	t [min]	Q [m³/s]	V [m³]
0	0	0	0
15	0.25	0.005562	0.083433
30	0.5	0.011124	0.250298
45	0.75	0.016687	0.500595
60	1	0.022249	0.834326
75	1.25	0.027811	1.251488
90	1.5	0.033373	1.752084
105	1.75	0.038935	2.336112
120	2	0.044497	3.003572
135	2.25	0.05006	3.754465
150	2.5	0.055622	4.588791
165	2.75	0.061184	5.506549
180	3	0.066746	6.50774
195	3.25	0.072308	7.592363
210	3.5	0.07787	8.760419
225	3.75	0.083433	10.01191
240	4	0.088995	11.34683
255	4.25	0.094557	12.76518
270	4.5	0.100119	14.26697
285	4.75	0.105681	15.85219
300	5	0.111243	17.52084
315	5.25	0.116806	19.27292
330	5.5	0.122368	21.10844
345	5.75	0.12793	23.02739
360	6	0.133492	25.02977
375	6.25	0.139054	27.11558
390	6.5	0.144616	29.28483
405	6.75	0.150179	31.53751
420	7	0.155741	33.87362
435	7.25	0.161303	36.29316
450	7.5	0.166865	38.79614
465	7.75	0.172427	41.38255
480	8	0.177989	44.05239
495	8.25	0.183552	46.80567
510	8.5	0.189114	49.64237
525	8.75	0.194676	52.56251
540	9	0.200238	55.56608
555	9.25	0.2058	58.65309
570	9.5	0.211362	61.82353
585	9.75	0.216925	65.0774
600	10	0.222487	68.4147
615	10.25	0.228049	71.83543
630	10.5	0.233611	75.3396
645	10.75	0.239173	78.9272
660	11	0.244736	82.59823
675	11.25	0.244736	86.26927
690	11.5	0.244736	89.9403
705	11.75	0.244736	93.61133
720	12	0.244736	97.28236
735	12.25	0.244736	100.9534
750	12.5	0.244736	104.6244
765	12.75	0.244736	108.2955
780	13	0.244736	111.9665
795	13.25	0.244736	115.6375
810	13.5	0.244736	119.3086
825	13.75	0.244736	122.9796
840	14	0.244736	126.6506
855	14.25	0.244736	130.3217

Detention tank	
V [m³]	
0	0
0.064	0.064
0.192	0.192
0.384	0.384
0.640	0.640
0.960	0.960
1.344	1.344
1.792	1.792
2.304	2.304
2.880	2.880
3.520	3.520
4.224	4.224
4.992	4.992
5.824	5.824
6.720	6.720
7.680	7.680
8.704	8.704
9.792	9.792
10.944	10.944
12.160	12.160
13.440	13.440
14.784	14.784
16.192	16.192
17.664	17.664
19.200	19.200
20.800	20.800
22.464	22.464
24.192	24.192
25.984	25.984
27.840	27.840
29.760	29.760
31.744	31.744
33.792	33.792
35.904	35.904
38.080	38.080
40.320	40.320
42.624	42.624
44.993	44.993
47.425	47.425
49.921	49.921
52.481	52.481
55.105	55.105
57.793	57.793
60.545	60.545
63.361	63.361
66.157	66.157
68.935	68.935
71.692	71.692
74.431	74.431
77.149	77.149
79.849	79.849
82.529	82.529
85.189	85.189
87.831	87.831
90.452	90.452
93.055	93.055
95.637	95.637
98.201	98.201

		Δt [sec]	15
Q ₁₀₀ [m³/s]	0.285	Pre-developed	Q ₁₀₀ [m³/s] 0.245 Developed
T _c [min]	55.00	peak flow	T _c [min] 11.00 peak flow
T _c [sec]	3300		T _c [sec] 660
	8.64E-05		0.000371
T _c [min]			T _c [min] 66.00 end of storm
T _c [sec]			T _c [sec] 3960
T [min]	82.5	end simulation	T [min] 82.5 end simulation
T [sec]	4950		T [sec] 4950
	5.76E-05		0.000247

Detention volume [m³] 266



870	14.5	0.075136	33.24784	870	14.5	0.244736	133.9927	100.745
885	14.75	0.076432	34.39432	885	14.75	0.244736	137.6637	103.269
900	15	0.077727	35.56023	900	15	0.244736	141.3348	105.775
915	15.25	0.079023	36.74557	915	15.25	0.244736	145.0058	108.260
930	15.5	0.080318	37.95034	930	15.5	0.244736	148.6768	110.726
945	15.75	0.081614	39.17455	945	15.75	0.244736	152.3479	113.173
960	16	0.082909	40.41818	960	16	0.244736	156.0189	115.601
975	16.25	0.084205	41.68125	975	16.25	0.244736	159.6899	118.009
990	16.5	0.0855	42.96375	990	16.5	0.244736	163.361	120.397
1005	16.75	0.086795	44.26568	1005	16.75	0.244736	167.032	122.766
1020	17	0.088091	45.58705	1020	17	0.244736	170.703	125.116
1035	17.25	0.089386	46.92784	1035	17.25	0.244736	174.374	127.446
1050	17.5	0.090682	48.28807	1050	17.5	0.244736	178.0451	129.757
1065	17.75	0.091977	49.66773	1065	17.75	0.244736	181.7161	132.048
1080	18	0.093273	51.06682	1080	18	0.244736	185.3871	134.320
1095	18.25	0.094568	52.48534	1095	18.25	0.244736	189.0582	136.573
1110	18.5	0.095864	53.9233	1110	18.5	0.244736	192.7292	138.806
1125	18.75	0.097159	55.38068	1125	18.75	0.244736	196.4002	141.020
1140	19	0.098455	56.8575	1140	19	0.244736	200.0713	143.214
1155	19.25	0.09975	58.35375	1155	19.25	0.244736	203.7423	145.389
1170	19.5	0.101045	59.86943	1170	19.5	0.244736	207.4133	147.544
1185	19.75	0.102341	61.40455	1185	19.75	0.244736	211.0844	149.680
1200	20	0.103636	62.95909	1200	20	0.244736	214.7554	151.796
1215	20.25	0.104932	64.53307	1215	20.25	0.244736	218.4264	153.893
1230	20.5	0.106227	66.12648	1230	20.5	0.244736	222.0975	155.971
1245	20.75	0.107523	67.73932	1245	20.75	0.244736	225.7685	158.029
1260	21	0.108818	69.37159	1260	21	0.244736	229.4395	160.068
1275	21.25	0.110114	71.0233	1275	21.25	0.244736	233.1106	162.087
1290	21.5	0.111409	72.69443	1290	21.5	0.244736	236.7816	164.087
1305	21.75	0.112705	74.385	1305	21.75	0.244736	240.4526	166.068
1320	22	0.114	76.095	1320	22	0.244736	244.1237	168.029
1335	22.25	0.115295	77.82443	1335	22.25	0.244736	247.7947	169.970
1350	22.5	0.116591	79.5733	1350	22.5	0.244736	251.4657	171.892
1365	22.75	0.117886	81.34159	1365	22.75	0.244736	255.1368	173.795
1380	23	0.119182	83.12932	1380	23	0.244736	258.8078	175.678
1395	23.25	0.120477	84.93648	1395	23.25	0.244736	262.4788	177.542
1410	23.5	0.121773	86.76307	1410	23.5	0.244736	266.1499	179.387
1425	23.75	0.123068	88.60909	1425	23.75	0.244736	269.8209	181.212
1440	24	0.124364	90.47455	1440	24	0.244736	273.4919	183.017
1455	24.25	0.125659	92.35943	1455	24.25	0.244736	277.163	184.804
1470	24.5	0.126955	94.26375	1470	24.5	0.244736	280.834	186.570
1485	24.75	0.12825	96.1875	1485	24.75	0.244736	284.505	188.318
1500	25	0.129545	98.13068	1500	25	0.244736	288.1761	190.045
1515	25.25	0.130841	100.0933	1515	25.25	0.244736	291.8471	191.754
1530	25.5	0.132136	102.0753	1530	25.5	0.244736	295.5181	193.443
1545	25.75	0.133432	104.0768	1545	25.75	0.244736	299.1892	195.112
1560	26	0.134727	106.0977	1560	26	0.244736	302.8602	196.762
1575	26.25	0.136023	108.1381	1575	26.25	0.244736	306.5312	198.393
1590	26.5	0.137318	110.1978	1590	26.5	0.244736	310.2023	200.004
1605	26.75	0.138614	112.277	1605	26.75	0.244736	313.8733	201.596
1620	27	0.139909	114.3757	1620	27	0.244736	317.5443	203.169
1635	27.25	0.141205	116.4938	1635	27.25	0.244736	321.2154	204.722
1650	27.5	0.1425	118.6313	1650	27.5	0.244736	324.8864	206.255
1665	27.75	0.143795	120.7882	1665	27.75	0.244736	328.5574	207.769
1680	28	0.145091	122.9645	1680	28	0.244736	332.2285	209.264
1695	28.25	0.146386	125.1603	1695	28.25	0.244736	335.8995	210.739
1710	28.5	0.147682	127.3756	1710	28.5	0.244736	339.5705	212.195
1725	28.75	0.148977	129.6102	1725	28.75	0.244736	343.2415	213.631
1740	29	0.150273	131.8643	1740	29	0.244736	346.9126	215.048
1755	29.25	0.151568	134.1378	1755	29.25	0.244736	350.5836	216.446
1770	29.5	0.152864	136.4308	1770	29.5	0.244736	354.2546	217.824
1785	29.75	0.154159	138.7432	1785	29.75	0.244736	357.9257	219.182
1800	30	0.155455	141.075	1800	30	0.244736	361.5967	220.522
1815	30.25	0.15675	143.4263	1815	30.25	0.244736	365.2677	221.841

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1830	30.5	0.158045	145.7969
1845	30.75	0.159341	148.187
1860	31	0.160636	150.5966
1875	31.25	0.161932	153.0256
1890	31.5	0.163227	155.474
1905	31.75	0.164523	157.9418
1920	32	0.165818	160.4291
1935	32.25	0.167114	162.9358
1950	32.5	0.168409	165.4619
1965	32.75	0.169705	168.0075
1980	33	0.171	170.5725
1995	33.25	0.172295	173.1569
2010	33.5	0.173591	175.7608
2025	33.75	0.174886	178.3841
2040	34	0.176182	181.0268
2055	34.25	0.177477	183.689
2070	34.5	0.178773	186.3706
2085	34.75	0.180068	189.0716
2100	35	0.181364	191.792
2115	35.25	0.182659	194.5319
2130	35.5	0.183955	197.2913
2145	35.75	0.18525	200.07
2160	36	0.186545	202.8682
2175	36.25	0.187841	205.6858
2190	36.5	0.189136	208.5228
2205	36.75	0.190432	211.3793
2220	37	0.191727	214.2552
2235	37.25	0.193023	217.1506
2250	37.5	0.194318	220.0653
2265	37.75	0.195614	222.9995
2280	38	0.196909	225.9532
2295	38.25	0.198205	228.9263
2310	38.5	0.1995	231.9188
2325	38.75	0.200795	234.9307
2340	39	0.202091	237.962
2355	39.25	0.203386	241.0128
2370	39.5	0.204682	244.0831
2385	39.75	0.205977	247.1727
2400	40	0.207273	250.2818
2415	40.25	0.208568	253.4103
2430	40.5	0.209864	256.5583
2445	40.75	0.211159	259.7257
2460	41	0.212455	262.9125
2475	41.25	0.21375	266.1188
2490	41.5	0.215045	269.3444
2505	41.75	0.216341	272.5895
2520	42	0.217636	275.8541
2535	42.25	0.218932	279.1381
2550	42.5	0.220227	282.4415
2565	42.75	0.221523	285.7643
2580	43	0.222818	289.1066
2595	43.25	0.224114	292.4683
2610	43.5	0.225409	295.8494
2625	43.75	0.226705	299.25
2640	44	0.228	302.67
2655	44.25	0.229295	306.1094
2670	44.5	0.230591	309.5683
2685	44.75	0.231886	313.0466
2700	45	0.233182	316.5443
2715	45.25	0.234477	320.0615
2730	45.5	0.235773	323.5981
2745	45.75	0.237068	327.1541
2760	46	0.238364	330.7295
2775	46.25	0.239659	334.3244

1830	30.5	0.244736	368.9388	223.142
1845	30.75	0.244736	372.6098	224.423
1860	31	0.244736	376.2808	225.684
1875	31.25	0.244736	379.9519	226.926
1890	31.5	0.244736	383.6229	228.149
1905	31.75	0.244736	387.2939	229.352
1920	32	0.244736	390.965	230.536
1935	32.25	0.244736	394.636	231.700
1950	32.5	0.244736	398.307	232.845
1965	32.75	0.244736	401.9781	233.971
1980	33	0.244736	405.6491	235.077
1995	33.25	0.244736	409.3201	236.163
2010	33.5	0.244736	412.9912	237.230
2025	33.75	0.244736	416.6622	238.278
2040	34	0.244736	420.3332	239.306
2055	34.25	0.244736	424.0043	240.315
2070	34.5	0.244736	427.6753	241.305
2085	34.75	0.244736	431.3463	242.275
2100	35	0.244736	435.0174	243.225
2115	35.25	0.244736	438.6884	244.156
2130	35.5	0.244736	442.3594	245.068
2145	35.75	0.244736	446.0305	245.960
2160	36	0.244736	449.7015	246.833
2175	36.25	0.244736	453.3725	247.687
2190	36.5	0.244736	457.0436	248.521
2205	36.75	0.244736	460.7146	249.335
2220	37	0.244736	464.3856	250.130
2235	37.25	0.244736	468.0567	250.906
2250	37.5	0.244736	471.7277	251.662
2265	37.75	0.244736	475.3987	252.399
2280	38	0.244736	479.0698	253.117
2295	38.25	0.244736	482.7408	253.815
2310	38.5	0.244736	486.4118	254.493
2325	38.75	0.244736	490.0829	255.152
2340	39	0.244736	493.7539	255.792
2355	39.25	0.244736	497.4249	256.412
2370	39.5	0.244736	501.096	257.013
2385	39.75	0.244736	504.767	257.594
2400	40	0.244736	508.438	258.156
2415	40.25	0.244736	512.109	258.699
2430	40.5	0.244736	515.7801	259.222
2445	40.75	0.244736	519.4511	259.725
2460	41	0.244736	523.1221	260.210
2475	41.25	0.244736	526.7932	260.674
2490	41.5	0.244736	530.4642	261.120
2505	41.75	0.244736	534.1352	261.546
2520	42	0.244736	537.8063	261.952
2535	42.25	0.244736	541.4773	262.339
2550	42.5	0.244736	545.1483	262.707
2565	42.75	0.244736	548.8194	263.055
2580	43	0.244736	552.4904	263.384
2595	43.25	0.244736	556.1614	263.693
2610	43.5	0.244736	559.8325	263.983
2625	43.75	0.244736	563.5035	264.254
2640	44	0.244736	567.1745	264.505
2655	44.25	0.244736	570.8456	264.736
2670	44.5	0.244736	574.5166	264.948
2685	44.75	0.244736	578.1876	265.141
2700	45	0.244736	581.8587	265.314
2715	45.25	0.244736	585.5297	265.468
2730	45.5	0.244736	589.2007	265.603
2745	45.75	0.244736	592.8718	265.718
2760	46	0.244736	596.5428	265.813
2775	46.25	0.244736	600.2138	265.889

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2790	46.5	0.240955	337.9388
2805	46.75	0.24225	341.5725
2820	47	0.243545	345.2257
2835	47.25	0.244841	348.8983
2850	47.5	0.246136	352.5903
2865	47.75	0.247432	356.3018
2880	48	0.248727	360.0327
2895	48.25	0.250023	363.7831
2910	48.5	0.251318	367.5528
2925	48.75	0.252614	371.342
2940	49	0.253909	375.1507
2955	49.25	0.255205	378.9788
2970	49.5	0.2565	382.8263
2985	49.75	0.257795	386.6932
3000	50	0.259091	390.5795
3015	50.25	0.260386	394.4853
3030	50.5	0.261682	398.4106
3045	50.75	0.262977	402.3552
3060	51	0.264273	406.3193
3075	51.25	0.265568	410.3028
3090	51.5	0.266864	414.3058
3105	51.75	0.268159	418.3282
3120	52	0.269455	422.37
3135	52.25	0.27075	426.4313
3150	52.5	0.272045	430.5119
3165	52.75	0.273341	434.612
3180	53	0.274636	438.7316
3195	53.25	0.275932	442.8706
3210	53.5	0.277227	447.029
3225	53.75	0.278523	451.2068
3240	54	0.279818	455.4041
3255	54.25	0.281114	459.6208
3270	54.5	0.282409	463.8569
3285	54.75	0.283705	468.1125
3300	55	0.285	472.3875

2790	46.5	0.244736	603.8849	265.946
2805	46.75	0.244736	607.5559	265.983
2820	47	0.244736	611.2269	266.001
2835	47.25	0.244736	614.898	266.000
2850	47.5	0.244736	618.569	265.979
2865	47.75	0.244736	622.24	265.938
2880	48	0.244736	625.9111	265.878
2895	48.25	0.244736	629.5821	265.799
2910	48.5	0.244736	633.2531	265.700
2925	48.75	0.244736	636.9242	265.582
2940	49	0.244736	640.5952	265.445
2955	49.25	0.244736	644.2662	265.287
2970	49.5	0.244736	647.9373	265.111
2985	49.75	0.244736	651.6083	264.915
3000	50	0.244736	655.2793	264.700
3015	50.25	0.244736	658.9504	264.465
3030	50.5	0.244736	662.6214	264.211
3045	50.75	0.244736	666.2924	263.937
3060	51	0.244736	669.9634	263.644
3075	51.25	0.244736	673.6345	263.332
3090	51.5	0.244736	677.3055	263.000
3105	51.75	0.244736	680.9765	262.648
3120	52	0.244736	684.6476	262.278
3135	52.25	0.244736	688.3186	261.887
3150	52.5	0.244736	691.9896	261.478
3165	52.75	0.244736	695.6607	261.049
3180	53	0.244736	699.3317	260.600
3195	53.25	0.244736	703.0027	260.132
3210	53.5	0.244736	706.6738	259.645
3225	53.75	0.244736	710.3448	259.138
3240	54	0.244736	714.0158	258.612
3255	54.25	0.244736	717.6869	258.066
3270	54.5	0.244736	721.3579	257.501
3285	54.75	0.244736	725.0289	256.916
3300	55	0.244736	728.7	256.312
3315	55.25	0.244736	732.371	
3330	55.5	0.244736	736.042	
3345	55.75	0.244736	739.7131	
3360	56	0.244736	743.3841	
3375	56.25	0.244736	747.0551	
3390	56.5	0.244736	750.7262	
3405	56.75	0.244736	754.3972	
3420	57	0.244736	758.0682	
3435	57.25	0.244736	761.7393	
3450	57.5	0.244736	765.4103	
3465	57.75	0.244736	769.0813	
3480	58	0.244736	772.7524	
3495	58.25	0.244736	776.4234	
3510	58.5	0.244736	780.0944	
3525	58.75	0.244736	783.7655	
3540	59	0.244736	787.4365	
3555	59.25	0.244736	791.1075	
3570	59.5	0.244736	794.7786	
3585	59.75	0.244736	798.4496	
3600	60	0.244736	802.1206	
3615	60.25	0.244736	805.7917	
3630	60.5	0.244736	809.4627	
3645	60.75	0.244736	813.1337	
3660	61	0.244736	816.8048	
3675	61.25	0.244736	820.4758	
3690	61.5	0.244736	824.1468	
3705	61.75	0.244736	827.8179	
3720	62	0.244736	831.4889	
3735	62.25	0.244736	835.1599	

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3750	62.5	0.244736	838.8309
3765	62.75	0.244736	842.502
3780	63	0.244736	846.173
3795	63.25	0.244736	849.844
3810	63.5	0.244736	853.5151
3825	63.75	0.244736	857.1861
3840	64	0.244736	860.8571
3855	64.25	0.244736	864.5282
3870	64.5	0.244736	868.1992
3885	64.75	0.244736	871.8702
3900	65	0.244736	875.5413
3915	65.25	0.244736	879.2123
3930	65.5	0.244736	882.8833
3945	65.75	0.244736	886.5544
3960	66	0.244736	890.2254
3975	66.25	0.241027	893.8408
3990	66.5	0.237319	897.4006
4005	66.75	0.233611	900.9048
4020	67	0.229903	904.3533
4035	67.25	0.226195	907.7462
4050	67.5	0.222487	911.0835
4065	67.75	0.218779	914.3652
4080	68	0.215071	917.5913
4095	68.25	0.211362	920.7617
4110	68.5	0.207654	923.8765
4125	68.75	0.203946	926.9357
4140	69	0.200238	929.9393
4155	69.25	0.19653	932.8873
4170	69.5	0.192822	935.7796
4185	69.75	0.189114	938.6163
4200	70	0.185406	941.3974
4215	70.25	0.181698	944.1228
4230	70.5	0.177989	946.7927
4245	70.75	0.174281	949.4069
4260	71	0.170573	951.9655
4275	71.25	0.166865	954.4685
4290	71.5	0.163157	956.9158
4305	71.75	0.159449	959.3076
4320	72	0.155741	961.6437
4335	72.25	0.152033	963.9242
4350	72.5	0.148325	966.149
4365	72.75	0.144616	968.3183
4380	73	0.140908	970.4319
4395	73.25	0.1372	972.4899
4410	73.5	0.133492	974.4923
4425	73.75	0.129784	976.4391
4440	74	0.126076	978.3302
4455	74.25	0.122368	980.1657
4470	74.5	0.11866	981.9456
4485	74.75	0.114952	983.6699
4500	75	0.111243	985.3385
4515	75.25	0.107535	986.9516
4530	75.5	0.103827	988.509
4545	75.75	0.100119	990.0107
4560	76	0.096411	991.4569
4575	76.25	0.092703	992.8475
4590	76.5	0.088995	994.1824
4605	76.75	0.085287	995.4617
4620	77	0.081579	996.6854
4635	77.25	0.07787	997.8534
4650	77.5	0.074162	998.9658
4665	77.75	0.070454	1000.023
4680	78	0.066746	1001.024
4695	78.25	0.063038	1001.969

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4710	78.5	0.05933	1002.859
4725	78.75	0.055622	1003.694
4740	79	0.051914	1004.472
4755	79.25	0.048205	1005.195
4770	79.5	0.044497	1005.863
4785	79.75	0.040789	1006.475
4800	80	0.037081	1007.031
4815	80.25	0.033373	1007.532
4830	80.5	0.029665	1007.977
4845	80.75	0.025957	1008.366
4860	81	0.022249	1008.7
4875	81.25	0.018541	1008.978
4890	81.5	0.014832	1009.2
4905	81.75	0.011124	1009.367
4920	82	0.007416	1009.478
4935	82.25	0.003708	1009.534
4950	82.5	0	1009.534
4965	82.75	0	1009.534
4980	83	0	1009.534

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Detention Volume - sizing - 1% AEP event - OPTION 4

Pre-developed			
t [sec]	t [min]	Q [m ³ /s]	V [m ³]

0	0	0	0
15	0.25	0.001295	0.019432
30	0.5	0.002591	0.058295
45	0.75	0.003886	0.116591
60	1	0.005182	0.194318
75	1.25	0.006477	0.291477
90	1.5	0.007773	0.408068
105	1.75	0.009068	0.544091
120	2	0.010364	0.699545
135	2.25	0.011659	0.874432
150	2.5	0.012955	1.06875
165	2.75	0.01425	1.2825
180	3	0.015545	1.515682
195	3.25	0.016841	1.768295
210	3.5	0.018136	2.040341
225	3.75	0.019432	2.331818
240	4	0.020727	2.642727
255	4.25	0.022023	2.973068
270	4.5	0.023318	3.322841
285	4.75	0.024614	3.692045
300	5	0.025909	4.080682
315	5.25	0.027205	4.48875
330	5.5	0.0285	4.91625
345	5.75	0.029795	5.363182
360	6	0.031091	5.829545
375	6.25	0.032386	6.315341
390	6.5	0.033682	6.820568
405	6.75	0.034977	7.345227
420	7	0.036273	7.889318
435	7.25	0.037568	8.452841
450	7.5	0.038864	9.035795
465	7.75	0.040159	9.638182
480	8	0.041455	10.26
495	8.25	0.04275	10.90125
510	8.5	0.044045	11.56193
525	8.75	0.045341	12.24205
540	9	0.046636	12.94159
555	9.25	0.047932	13.66057
570	9.5	0.049227	14.39898
585	9.75	0.050523	15.15682
600	10	0.051818	15.93409
615	10.25	0.053114	16.7308
630	10.5	0.054409	17.54693
645	10.75	0.055705	18.3825
660	11	0.057	19.2375
675	11.25	0.058295	20.11193
690	11.5	0.059591	21.0058
705	11.75	0.060886	21.91909
720	12	0.062182	22.85182
735	12.25	0.063477	23.80398
750	12.5	0.064773	24.77557
765	12.75	0.066068	25.76659
780	13	0.067364	26.77705
795	13.25	0.068659	27.80693
810	13.5	0.069955	28.85625
825	13.75	0.07125	29.925
840	14	0.072545	31.01318
855	14.25	0.073841	32.1208
870	14.5	0.075136	33.24784
885	14.75	0.076432	34.39432
900	15	0.077727	35.56023
915	15.25	0.079023	36.74557
930	15.5	0.080318	37.95034
945	15.75	0.081614	39.17455
960	16	0.082909	40.41818
975	16.25	0.084205	41.68125
990	16.5	0.0855	42.96375
1005	16.75	0.086795	44.26568
1020	17	0.088091	45.58705
1035	17.25	0.089386	46.92784

Post-developed			
t [sec]	t [min]	Q [m ³ /s]	V [m ³]

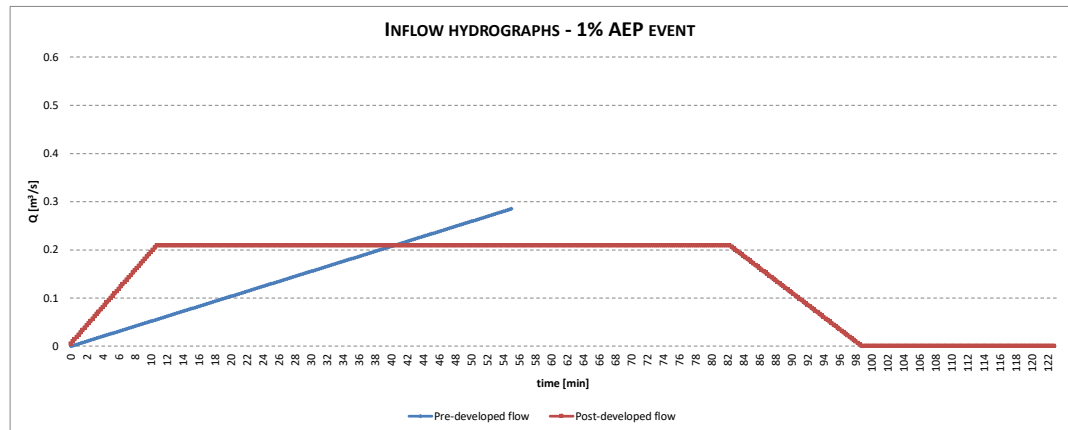
0	0	0	0
15	0.25	0.004755	0.071328
30	0.5	0.00951	0.213985
45	0.75	0.014266	0.42797
60	1	0.019021	0.713284
75	1.25	0.023776	1.069925
90	1.5	0.028531	1.497895
105	1.75	0.033287	1.997194
120	2	0.038042	2.567821
135	2.25	0.042797	3.209776
150	2.5	0.047552	3.923059
165	2.75	0.052307	4.707671
180	3	0.057063	5.563612
195	3.25	0.061818	6.49088
210	3.5	0.066573	7.489477
225	3.75	0.071328	8.559402
240	4	0.076084	9.700656
255	4.25	0.080839	10.91324
270	4.5	0.085594	12.19715
285	4.75	0.090349	13.55239
300	5	0.095104	14.97895
315	5.25	0.09986	16.47685
330	5.5	0.104615	18.04607
345	5.75	0.10937	19.68663
360	6	0.114125	21.39851
375	6.25	0.118881	23.18171
390	6.5	0.123636	25.03625
405	6.75	0.128391	26.96212
420	7	0.133146	28.95931
435	7.25	0.137901	31.02783
450	7.5	0.142657	33.16768
465	7.75	0.147412	35.37886
480	8	0.152167	37.66137
495	8.25	0.156922	40.01521
510	8.5	0.161678	42.44037
525	8.75	0.166433	44.93686
540	9	0.171188	47.50468
555	9.25	0.175943	50.14383
570	9.5	0.180698	52.85431
585	9.75	0.185454	55.63612
600	10	0.190209	58.48925
615	10.25	0.194964	61.41371
630	10.5	0.199719	64.4095
645	10.75	0.204475	67.47662
660	11	0.20923	70.61507
675	11.25	0.20923	73.75352
690	11.5	0.20923	76.89197
705	11.75	0.20923	80.03041
720	12	0.20923	83.16886
735	12.25	0.20923	86.30731
750	12.5	0.20923	89.44576
765	12.75	0.20923	92.5842
780	13	0.20923	95.72265
795	13.25	0.20923	98.8611
810	13.5	0.20923	101.9995
825	13.75	0.20923	105.138
840	14	0.20923	108.2764
855	14.25	0.20923	111.4149
870	14.5	0.20923	114.5533
885	14.75	0.20923	117.6918
900	15	0.20923	120.8302
915	15.25	0.20923	123.9687
930	15.5	0.20923	127.1071
945	15.75	0.20923	130.2456
960	16	0.20923	133.384
975	16.25	0.20923	136.5225
990	16.5	0.20923	139.6609
1005	16.75	0.20923	142.7994
1020	17	0.20923	145.9378
1035	17.25	0.20923	149.0763

Detention tank	
V [m ³]	

0	0.052
0.052	0.156
0.156	0.311
0.311	0.519
0.519	0.778
0.778	1.090
1.090	1.453
1.453	1.868
1.868	2.335
2.335	2.854
2.854	3.425
3.425	4.048
4.048	4.723
4.723	5.449
5.449	6.228
6.228	7.058
7.058	7.940
7.940	8.874
8.874	9.860
9.860	10.898
10.898	11.988
11.988	13.130
13.130	14.323
14.323	15.569
15.569	16.866
16.866	18.216
18.216	19.617
19.617	21.070
21.070	22.575
22.575	24.132
24.132	25.741
25.741	27.401
27.401	29.114
29.114	30.878
30.878	32.695
32.695	34.563
34.563	36.483
36.483	38.455
38.455	40.479
40.479	42.555
42.555	44.683
44.683	46.863
46.863	49.094
49.094	51.378
51.378	53.642
53.642	55.886
55.886	58.111
58.111	60.317
60.317	62.503
62.503	64.670
64.670	66.818
66.818	68.946
68.946	71.054
71.054	73.143
73.143	75.213
75.213	77.263
77.263	79.294
79.294	81.305
81.305	83.297
83.297	85.270
85.270	87.223
87.223	89.157
89.157	91.071
91.071	92.966
92.966	94.841
94.841	96.697
96.697	98.534
98.534	100.351
100.351	102.148

Q ₁₀₀ [m ³ /s]		0.285	Pre-developed	Q ₁₀₀ [m ³ /s]	0.209	Developed
T _c [min]		55.00	peak flow	T _c [min]	11.00	peak flow
T _c [sec]		3300		T _c [sec]	660	
		8.64E-05			0.000317	
T _c [min]				T _c [min]	82.50	end of storm
T _c [sec]				T _c [sec]	4950	
T [min]		99	end simulation	T [min]	99	end simulation
T [sec]		5940		T [sec]	5940	
		4.8E-05			0.000211	

Detention volume [m³] 184



1050	17.5	0.090682	48.28807	1050	17.5	0.20923	152.2147	103.927
1065	17.75	0.091977	49.66773	1065	17.75	0.20923	155.3532	105.685
1080	18	0.093273	51.06682	1080	18	0.20923	158.4916	107.425
1095	18.25	0.094568	52.48534	1095	18.25	0.20923	161.63	109.145
1110	18.5	0.095864	53.9233	1110	18.5	0.20923	164.7685	110.845
1125	18.75	0.097159	55.38068	1125	18.75	0.20923	167.9069	112.526
1140	19	0.098455	56.8575	1140	19	0.20923	171.0454	114.188
1155	19.25	0.09975	58.35375	1155	19.25	0.20923	174.1838	115.830
1170	19.5	0.101045	59.86943	1170	19.5	0.20923	177.3223	117.453
1185	19.75	0.102341	61.40455	1185	19.75	0.20923	180.4607	119.056
1200	20	0.103636	62.95909	1200	20	0.20923	183.5992	120.640
1215	20.25	0.104932	64.53307	1215	20.25	0.20923	186.7376	122.205
1230	20.5	0.106227	66.12648	1230	20.5	0.20923	189.8761	123.750
1245	20.75	0.107523	67.73932	1245	20.75	0.20923	193.0145	125.275
1260	21	0.108818	69.37159	1260	21	0.20923	196.153	126.781
1275	21.25	0.110114	71.0233	1275	21.25	0.20923	199.2914	128.268
1290	21.5	0.111409	72.69443	1290	21.5	0.20923	202.4299	129.735
1305	21.75	0.112705	74.385	1305	21.75	0.20923	205.5683	131.183
1320	22	0.114	76.095	1320	22	0.20923	208.7068	132.612
1335	22.25	0.115295	77.82443	1335	22.25	0.20923	211.8452	134.021
1350	22.5	0.116591	79.5733	1350	22.5	0.20923	214.9837	135.410
1365	22.75	0.117886	81.34159	1365	22.75	0.20923	218.1221	136.781
1380	23	0.119182	83.12932	1380	23	0.20923	221.2606	138.131
1395	23.25	0.120477	84.93648	1395	23.25	0.20923	224.399	139.463
1410	23.5	0.121773	86.76307	1410	23.5	0.20923	227.5374	140.774
1425	23.75	0.123068	88.60909	1425	23.75	0.20923	230.6759	142.067
1440	24	0.124364	90.47455	1440	24	0.20923	233.8143	143.340
1455	24.25	0.125659	92.35943	1455	24.25	0.20923	236.9528	144.593
1470	24.5	0.126955	94.26375	1470	24.5	0.20923	240.0912	145.827
1485	24.75	0.12825	96.1875	1485	24.75	0.20923	243.2297	147.042
1500	25	0.129545	98.13068	1500	25	0.20923	246.3681	148.237
1515	25.25	0.130841	100.0933	1515	25.25	0.20923	249.5066	149.413
1530	25.5	0.132136	102.0753	1530	25.5	0.20923	252.645	150.570
1545	25.75	0.133432	104.0768	1545	25.75	0.20923	255.7835	151.707
1560	26	0.134727	106.0977	1560	26	0.20923	258.9219	152.824
1575	26.25	0.136023	108.1381	1575	26.25	0.20923	262.0604	153.922
1590	26.5	0.137318	110.1978	1590	26.5	0.20923	265.1988	155.001
1605	26.75	0.138614	112.277	1605	26.75	0.20923	268.3373	156.060
1620	27	0.139909	114.3757	1620	27	0.20923	271.4757	157.100
1635	27.25	0.141205	116.4938	1635	27.25	0.20923	274.6142	158.120
1650	27.5	0.1425	118.6313	1650	27.5	0.20923	277.7526	159.121
1665	27.75	0.143795	120.7882	1665	27.75	0.20923	280.8911	160.103
1680	28	0.145091	122.9645	1680	28	0.20923	284.0295	161.065
1695	28.25	0.146386	125.1603	1695	28.25	0.20923	287.168	162.008
1710	28.5	0.147682	127.3756	1710	28.5	0.20923	290.3064	162.931
1725	28.75	0.148977	129.6102	1725	28.75	0.20923	293.4448	163.835
1740	29	0.150273	131.8643	1740	29	0.20923	296.5833	164.719
1755	29.25	0.151568	134.1378	1755	29.25	0.20923	299.7217	165.584
1770	29.5	0.152864	136.4308	1770	29.5	0.20923	302.8602	166.429
1785	29.75	0.154159	138.7432	1785	29.75	0.20923	305.9986	167.255
1800	30	0.155455	141.075	1800	30	0.20923	309.1371	168.062
1815	30.25	0.15675	143.4263	1815	30.25	0.20923	312.2755	168.849
1830	30.5	0.158045	145.7969	1830	30.5	0.20923	315.414	169.617
1845	30.75	0.159341	148.187	1845	30.75	0.20923	318.5524	170.365
1860	31	0.160636	150.5966	1860	31	0.20923	321.6909	171.094
1875	31.25	0.161932	153.0256	1875	31.25	0.20923	324.8293	171.804
1890	31.5	0.163227	155.474	1890	31.5	0.20923	327.9678	172.494
1905	31.75	0.164523	157.9418	1905	31.75	0.20923	331.1062	173.164
1920	32	0.165818	160.4291	1920	32	0.20923	334.2447	173.816
1935	32.25	0.167114	162.9358	1935	32.25	0.20923	337.3831	174.447
1950	32.5	0.168409	165.4619	1950	32.5	0.20923	340.5216	175.060
1965	32.75	0.169705	168.0075	1965	32.75	0.20923	343.66	175.653
1980	33	0.171	170.5725	1980	33	0.20923	346.7985	176.226
1995	33.25	0.172295	173.1569	1995	33.25	0.20923	349.9369	176.780
2010	33.5	0.173591	175.7608	2010	33.5	0.20923	353.0754	177.315
2025	33.75	0.174886	178.3841	2025	33.75	0.20923	356.2138	177.830
2040	34	0.176182	181.0268	2040	34	0.20923	359.3522	178.325
2055	34.25	0.177477	183.689	2055	34.25	0.20923	362.4907	178.802
2070	34.5	0.178773	186.3706	2070	34.5	0.20923	365.6291	179.259
2085	34.75	0.180068	189.0716	2085	34.75	0.20923	368.7676	179.696
2100	35	0.181364	191.792	2100	35	0.20923	371.906	180.114
2115	35.25	0.182659	194.5319	2115	35.25	0.20923	375.0445	180.513
2130	35.5	0.183955	197.2913	2130	35.5	0.20923	378.1829	180.892
2145	35.75	0.18525	200.07	2145	35.75	0.20923	381.3214	181.251
2160	36	0.186545	202.8682	2160	36	0.20923	384.4598	181.592
2175	36.25	0.187841	205.6858	2175	36.25	0.20923	387.5983	181.912

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2190	36.5	0.189136	208.5228	2190	36.5	0.20923	390.7367	182.214
2205	36.75	0.190432	211.3793	2205	36.75	0.20923	393.8752	182.496
2220	37	0.191727	214.2552	2220	37	0.20923	397.0136	182.758
2235	37.25	0.193023	217.1506	2235	37.25	0.20923	400.1521	183.001
2250	37.5	0.194318	220.0653	2250	37.5	0.20923	403.2905	183.225
2265	37.75	0.195614	222.9995	2265	37.75	0.20923	406.429	183.429
2280	38	0.196909	225.9532	2280	38	0.20923	409.5674	183.614
2295	38.25	0.198205	228.9263	2295	38.25	0.20923	412.7059	183.780
2310	38.5	0.1995	231.9188	2310	38.5	0.20923	415.8443	183.926
2325	38.75	0.200795	234.9307	2325	38.75	0.20923	418.9827	184.052
2340	39	0.202091	237.962	2340	39	0.20923	422.1212	184.159
2355	39.25	0.203386	241.0128	2355	39.25	0.20923	425.2596	184.247
2370	39.5	0.204682	244.0831	2370	39.5	0.20923	428.3981	184.315
2385	39.75	0.205977	247.1727	2385	39.75	0.20923	431.5365	184.364
2400	40	0.207273	250.2818	2400	40	0.20923	434.675	184.393
2415	40.25	0.208568	253.4103	2415	40.25	0.20923	437.8134	184.403
2430	40.5	0.209864	256.5583	2430	40.5	0.20923	440.9519	184.394
2445	40.75	0.211159	259.7257	2445	40.75	0.20923	444.0903	184.365
2460	41	0.212455	262.9125	2460	41	0.20923	447.2288	184.316
2475	41.25	0.21375	266.1188	2475	41.25	0.20923	450.3672	184.248
2490	41.5	0.215045	269.3444	2490	41.5	0.20923	453.5057	184.161
2505	41.75	0.216341	272.5895	2505	41.75	0.20923	456.6441	184.055
2520	42	0.217636	275.8541	2520	42	0.20923	459.7826	183.928
2535	42.25	0.218932	279.1381	2535	42.25	0.20923	462.921	183.783
2550	42.5	0.220227	282.4415	2550	42.5	0.20923	466.0595	183.618
2565	42.75	0.221523	285.7643	2565	42.75	0.20923	469.1979	183.434
2580	43	0.222818	289.1066	2580	43	0.20923	472.3364	183.230
2595	43.25	0.224114	292.4683	2595	43.25	0.20923	475.4748	183.007
2610	43.5	0.225409	295.8494	2610	43.5	0.20923	478.6133	182.764
2625	43.75	0.226705	299.25	2625	43.75	0.20923	481.7517	182.502
2640	44	0.228	302.67	2640	44	0.20923	484.8901	182.220
2655	44.25	0.229295	306.1094	2655	44.25	0.20923	488.0286	181.919
2670	44.5	0.230591	309.5683	2670	44.5	0.20923	491.167	181.599
2685	44.75	0.231886	313.0466	2685	44.75	0.20923	494.3055	181.259
2700	45	0.233182	316.5443	2700	45	0.20923	497.4439	180.900
2715	45.25	0.234477	320.0615	2715	45.25	0.20923	500.5824	180.521
2730	45.5	0.235773	323.5981	2730	45.5	0.20923	503.7208	180.123
2745	45.75	0.237068	327.1541	2745	45.75	0.20923	506.8593	179.705
2760	46	0.238364	330.7295	2760	46	0.20923	509.9977	179.268
2775	46.25	0.239659	334.3244	2775	46.25	0.20923	513.1362	178.812
2790	46.5	0.240955	337.9388	2790	46.5	0.20923	516.2746	178.336
2805	46.75	0.24225	341.5725	2805	46.75	0.20923	519.4131	177.841
2820	47	0.243545	345.2257	2820	47	0.20923	522.5515	177.326
2835	47.25	0.244841	348.8983	2835	47.25	0.20923	525.69	176.792
2850	47.5	0.246136	352.5903	2850	47.5	0.20923	528.8284	176.238
2865	47.75	0.247432	356.3018	2865	47.75	0.20923	531.9669	175.665
2880	48	0.248727	360.0327	2880	48	0.20923	535.1053	175.073
2895	48.25	0.250023	363.7831	2895	48.25	0.20923	538.2438	174.461
2910	48.5	0.251318	367.5528	2910	48.5	0.20923	541.3822	173.829
2925	48.75	0.252614	371.342	2925	48.75	0.20923	544.5207	173.179
2940	49	0.253909	375.1507	2940	49	0.20923	547.6591	172.508
2955	49.25	0.255205	378.9788	2955	49.25	0.20923	550.7975	171.819
2970	49.5	0.2565	382.8263	2970	49.5	0.20923	553.936	171.110
2985	49.75	0.257795	386.6932	2985	49.75	0.20923	557.0744	170.381
3000	50	0.259091	390.5795	3000	50	0.20923	560.2129	169.633
3015	50.25	0.260386	394.4853	3015	50.25	0.20923	563.3513	168.866
3030	50.5	0.261682	398.4106	3030	50.5	0.20923	566.4898	168.079
3045	50.75	0.262977	402.3552	3045	50.75	0.20923	569.6282	167.273
3060	51	0.264273	406.3193	3060	51	0.20923	572.7667	166.447
3075	51.25	0.265568	410.3028	3075	51.25	0.20923	575.9051	165.602
3090	51.5	0.266864	414.3058	3090	51.5	0.20923	579.0436	164.738
3105	51.75	0.268159	418.3282	3105	51.75	0.20923	582.182	163.854
3120	52	0.269455	422.37	3120	52	0.20923	585.3205	162.950
3135	52.25	0.27075	426.4313	3135	52.25	0.20923	588.4589	162.028
3150	52.5	0.272045	430.5119	3150	52.5	0.20923	591.5974	161.085
3165	52.75	0.273341	434.612	3165	52.75	0.20923	594.7358	160.124
3180	53	0.274636	438.7316	3180	53	0.20923	597.8743	159.143
3195	53.25	0.275932	442.8706	3195	53.25	0.20923	601.0127	158.142
3210	53.5	0.277227	447.029	3210	53.5	0.20923	604.1512	157.122
3225	53.75	0.278523	451.2068	3225	53.75	0.20923	607.2896	156.083
3240	54	0.279818	455.4041	3240	54	0.20923	610.4281	155.024
3255	54.25	0.281114	459.6208	3255	54.25	0.20923	613.5665	153.946
3270	54.5	0.282409	463.8569	3270	54.5	0.20923	616.7049	152.848
3285	54.75	0.283705	468.1125	3285	54.75	0.20923	619.8434	151.731
3300	55	0.285	472.3875	3300	55	0.20923	622.9818	150.594
				3315	55.25	0.20923	626.1203	

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3330	55.5	0.20923	629.2587
3345	55.75	0.20923	632.3972
3360	56	0.20923	635.5356
3375	56.25	0.20923	638.6741
3390	56.5	0.20923	641.8125
3405	56.75	0.20923	644.951
3420	57	0.20923	648.0894
3435	57.25	0.20923	651.2279
3450	57.5	0.20923	654.3663
3465	57.75	0.20923	657.5048
3480	58	0.20923	660.6432
3495	58.25	0.20923	663.7817
3510	58.5	0.20923	666.9201
3525	58.75	0.20923	670.0586
3540	59	0.20923	673.197
3555	59.25	0.20923	676.3354
3570	59.5	0.20923	679.4739
3585	59.75	0.20923	682.6123
3600	60	0.20923	685.7508
3615	60.25	0.20923	688.8892
3630	60.5	0.20923	692.0277
3645	60.75	0.20923	695.1661
3660	61	0.20923	698.3046
3675	61.25	0.20923	701.443
3690	61.5	0.20923	704.5815
3705	61.75	0.20923	707.7199
3720	62	0.20923	710.8584
3735	62.25	0.20923	713.9968
3750	62.5	0.20923	717.1353
3765	62.75	0.20923	720.2737
3780	63	0.20923	723.4122
3795	63.25	0.20923	726.5506
3810	63.5	0.20923	729.6891
3825	63.75	0.20923	732.8275
3840	64	0.20923	735.966
3855	64.25	0.20923	739.1044
3870	64.5	0.20923	742.2428
3885	64.75	0.20923	745.3813
3900	65	0.20923	748.5197
3915	65.25	0.20923	751.6582
3930	65.5	0.20923	754.7966
3945	65.75	0.20923	757.9351
3960	66	0.20923	761.0735
3975	66.25	0.20923	764.212
3990	66.5	0.20923	767.3504
4005	66.75	0.20923	770.4889
4020	67	0.20923	773.6273
4035	67.25	0.20923	776.7658
4050	67.5	0.20923	779.9042
4065	67.75	0.20923	783.0427
4080	68	0.20923	786.1811
4095	68.25	0.20923	789.3196
4110	68.5	0.20923	792.458
4125	68.75	0.20923	795.5965
4140	69	0.20923	798.7349
4155	69.25	0.20923	801.8734
4170	69.5	0.20923	805.0118
4185	69.75	0.20923	808.1502
4200	70	0.20923	811.2887
4215	70.25	0.20923	814.4271
4230	70.5	0.20923	817.5656
4245	70.75	0.20923	820.704
4260	71	0.20923	823.8425
4275	71.25	0.20923	826.9809
4290	71.5	0.20923	830.1194
4305	71.75	0.20923	833.2578
4320	72	0.20923	836.3963
4335	72.25	0.20923	839.5347
4350	72.5	0.20923	842.6732
4365	72.75	0.20923	845.8116
4380	73	0.20923	848.9501
4395	73.25	0.20923	852.0885
4410	73.5	0.20923	855.227
4425	73.75	0.20923	858.3654
4440	74	0.20923	861.5039
4455	74.25	0.20923	864.6423

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4470	74.5	0.20923	867.7808
4485	74.75	0.20923	870.9192
4500	75	0.20923	874.0576
4515	75.25	0.20923	877.1961
4530	75.5	0.20923	880.3345
4545	75.75	0.20923	883.473
4560	76	0.20923	886.6114
4575	76.25	0.20923	889.7499
4590	76.5	0.20923	892.8883
4605	76.75	0.20923	896.0268
4620	77	0.20923	899.1652
4635	77.25	0.20923	902.3037
4650	77.5	0.20923	905.4421
4665	77.75	0.20923	908.5806
4680	78	0.20923	911.719
4695	78.25	0.20923	914.8575
4710	78.5	0.20923	917.9959
4725	78.75	0.20923	921.1344
4740	79	0.20923	924.2728
4755	79.25	0.20923	927.4113
4770	79.5	0.20923	930.5497
4785	79.75	0.20923	933.6881
4800	80	0.20923	936.8266
4815	80.25	0.20923	939.965
4830	80.5	0.20923	943.1035
4845	80.75	0.20923	946.2419
4860	81	0.20923	949.3804
4875	81.25	0.20923	952.5188
4890	81.5	0.20923	955.6573
4905	81.75	0.20923	958.7957
4920	82	0.20923	961.9342
4935	82.25	0.20923	965.0726
4950	82.5	0.20923	968.2111
4965	82.75	0.20606	971.302
4980	83	0.20289	974.3453
4995	83.25	0.199719	977.3411
5010	83.5	0.196549	980.2893
5025	83.75	0.193379	983.19
5040	84	0.190209	986.0432
5055	84.25	0.187039	988.8487
5070	84.5	0.183869	991.6068
5085	84.75	0.180698	994.3173
5100	85	0.177528	996.9802
5115	85.25	0.174358	999.5955
5130	85.5	0.171188	1002.163
5145	85.75	0.168018	1004.684
5160	86	0.164848	1007.156
5175	86.25	0.161678	1009.582
5190	86.5	0.158507	1011.959
5205	86.75	0.155337	1014.289
5220	87	0.152167	1016.572
5235	87.25	0.148997	1018.807
5250	87.5	0.145827	1020.994
5265	87.75	0.142657	1023.134
5280	88	0.139487	1025.226
5295	88.25	0.136316	1027.271
5310	88.5	0.133146	1029.268
5325	88.75	0.129976	1031.218
5340	89	0.126806	1033.12
5355	89.25	0.123636	1034.974
5370	89.5	0.120466	1036.781
5385	89.75	0.117296	1038.541
5400	90	0.114125	1040.253
5415	90.25	0.110955	1041.917
5430	90.5	0.107785	1043.534
5445	90.75	0.104615	1045.103
5460	91	0.101445	1046.625
5475	91.25	0.098275	1048.099
5490	91.5	0.095104	1049.525
5505	91.75	0.091934	1050.904
5520	92	0.088764	1052.236
5535	92.25	0.085594	1053.52
5550	92.5	0.082424	1054.756
5565	92.75	0.079254	1055.945
5580	93	0.076084	1057.086
5595	93.25	0.072913	1058.18

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5610	93.5	0.069743	1059.226
5625	93.75	0.066573	1060.225
5640	94	0.063403	1061.176
5655	94.25	0.060233	1062.079
5670	94.5	0.057063	1062.935
5685	94.75	0.053893	1063.744
5700	95	0.050722	1064.504
5715	95.25	0.047552	1065.218
5730	95.5	0.044382	1065.883
5745	95.75	0.041212	1066.502
5760	96	0.038042	1067.072
5775	96.25	0.034872	1067.595
5790	96.5	0.031701	1068.071
5805	96.75	0.028531	1068.499
5820	97	0.025361	1068.879
5835	97.25	0.022191	1069.212
5850	97.5	0.019021	1069.497
5865	97.75	0.015851	1069.735
5880	98	0.012681	1069.925
5895	98.25	0.00951	1070.068
5910	98.5	0.00634	1070.163
5925	98.75	0.00317	1070.211
5940	99	0	1070.211
5955	99.25	0	1070.211
5970	99.5	0	1070.211
5985	99.75	0	1070.211
6000	100	0	1070.211
6015	100.25	0	1070.211
6030	100.5	0	1070.211
6045	100.75	0	1070.211
6060	101	0	1070.211
6075	101.25	0	1070.211
6090	101.5	0	1070.211
6105	101.75	0	1070.211
6120	102	0	1070.211
6135	102.25	0	1070.211
6150	102.5	0	1070.211
6165	102.75	0	1070.211
6180	103	0	1070.211
6195	103.25	0	1070.211
6210	103.5	0	1070.211
6225	103.75	0	1070.211
6240	104	0	1070.211
6255	104.25	0	1070.211
6270	104.5	0	1070.211
6285	104.75	0	1070.211
6300	105	0	1070.211
6315	105.25	0	1070.211
6330	105.5	0	1070.211
6345	105.75	0	1070.211
6360	106	0	1070.211
6375	106.25	0	1070.211
6390	106.5	0	1070.211
6405	106.75	0	1070.211
6420	107	0	1070.211
6435	107.25	0	1070.211
6450	107.5	0	1070.211
6465	107.75	0	1070.211
6480	108	0	1070.211
6495	108.25	0	1070.211
6510	108.5	0	1070.211
6525	108.75	0	1070.211
6540	109	0	1070.211
6555	109.25	0	1070.211
6570	109.5	0	1070.211
6585	109.75	0	1070.211
6600	110	0	1070.211
6615	110.25	0	1070.211
6630	110.5	0	1070.211
6645	110.75	0	1070.211
6660	111	0	1070.211
6675	111.25	0	1070.211
6690	111.5	0	1070.211
6705	111.75	0	1070.211
6720	112	0	1070.211
6735	112.25	0	1070.211

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6750	112.5	0	1070.211
6765	112.75	0	1070.211
6780	113	0	1070.211
6795	113.25	0	1070.211
6810	113.5	0	1070.211
6825	113.75	0	1070.211
6840	114	0	1070.211
6855	114.25	0	1070.211
6870	114.5	0	1070.211
6885	114.75	0	1070.211
6900	115	0	1070.211
6915	115.25	0	1070.211
6930	115.5	0	1070.211
6945	115.75	0	1070.211
6960	116	0	1070.211
6975	116.25	0	1070.211
6990	116.5	0	1070.211
7005	116.75	0	1070.211
7020	117	0	1070.211
7035	117.25	0	1070.211
7050	117.5	0	1070.211
7065	117.75	0	1070.211
7080	118	0	1070.211
7095	118.25	0	1070.211
7110	118.5	0	1070.211
7125	118.75	0	1070.211
7140	119	0	1070.211
7155	119.25	0	1070.211
7170	119.5	0	1070.211
7185	119.75	0	1070.211
7200	120	0	1070.211
7215	120.25	0	1070.211
7230	120.5	0	1070.211
7245	120.75	0	1070.211
7260	121	0	1070.211
7275	121.25	0	1070.211
7290	121.5	0	1070.211
7305	121.75	0	1070.211
7320	122	0	1070.211
7335	122.25	0	1070.211
7350	122.5	0	1070.211
7365	122.75	0	1070.211
7380	123	0	1070.211
7395	123.25	0	1070.211
7410	123.5	0	1070.211
7425	123.75	0	1070.211
7440	124	0	1070.211
7455	124.25	0	1070.211
7470	124.5	0	1070.211
7485	124.75	0	1070.211
7500	125	0	1070.211
7515	125.25	0	1070.211
7530	125.5	0	1070.211
7545	125.75	0	1070.211
7560	126	0	1070.211
7575	126.25	0	1070.211
7590	126.5	0	1070.211
7605	126.75	0	1070.211
7620	127	0	1070.211
7635	127.25	0	1070.211
7650	127.5	0	1070.211
7665	127.75	0	1070.211
7680	128	0	1070.211
7695	128.25	0	1070.211
7710	128.5	0	1070.211
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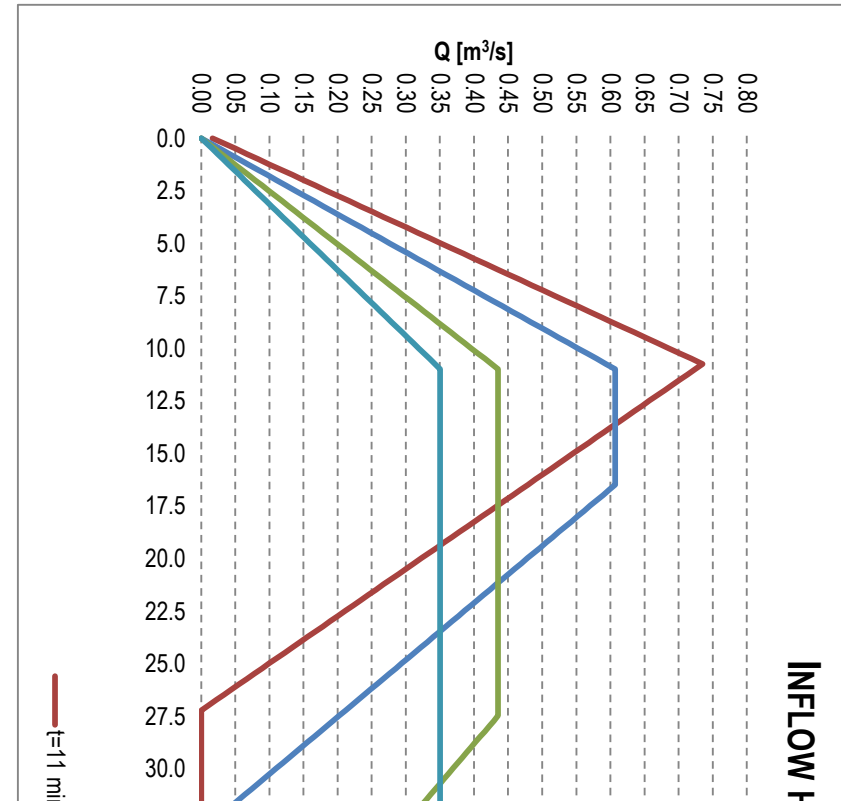
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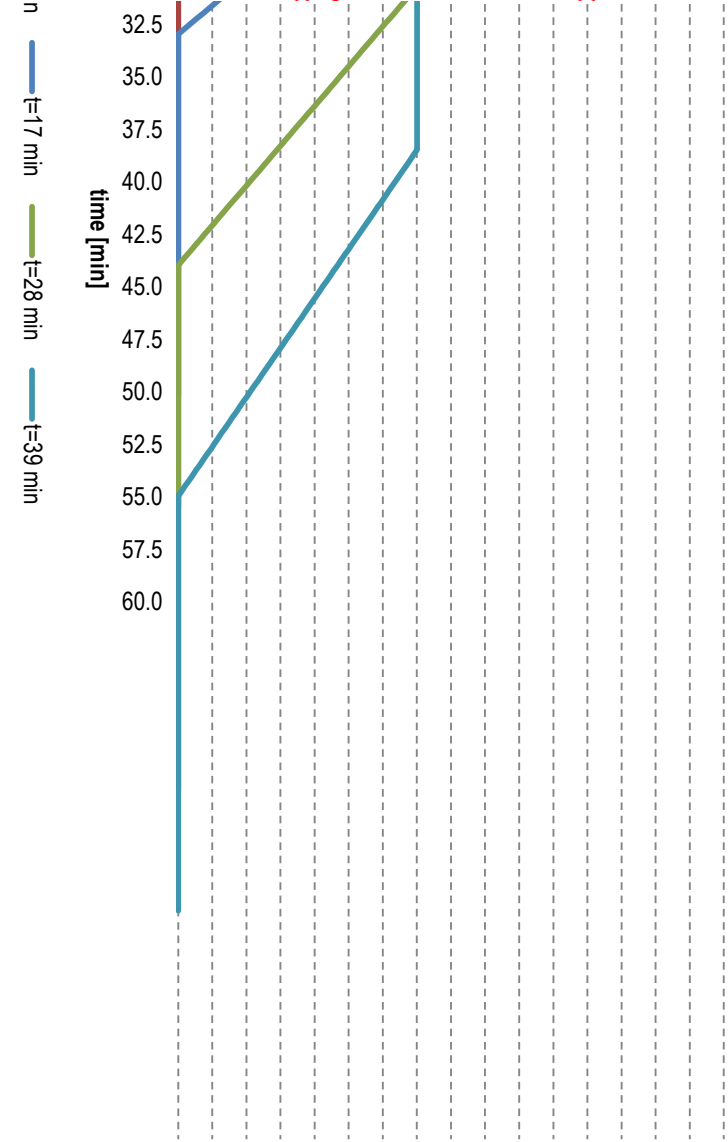
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HYDROGRAPHS - 1% AEP EVENT



Appendix F – Overland Flow

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OVERLAND CAPACITY



@ Chainage: **TBA**

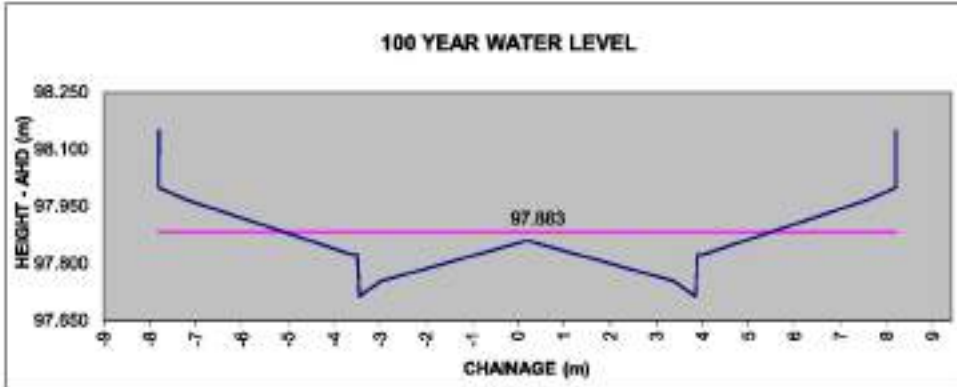
Date: **14.03.2023**

$Q_{200} = 0.744 \text{ m}^3/\text{s}$ $Q_{\text{pipe}} = 0.358 \text{ m}^3/\text{s}$
 $Q_{\text{ex}} = 0.386 \text{ m}^3/\text{s}$ Water Level = **97.883** AHD
 $n = 0.020$ Water Area = 0.736 m^2
 $S_o = 0.0040 \text{ m/m}$ Wetted Perimeter = 10.751 m
 $a = 0.547$
 $K_n = 0.122$
 $E(\text{min}) = 0.177 \text{ m}$ $y_n > y_c$ subcritical flow $y = y_n$ when $F = 0$
 $y_n = 0.170 \text{ m}$ $y_n < y_c$ supercritical flow

y(min)	E	y_c	y	A	P	F	$R^{2/3}$	V	$aV^2/2g$
97.73	0.177	0.170	0.170	0.74	10.75	-0.001	0.17	0.525	0.008

CHANNEL SETOUT

x	y	Water Level
-8.000	98.150	97.883
-8.000	98.000	97.883
-7.450	97.969	97.883
-3.800	97.823	97.883
-3.690	97.823	97.883
-3.650	97.713	97.883
-3.200	97.753	97.883
0.000	97.860	97.883
3.200	97.753	97.883
3.650	97.713	97.883
3.690	97.823	97.883
3.800	97.823	97.883
7.450	97.969	97.883
8.000	98.000	97.883
8.000	98.150	97.883



Road Cross Section Assumes:-
 1 in 50 cross fall for footpaths
 1 in 25 cross fall for nature strips
 1 in 30 cross fall for carriageway

Actual Flow

$d_w =$	0.058 m	<	0.300 m	OK	As per Guidelines for Development in Flood Affected Areas (DELWP, February 2019)
$V_w =$	0.525 m/s				
$V.d_w =$	0.036 m ² /s	<	0.300 m ² /s	OK	As per Guidelines for Development in Flood Affected Areas (DELWP, February 2019)
$d_{\text{max}} =$	0.170 m	<	0.300 m	OK	As per Guidelines for Development in Flood Affected Areas (DELWP, February 2019)

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Appendix G – MW Correspondences

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Please note I discussed the below matter with our respective engineers.

The upshot was that MW's preference is that the pipeline section referred to (i.e. D1 to D2) is relocated south to within the gravel section of Petty Road, to avoid the stated tree impacts. This would also generally align with the DSS.

Kind regards,



We acknowledge the Victorian Traditional Owners and their Elders past and present as the original custodians of Victoria's land and waters and I pay my respects to their Elders past and present and to the ongoing living culture of Aboriginal and Torres Strait

I hope this finds you well.

Can we get an urgent ETA on the result of your discussions regarding the result of your discussions regarding my email below dated 11th March 2025.
Thank you in advance.



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Thank you for your time on the phone earlier today.

You have provided the Planning Permit conditions for the above-mentioned application and associated reference. We would like to bring to your attention a request from Cardinia Shire Council that has regard to the removal of the pipes in the Bunyip West DSS identified as D1 and D2 on the basis that the construction of this section of the Bunyip West DSS will have avoidable biodiversity consequences and impacts for vegetation within the proposed bushland reserve and the Petty Road reserve.

We propose that the D1 and D2 pipes are removed and their drainage capacity (for Number 4 Wattletree Road) be replaced via a northward extension of N1 (Highlighted as the blue line below). The topography lends itself to this configuration and the vegetation in this section of McNamara looks to be less dense.



can the merits of this proposal please be raised with your peers. We are happy to discuss this in a meeting with all relevant parties in attendance.

We will revise our SWMS for this proposal in accordance with the agreed position of the Responsible Authorities.

We look forward to talking with you further, at your earliest convenience.

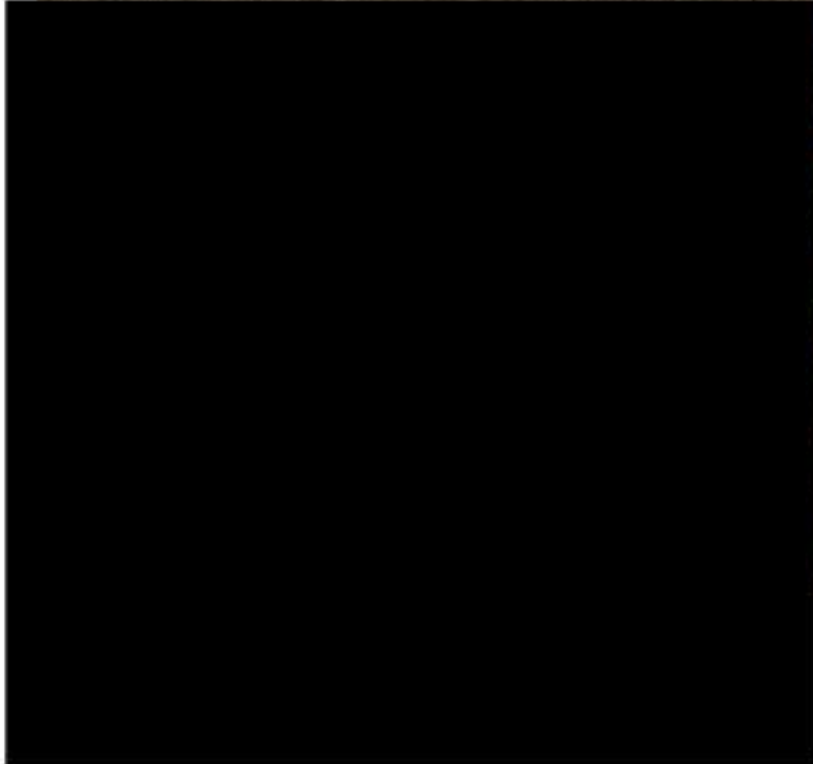


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Arboricultural Report v8.

8 WATTLETREE RD, BUNYIP 3815



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Introduction

This arboricultural report has been prepared by Healesville Plants under instructions by Nobelius Surveyors on behalf of the owners of 8 Wattletree Rd, Bunyip, located in the Cardinia Shire Council, where an on-site assessment of the trees is required to ascertain the impact of a proposed new subdivision.

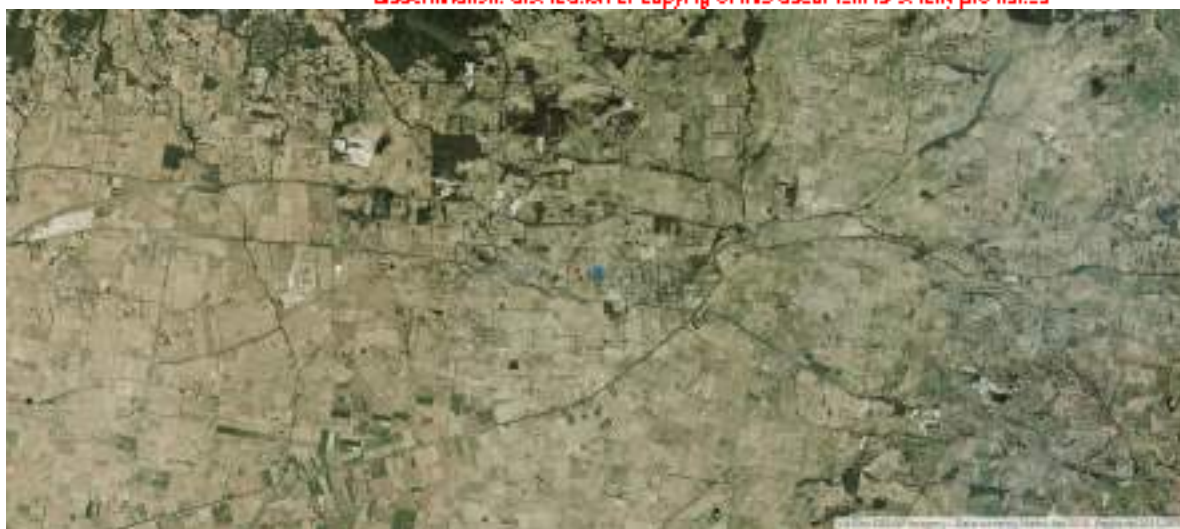
There were 95 trees to be addressed, 54 on the property, 2 on the neighbouring property to the west and 35 on the nature strip to the south, all are numbered on the Site Plan. The size, health and any particular issues for the trees assessed were noted. The general health of the trees assessed varied with some deadwood, and minor signs of stress, i.e. insect damage and epicormic growth. Of the trees addressed 55 are indigenous to the area, 1 is a planted native species, 35 are exotic species and 4 are dead – assessed due to them being greater than 40cm DBH. 40 trees require a permit to remove.

Site description 2.0

Healesville Plants undertook this tree assessment in March & April 2023, and June 2025. Inspection was made at ground level and observations, recommendations and conclusions reached in light of our experience.

Council Property Number: 5000016494
SPI (Standard Parcel Identifier): 2\PS708283
Lot and Plan Number: Lot 2 PS708283
Directory Reference: Vicroads 718 E9

The ~10-acre property is located on Wattletree Road, Bunyip, backing onto Petty Road, it is ~65m ASL with a southerly aspect and currently consists of paddock areas with windbreak treed section, a shed and large dam and a bushland area. This property is in a well - established area, with residential and rural residential properties in Bunyip. There is a mix of smaller and larger properties in the immediate surrounds, with fragmented treed areas.



Map 1. Aerial image (Source Vicplan 2018)



Map 1a). Close up aerial image of property (Source Vicplan 2018)

The site is zoned General Residential Zone – Schedule 1 (GRZ1) with no planning overlays; it is in a Designated Bushfire Prone Area.

The original indigenous vegetation expected is Highlands Southern Fall EVC 16 – Lowland Forest with the predominant tree species being *Eucalyptus obliqua*, *E. radiata*, *E. sieberi* & *E. dives*. The Cardinia vegetation zoning is Zone 4, Heathy Woodland Complex where *Allocasuarina littoralis*, *Eucalyptus baxteri*, *E. cephalocarpa*, *E. cypellocarpa*, *E. dives*, *E. fulgens*, *E. goniocalyx*, *E. obliqua*, *E. ovata*, *E. radiata* and *E. viminalis* ssp. *viminalis* are expected. *Eucalyptus globoidea*, White Stringybark is also present on the site some as Large and Very Large Old Trees. There is some remnant indigenous canopy and lower storey species present in the proposed bushland reserve zone, and the cleared area of the property has long been managed as grazing for sheep and horses.

Map 2. Contours (Source Vicplan 2023)



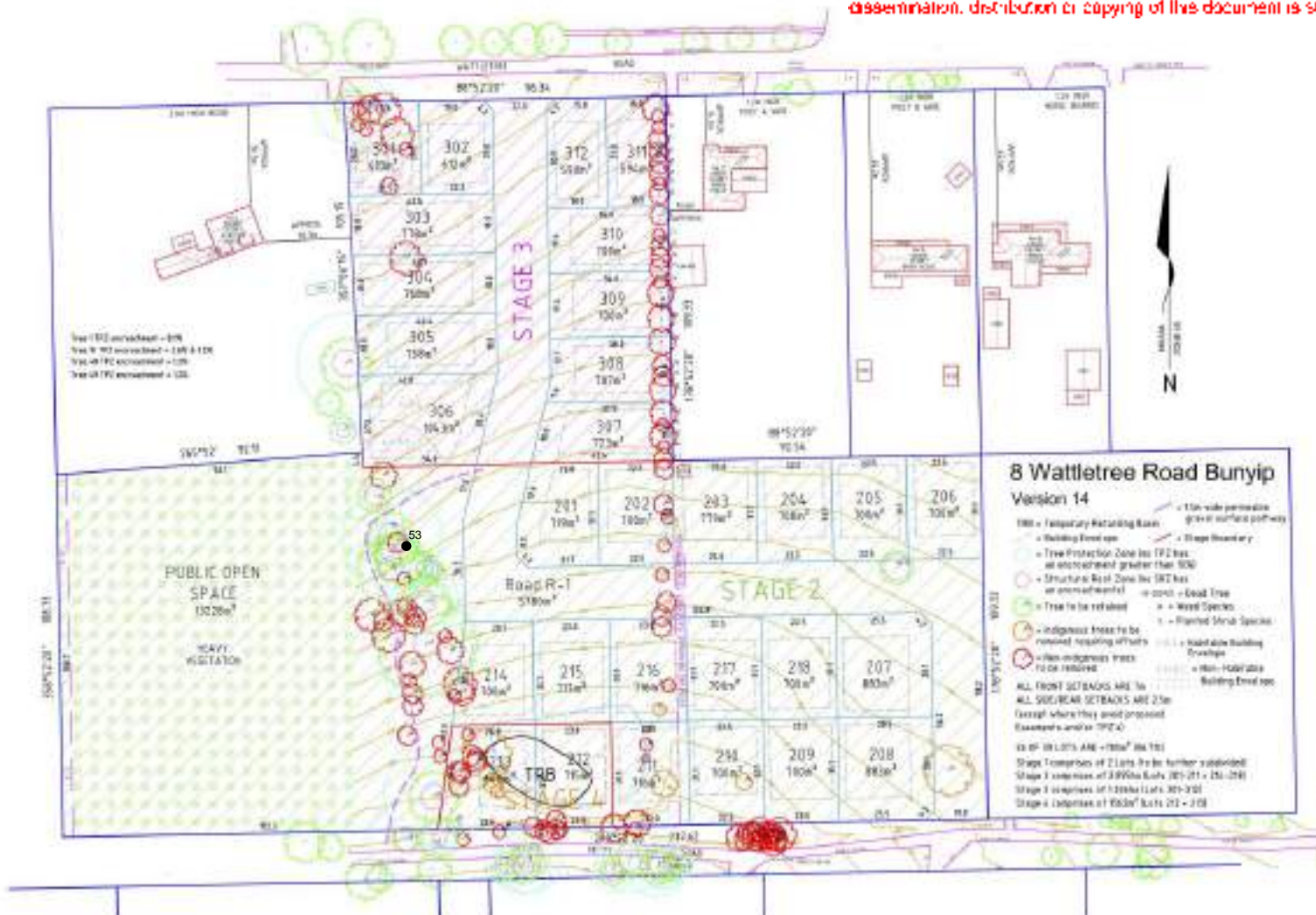
Map 3. Location (Source Vicplan 2023)

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Map 4. Site map including tree locations and existing conditions

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Map 5. Site map including development proposal and tree management – retain/remove & TPZ/SRZ plus incursion from proposed development.

Vegetation Assessment

3.0

Table 1. Tree List at 8 Wattletree Rd, Bunyip

No.	Species	DBH cm	TPZ m	SRZ m	Hgt- m	Wth- m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
1	<i>Eucalyptus globoidea</i> (White Stringybark)	91 L.O.T	10.9	3.4	22	N-S 8 E-W 18	Mat	High	10+	2	2	4	High	Ret	Was bifurcated at base – N co-dependant broken off – large cavity scar – also scar E side - medium response growth, large & fine deadwood, asymmetrical bifurcation with included bark – up high - repeated, termites, exposed & damaged SR, NDW driveway, road, drain and fences within TPZ, pruned from powerlines, crossing limbs, scar high in canopy on main trunk. Offset as consequential loss.
2	<i>Cupressus x leylandii</i> (Leyland's Cypress)	21	2.5	1.9	9	N-S 6 E-W 5	Mat	Mod	15+	3	3	3	Low	R	1-sided N&W, fine & large deadwood, pruned from powerlines, fence within TPZ, phototropic response from #3.
3	<i>Cupressus x leylandii</i>	40+ 28+ 27= 56	6.7	3.0	16	N-S 9 E-W 7	Mat	Mod	15+	4	3	4	Mod	R	Repeated bifurcation, had pruning from powerlines, large & fine deadwood, fence within TPZ.
4	<i>Cupressus x leylandii</i>	32+ 32+ 32+ 23= 60	7.2	3.0	16	N-S 12 E-W 9	Mat	Mod	15+	4	3	4	Mod	R	Repeated bifurcation, had pruning from powerlines, large & fine deadwood, fence within SRZ.
5	<i>Betula alba</i> (Silver Birch)	6+ 21=	2.6	2.0	12	N-S 6	Mat	Mod	7+	3	3	2	Low	R	Lots of large & fine deadwood, faunal browsing, apical dieback, broken

No.	Species	DBH cm	TPZ m	SRZ m	Hgt~ m	Wth~ m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
		22				E-W 5									limbs, suckering from base, bends in trunk.
6	<i>Betula alba</i>	19+ 10+ 10+ 10= 26	3.1	2.4	12	N-S 5 E-W 7	Mat	Mod	5+	2	3	2	Low	R	Apical dieback, lots of large & fine deadwood, suckering E&W sides, low LCR, girdles & damaged SR, broken limbs, flat asymmetrical bifurcation – repeated.
7	<i>Quercus robur</i> (English Oak)	51	6.1	2.6	14	N-S 13 E-W 13	Mat	Mod	15+	4	3	3	Mod	R	Has had some pruning, lots of epicormics, large & fine deadwood, well balanced, faunal browsing, powdery mildew on foliage, repeated bifurcation up high, insect damage.
8	<i>Betula alba</i>	22	2.6	2.0	15	N-S 5 E-W 7	Mat	Mod	7+	3	2	3	Low	R	Faunal browsing, asymmetrical bifurcation – repeated, large & fine deadwood, broken limbs, lost limbs – good response growth, rabbit warren & scratching in RZ, exposed SR, extreme root flare on S side, leaning ~70°.
9	<i>Quercus robur</i>	43	5.2	2.5	14	N-S 16 E-W 16	Mat	Mod	15+	4	3	4	Mod	R	Growing in fenced area in paddock, large & fine deadwood, rabbit scratching in RZ, exposed & damaged SR, epicormics, Ivy up trunk, faunal browsing, repeated asymmetrical bifurcation, natural grafting of limbs.
10	<i>Eucalyptus globoidea</i>	140 Estimated L.O.T	15.0	4.1 Est.	26	N-S 22 E-W 18	Mat	Mod	15+	4	3	4	High	Ret	NDW. Large & fine deadwood, has had some pruning – including large limbs, mature & young epicormics, exposed SR, repeated asymmetrical bifurcation, fence within SRZ, wood stored at base.

No.	Species	DBH cm	TPZ m	SRZ m	Hgt~ m	Wth~ m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
11	<i>Robinia pseudoacacia</i> (Black Locust)	24+ 24= 34 Est.	4.1	2.2 Est.	17	N-S 9 E-W 10	Mat	Mod	15+	3	4	3	Low	Ret	NDW. Fine deadwood, symmetrical bifurcation – lots of included bark, overextended limbs E, 1-sided N, lots of seedlings in yard (& bush reserve area).
12	<i>Cupressus x leylandii</i>	38+ 110 = 116 Est.	13.9	3.6 Est.	16	N-S 8 E-W 10	Mat	Mod	15+	3	3	4	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE driveway & fences within SRZ, repeated asymmetrical bifurcation – 3 co-dependants fused at 1.3m, has had pruning from powerlines, 1-sided W.
13	<i>Photinia robusta</i> (Red-leaf Photinia)	12+ 12+ 12+ 10+ 8= 24 Est.	2.9	1.7 Est.	6	N-S 4 E-W 5	Mat	Mod	15+	3	3	4	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE driveway & fences within SRZ, repeated bifurcation, fine deadwood, allelopathic effect from #12. Retain for screening
14	<i>Alnus glutinosa</i> (Common Alder)	18+ 8+ 10+ 10= 24 Est.	2.9	1.8 Est.	6	N-S 3 E-W 5	Sen	Mod	5+	1	3	2	Low	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE driveway & fences within SRZ, main trunk & branching damaged - dying back – rot, poor response growth, suckering from base, large & fine deadwood.
15	<i>Photinia robusta</i>	12+ 12+ 16+ 14+ 12= 30	3.6	1.9 Est.	7	N-S 6 E-W 6	Mat	Mod	15+	3	3	4	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE driveway & fences within SRZ, 1-sided & overextended limbs W, lower limbs pruned W side,

No.	Species	DBH cm	TPZ m	SRZ m	Hgt~ m	Wth~ m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
		Est.													large & fine deadwood, repeated bifurcation. Retain for screening
16	<i>Cupressus x leylandii</i>	100 Est.	12.0	3.4 Est.	8	N-S 8 E-W 10	Mat	Mod	7+	2	3	3	Low	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE driveway & fences within SRZ, fine & large deadwood, has had main leaders lopped off - epicormics & suckering lower down – not from cuts, dying back from top, repeated bifurcation – 3 co-dependants fused at 1.3m.
17	<i>Photinia robusta</i>	8+8 +8+ 8+8 =18 Est.	2.2	1.8 Est.	7	N-S 6 E-W 6	Mat	Mod	12+	3	3	4	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE driveway & fences within SRZ, repeated bifurcation, large & fine deadwood, excluded from light by #16&18. Retain for screening.
18	<i>Cupressus x leylandii</i>	42 Est.	5.0	2.3 Est.	8	N-S 7 E-W 8	Mat	Mod	12+	3	4	4	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE driveway & fences within SRZ, top lopped off, epicormics coming from cuts, repeated bifurcation within included bark – fused co-dependants. Retain for screening
19	<i>Photinia robusta</i>	6+6 +8+ 8+ 10= 17 Est.	2.0	1.6 Est.	8	N-S 5 E-W 7	Mat	Mod	15+	3	3	4	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE driveway & fences within SRZ, repeated bifurcation,

No.	Species	DBH cm	TPZ m	SRZ m	Hgt~ m	Wth~ m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
															light excluded from #18&20, fine deadwood. Retain for screening
20	<i>Cupressus x leylandii</i>	62 Est.	7.4	2.7 Est.	8	N-S 9 E-W 10	Mat	Mod	12+	3	3	4	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE driveway & fences within SRZ, bifurcated with included bark, main co-dependants fused at 1.3m, large & fine deadwood, top lopped off, epicormics. Retain for screening
21	<i>Alnus glutinosa</i>	28 Est.	3.4	2.0 Est.	11	N-S 7 E-W 10	Mat	Mod	7+	3	3	4	Low	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE driveway & fences within SRZ, asymmetrical bifurcation, large & fine deadwood, scarring / guttering on top of lower limbs, epicormics, suckering.
22	<i>Photinia robusta</i>	6+6 +8+ 8+ 10= 17 Est.	2.0	1.8 Est.	6	N-S 5 E-W 5	Mat	Mod	12+	4	3	3	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE driveway & fences within SRZ, repeated bifurcation, fine deadwood, allelopathic effect from #21&23.
23	<i>Alnus glutinosa</i>	22+ 24+ 3+4 =33 Est.	4.0	2.0 Est.	14	N-S 8 E-W 9	Mat	Mod	10+	4	2	4	Low	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE shed & concrete apron & fences within SRZ, exposed SR, NDE driveway within TPZ, repeated asymmetrical bifurcation, fine & large deadwood, has had some

No.	Species	DBH cm	TPZ m	SRZ m	Hgt~ m	Wth~ m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
															pruning, epicormics, guttering on top of lower limbs.
24	<i>Photinia robusta</i>	4+4 +9+ 12= 16 Est.	2.0	1.6 Est.	6	N-S 5 E-W 5	Mat	Mod	12+	3	3	3	Low	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE shed & fences within SRZ, repeated bifurcation, fine & large deadwood, allelopathic effect from #23&25, epicormics.
25	<i>Alnus glutinosa</i>	21+ 21+ 38= 48 Est.	5.8	2.2 Est.	10	N-S 7 E-W 9	Mat +	Mod	5+	2	2	2	Low	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE shed & fences within SRZ, exposed SR, repeated asymmetrical bifurcation, fine & large deadwood, large scarring/guttering on all main leaders – rot in wounds, mature & young epicormics, suckering from base, poor taper, low LCR.
26	<i>Photinia robusta</i>	9+6 +4+ 4+4 =13 Est.	2.0	1.8 Est.	7	N-S 4 E-W 5	Mat	Mod	12+	3	3	4	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE shed & fences within SRZ, repeated bifurcation, fine deadwood, epicormics, 1-sided N&E - allelopathic effect from #25&27.
27	<i>Cupressus x leylandii</i>	50+ 18+ 24= 58 Est.	7.0	2.8 Est.	14	N-S 10 E-W 10	Mat	Mod	15+	4	3	4	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, NDE shed & fences within SRZ, wood box & building materials within TPZ, repeated bifurcation, fine & large deadwood, epicormics, altered NGL.

No.	Species	DBH cm	TPZ m	SRZ m	Hgt- m	Wth- m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
28	<i>Cupressus x leylandii</i>	54+ 22= 58 Est.	7.0	2.9 Est.	14	N-S 8 E-W 9	Mat	Mod	15+	4	4	4	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, fences within SRZ, wood box & building materials within TPZ, repeated bifurcation, large & fine deadwood, lower limbs pruned, epicormics.
29	<i>Cupressus x leylandii</i>	55+ 20+ 20= 62 Est.	7.4	2.8 Est.	14	N-S 10 E-W 11	Mat	Mod	15+	4	4	4	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, fences within SRZ, wood box & building materials within TPZ, repeated bifurcation, large & fine deadwood, epicormics.
30	<i>Alnus glutinosa</i>	32 Est.	3.8	2.1 Est.	14	N-S 6 E-W 9	Mat	Mod	7+	3	3	2	Low	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, fences & wood box within SRZ, low LCR, large & fine deadwood, scarring main trunk & tops of limbs, lost limbs, epicormics.
31	<i>Photinia robusta</i>	8+6 +10 +12 =19 Est.	2.3	1.6 Est.	7	N-S 4 E-W 6	Mat	Mod	12+	3	4	3	Low	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, fences within SRZ, repeated bifurcation, large & fine deadwood, allelopathic effect from #30.
32	<i>Cupressus x leylandii</i>	54 Est.	6.5	2.8 Est.	15	N-S 9 E-W 10	Mat	Mod	15+	4	4	4	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, fences within SRZ, large & fine deadwood.
33	<i>Cupressus x leylandii</i>	46 Est.	5.5	2.4 Est.	13	N-S 7	Mat	Mod	12+	3	4	4	Low	R	Growing as part of a fenced off windbreak planting on E boundary

No.	Species	DBH cm	TPZ m	SRZ m	Hgt~ m	Wth~ m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
						E-W 8									fenceline, fences within SRZ, large & fine deadwood, dry rot in main trunk – in scar W side, repeated asymmetrical bifurcation – fused co-dependants, epicormics.
34	<i>Photinia robusta</i>	9+9 +8+ 12= 19 Est.	2.3	1.5 Est.	7	N-S 6 E-W 6	Mat	Mod	12+	3	4	4	Low	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, fences within SRZ, repeated bifurcation, fine deadwood, allelopathic effect from #33&35
35	<i>Cupressus x leylandii</i>	46+ 18= 49 Est.	5.9	2.5 Est.	15	N-S 9 E-W 10	Mat	Mod	15+	4	4	4	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, fences within SRZ, large & fine deadwood, asymmetrical bifurcation, epicormics.
36	<i>Photinia robusta</i>	4+6 +4+ 4+4 =10 Est.	2.0	1.5 Est.	6	N-S 5 E-W 6	Mat	Mod	15+	3	4	4	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, fences within SRZ, repeated bifurcation, fine deadwood, epicormics, allelopathic effect from #35.
37	<i>Callistemon salignus</i> (Willow Bottlebrush)	20+ 10+ 10+ 19= 31 Est.	3.7	2.5 Est.	9	N-S 6 E-W 7	Mat	Mod	12+	3	4	4	Mod	R	Growing as part of a fenced off windbreak planting on E boundary fenceline, fences within SRZ, repeated bifurcation from base, lots of large & fine deadwood.
38	<i>Betula alba</i>	18	2.2	1.8	8	N-S 6 E-W 6	Mat	Mod	10+	3	3	3	Low	R	Fine deadwood, internal fence within SRZ, drain within TPZ, bends in trunk 70° N then E.

No.	Species	DBH cm	TPZ m	SRZ m	Hgt- m	Wth- m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
39	<i>Eucalyptus viminalis</i> ssp. <i>pryoriana</i> (Gippsland Manna Gum)	36+ 36+ 60= 79	9.5	3.9 Est.	20	N-S 14 E-W 16	Mat	High	15+	3	3	4	High	R	Growing at toe of dam embankment, repeated asymmetrical bifurcation, epicormics, 1-sided N&E, insect damage, lost main leaders, galls up high – in union, internal fence within SRZ, Sweet Pittosporum at base. Offset as will be lost with dam works.
40	<i>Eucalyptus obliqua</i> (Messmate)	54	6.5	2.7	18	N-S 14 E-W 16	Mat	High	15+	4	3	4	High	R	Growing at toe of dam embankment, boundary fence within SRZ, high symmetrical bifurcation, large & fine deadwood, epicormics, insect damage, exposed & damaged SR. Offset as will be lost with dam works.
41	<i>Eucalyptus viminalis</i> ssp. <i>pryoriana</i>	14+ 41= 43	5.2	2.4	18	N-S 8 E-W 9	Mat	High	12+	3	2	4	High	R	Growing out of middle of dam embankment, large & fine deadwood, high asymmetrical bifurcation – repeated, insect damage, 1-sided N – allelopathic effect NS trees, fence within TPZ. Offset as will be lost with dam works.
42	<i>Eucalyptus globoidea</i>	43	5.2	2.4	18	N-S 12 E-W 14	Mat	High	12+	3	3	4	High	R	Growing right on boundary fence & drain within SRZ, large & fine deadwood, was bifurcated at base E co-dependant fallen, symmetrical bifurcation up high, NE co-dependant broken off – scar – medium response growth, large hanger held in canopy, mature & young epicormics, insect damage, some peripheral dieback. Offset as will be lost with dam works.

No.	Species	DBH cm	TPZ m	SRZ m	Hgt- m	Wth- m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
43	Dead	52		2.7										R	Offset as will be lost with dam works.
44	<i>Eucalyptus fulgens</i> (Green Scentbark)	41	4.9	2.5	16	N-S 11 E-W 12	Mat	High	12+	3	3	4	Mod	R	Asymmetrical bifurcation, large & fine deadwood, growing on toe of dam embankment, insect damage, epicormics, E co-dependant top bent S – phototropic effect from #45, W co-dependant bent W. Offset as will be lost with dam works.
45	<i>Eucalyptus fulgens</i>	50	6.0	2.7	20	N-S 13 E-W 14	Mat	High	15+	4	3	3	High	R	Growing at toe of dam embankment, large & fine deadwood, mature & young epicormics, top bent N then self-corrected - phototropic effect #44. Offset as will be lost with dam works.
46	<i>Eucalyptus fulgens</i>	33	4.0	2.2	10	N-S 9 E-W 8	Mat	High	12+	2	2	3	Low	R	Wide asymmetrical bifurcation, exposed SR, growing on TOB, large & fine deadwood, 1-sided NE & bent top - phototropic effect #45, lots of insect damage, thin canopy on W co-dependant. Offset as will be lost with dam works.
47	<i>Eucalyptus fulgens</i>	110 L.O.T.	13.2	3.4	22	N-S 16 E-W 14	Mat	High	12+	3	2	3	High	R	Lots of exposed & girdled SR, growing on TOB, large & fine deadwood, repeated bifurcation – fused at 1.3m with included bark, mature & young epicormics, insect damage, peripheral dieback, longicorn beetle damage. Offset as will be lost with dam works.

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No.	Species	DBH cm	TPZ m	SRZ m	Hgt~ m	Wth~ m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
54	<i>Eucalyptus globoidea</i>	87 L.O.T	10.4	3.5	26	N-S 20 E-W 18	Mat	High	15+	4	3	4	High	Ret	Fine & large deadwood, main trunk slight lean W, exposed & girdled SR, wide symmetrical bifurcation - repeated, mature & young epicormics.
55	<i>Eucalyptus globoidea</i>	54	6.5	3.3	15	N-S 16 E-W 12	Mat	High	7+	2	3	3	Low	Ret	Repeated asymmetrical bifurcation from base, mature & young epicormics, fine & large deadwood, 1-sided & bent top E – phototropic effect from #54, N co-dependant dead, insect damage.
56	<i>Eucalyptus globoidea</i>	94+ 111 = 147 L.O.T	15.0	4.4	28	N-S 31 E-W 24	Mat	High	12+	4	3	4	High	Ret	Multi-trunked from base – repeated bifurcation, S co-dependant dead, W co-dependant overextended N, fine & large deadwood, insect damage, lost large limbs, hollows at base, 1-sided N, phototropic effect #54. Dead-wooding & structural prune.
57	<i>Eucalyptus radiata</i> (Narrow-leaf Peppermint)	74 L.O.T	8.9	3.1	13	N-S 10 E-W 7	Mat +	High	5+/ ~	1	3	3	Low	Ret	Bifurcated up high – N & E co-dependants dead – rot in trunks, large & fine deadwood, had mistletoe, ~100% mature & young epicormics, Sweet Pittosporum at base.
58	<i>Eucalyptus globoidea</i>	96 L.O.T	11.5	3.4	26	N-S 18 E-W 21	Mat	High	12+	3	2	4	High	Ret	NS. Large & fine deadwood, drain, fence & road within SRZ, exposed SR, broken limbs, high E-W asymmetrical bifurcation, peripheral dieback, mature & young epicormics, good buttressing/taper.
59	<i>Eucalyptus fulgens</i>	42	5.0	2.4	15	N-S 6	Mat	High	7+	2	2	3	Mod	Ret	NS. Bent, leaning & massively overextended S, allelopathic effect

No.	Species	DBH cm	TPZ m	SRZ m	Hgt~ m	Wth~ m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
						E-W 11									from #58, mature & young epicormics including up trunk, peripheral dieback, large & fine deadwood, fence, drain & road within SRZ.
60	<i>Eucalyptus fulgens</i>	23+ 16= 28	3.4	2.2	7	N-S 7 E-W 11	Mat	High	10+	2	3	4	Low	Ret	NS. Bifurcated from base - repeated, mature & young epicormics, large & fine deadwood, fence right at base – SRZ, drain within TPZ, insect damage, curly limbs, Sweet Pittosporum at base.
61	<i>Eucalyptus fulgens</i>	39	4.7	2.4	17	N-S 11 E-W 7	Mat	High	7+	2	2	3	Mod	R	NS. Symmetrical bifurcation up high with included bark, E & W co-dependants apical dominance dead, large & fine deadwood, mature & young epicormics, fence, drain & road within SRZ, 1-sided & majority of canopy E, allelopathic effect #58, crossing limbs. Offset as will be considered lost due to works.
62	<i>Eucalyptus globoidea</i>	19	2.3	1.8	8	N-S 6 E-W 4	Mat	High	7+	2	2	4	Low	R	NS. Maybe a lignotuber of #64, growing right on boundary fence – SRZ, large & fine deadwood, symmetrical bifurcation, N co-dependant bent N, epicormics. Offset as will be considered lost due to works.
63	<i>Eucalyptus fulgens</i>	21	2.5	2.0	10	N-S 8 E-W 4	Mat	High	10+	3	3	3	Mod	R	NS. Asymmetrical bifurcation up high, N co-dependant bent N, fence within SRZ, drain & road within TPZ, large & fine deadwood, epicormics.

No.	Species	DBH cm	TPZ m	SRZ m	Hgt~ m	Wth~ m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
															Offset as will be considered lost due to works.
64	<i>Eucalyptus globoidea</i>	58	7.0	2.8	26	N-S 16 E-W 17	Mat	High	10+	3	2	3	High	R	NS. Exposed SR, asymmetrical bifurcation up high, nice taper, large & fine deadwood, , epicormics, insect damage, peripheral dieback, drain & fence within SRZ, road within TPZ. Offset as will be considered lost due to works.
65	<i>Eucalyptus globoidea</i>	31	3.7	2.2	15	N-S 11 E-W 10	Mat	High	7+	2	2	3	Low	R	NS. Repeated symmetrical bifurcation up high, S co-dependant overextended S, phototropic effect from #64, scar S side at base, lots of insect damage, mature & young epicormics, large & fine deadwood. Offset as will be considered lost due to works.
66	<i>Eucalyptus viminalis</i> ssp. <i>pryoriana</i>	46	5.5	2.6	14	N-S 10 E-W 12	Mat	High	10+	3	2	4	Mod	R	NS. Growing right on boundary fence & dam embankment within SRZ, drain & road within TPZ, repeated bifurcation, large & fine deadwood, mature & young epicormics, peripheral dieback, insect damage. Offset as will be considered lost due to works.
67	<i>Eucalyptus fulgens</i>	21+ 10= 23	2.8	1.8	7	N-S 3 E-W 6	Mat +	High	5+	1	3	2	Low	R	NS. Repeated bifurcation, large & fine deadwood, insect damage, epicormics, apical dieback, fence within SRZ. Offset as will be considered lost due to works.

No.	Species	DBH cm	TPZ m	SRZ m	Hgt- m	Wth- m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
68	<i>Eucalyptus viminalis</i> ssp. <i>pryoriana</i>	170 L.O.T	15.0	4.1	28	N-S 14 E-W 16	Mat	High	12+	3	2	4	High	R	NS. Growing on top of drain bank ~ & road within SRZ, insect damage, large & fine deadwood, mature & young epicormics, Ivy growing up trunk, bifurcated at ~1.4m – N co-dependant at base – scar & rot at base - good response growth. Offset as will be considered lost due to works.
69	<i>Eucalyptus fulgens</i>	47	5.6	2.6	14	N-S 6 E-W 5	Mat	High	5+	1	2	3	Low	R	NS. Lost apical dominance – all canopy is epicormics, repeated bifurcation, Ivy up trunk, drain & road within SRZ, large & fine deadwood. Offset as will be considered lost due to works.
70	<i>Eucalyptus fulgens</i>	41	4.9	2.5	10	N-S 5 E-W 8	Mat	High	5+	1	3	3	Low	R	NS. Lost apical dominance, mature & young epicormics, fence within SRZ, drain & road within TPZ, large & fine deadwood, lignotuber, Sweet Pittosporum at base. Offset as will be considered lost due to works.
71	<i>Eucalyptus fulgens</i>	22	2.6	2.1	12	N-S 3 E-W 3	Mat	High	5+	1	3	3	Low	R	Repeated bifurcation, E co-dependant dead, large & fine deadwood, peripheral dieback, drain & road within SRZ, Sweet Pittosporum at base. Offset as will be considered lost due to works.
72	<i>Eucalyptus fulgens</i>	38	4.6	2.4	12	N-S 8 E-W 4	Mat	High	5+	2	2	3	Low	R	NS. Bent top S, faunal browsing, insect damage, large & fine deadwood, drain & road within SRZ. Offset as will be considered lost due to works.

No.	Species	DBH cm	TPZ m	SRZ m	Hgt- m	Wth- m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
73	<i>Eucalyptus fulgens</i>	30	3.6	2.2	8	N-S 4 E-W 4	Mat	High	5+	3	3	4	Low	R	NS. Main canopy N, lignotubers, epicormics, Sweet Pittosporum at base, drain & road within TPZ. Offset as will be considered lost due to works.
74	<i>Eucalyptus fulgens</i>	28	3.4	2.0	8	N-S 4 E-W 4	Mat	High	5+	2	3	4	Low	R	NS. Leaning E from base, main canopy overextended NE, Sweet Pittosporum at base, drain & road within TPZ, large & fine deadwood. Offset as will be considered lost due to works.
75	<i>Eucalyptus fulgens</i>	32	3.8	2.3	14	N-S 10 E-W 8	Mat	High	5+	2	3	3	Low	R	NS. Main trunk on ~45° E, mature epicormics, large & fine deadwood, insect damage, Sweet Pittosporum at base. Offset as will be considered lost due to works.
76	<i>Eucalyptus fulgens</i>	28	3.4	2.2	14	N-S 5 E-W 8	Mat	High	5+	1	3	3	Low	R	NS. Main trunk on 90° bend, repeated bifurcation, mature epicormics, large & fine deadwood, fence within SRZ. Offset as will be considered lost due to works.
77	<i>Eucalyptus fulgens</i>	32+ 36+ 29= 56	6.7	2.9	16	N-S 9 E-W 7	Mat	High	7+	2	3	3	Low	R	NS. Asymmetrical bifurcation from base, S co-dependant ~45° to SE – broken off, large & fine deadwood, mature & young epicormics, fence within SRZ, Sweet Pittosporum at base. Offset as will be considered lost due to works.
78	<i>Eucalyptus fulgens</i>	36+ 23+ 17=	5.5	2.8	16	N-S 10	Mat	High	10+	3	2	4	High	R	NS. Top bent W around #77, repeated bifurcation from base, mature & young epicormics, large &

No.	Species	DBH cm	TPZ m	SRZ m	Hgt~ m	Wth~ m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
		46				E-W 8									fine deadwood, has had some pruning, drain & road within SRZ. Offset as will be considered lost due to works.
79	<i>Eucalyptus fulgens</i>	54	6.5	2.7	18	N-S 10 E-W 10	Mat	High	7+	2	3	3	Low	R	NS. Mostly epicormics, large & fine deadwood, fence within SRZ, drain & road within TPZ. Offset as will be considered lost due to works.
80	<i>Eucalyptus fulgens</i>	21	2.5	2.0	8	N-S 6 E-W 5	Mat	High	5+	2	3	3	Low	R	NS. Fence within SRZ, bent ~70° N, mature & young epicormics, large & fine deadwood. Offset as will be considered lost due to works.
81	<i>Eucalyptus fulgens</i>	50	6.0	2.8	16	N-S 14 E-W 9	Mat	High	7+	2	3	3	Mod	R	NS. Ivy up trunk, growing on edge of drain bank & road within SRZ, peripheral dieback, high symmetrical bifurcation, large & fine deadwood, mature & young epicormics. Offset as will be considered lost due to works.
82	<i>Eucalyptus fulgens</i>	42 36= 55	6.6	3.2	16	N-S 12 E-W 10	Mat	High	7+	3	3	4	Mod	R	NS. Symmetrical bifurcation from base – repeated, large gall on main trunk, lots of mature & young epicormics, large & fine deadwood, peripheral dieback. Offset as will be considered lost due to works.
83	<i>Eucalyptus fulgens</i>	33	4.0	2.4	11	N-S 9 E-W 7	Mat	High	10+	3	3	4	Mod	R	NS. Main trunk ~70° & top bent E – self-corrected, repeated bifurcation, fence within SRZ, drain & road within TPZ, mature & young epicormics, fine deadwood. Offset as will be considered lost due to works.

No.	Species	DBH cm	TPZ m	SRZ m	Hgt~ m	Wth~ m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
84	<i>Eucalyptus fulgens</i>	111 L.O.T	13.2	3.7	24	N-S 18 E-W 18	Mat	High	15+	3	3	4	High	R	Growing as a SA in paddock, broken limbs – including large limb SW side – scar with good response growth – gap in canopy, exposed & damaged SR, large & fine deadwood, mature & young epicormics, peripheral dieback S side. Offset as will be considered lost due to works.
85	<i>Eucalyptus viminalis</i> ssp. <i>pryoriana</i>	12+ 11+ 12+ 11+ 6= 28	3.4	2.2	7	N-S 8 E-W 6	Mat	High	7+	1	1	4	Low	R	Fallen in paddock area – main trunk horizontal ~8m then grown up again, large & fine deadwood, repeated bifurcation, epicormics. Offset as will be considered lost due to works.
86	Dead	132 L.O.T		3.9										Ret	Dead. Offset as will be considered lost due to works. Check for fauna, pull test for integrity.
A	<i>Eucalyptus fulgens</i>	41	4.9	2.9	12	N-S 7 E-W 7	Mat	High	10+	3	2	3	High	Ret	NSS. Symmetrical bifurcation from ~40cm with included bark – crack & scar at initial union – W co-dependant dead, drain & road within SRZ, fence within TPZ, exposed SR, 1-sided S, large & fine deadwood, mature & young epicormics.
B	Dead	44													NSS. Stump at ~9m
C	<i>Eucalyptus fulgens</i>	59	7.1	3.9	15	N-S 11 E-W 9	Mat	High	7+	2	2	3	High	Ret	NSS. Drain within SRZ, road & fence within TPZ, main trunk ~45° lean SE, lignotuber, rubbing on trunk from #B, repeated bifurcation, large & fine

No.	Species	DBH cm	TPZ m	SRZ m	Hgt~ m	Wth~ m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
															deadwood, old limb loss – good response growth, peripheral dieback.
D	<i>Eucalyptus fulgens</i>	74	8.9	3.2	18	N-S 12 E-W 9	Mat	High	10+	3	2	4	High	Ret	NSS. Drain within SRZ, road & fence within TPZ, exposed SR, broken limbs, large & fine deadwood, mature & young epicormics, majority of canopy to E&S, nest box strapped on trunk, apical dieback.
E	<i>Eucalyptus fulgens</i>	63+ 50= 80	9.6	3.3	18	N-S 9 E-W 12	Mat	High	7+	2	2	4	High	Ret	NSS. Road within SRZ, drain & fence within TPZ, exposed SR, large & fine deadwood, mature & young epicormics, bracket fungi, W co-dependant has dieback.
F	<i>Eucalyptus fulgens</i>	50	6.0	2.7	15	N-S 10 E-W 7	Mat +	High	5+	2	2	2	High	Ret	NSS. Growing right on edge of drain – SRZ, road & fence within TPZ, exposed SR, bent trunk to S, broken main trunk, apical dieback, all canopy is mature & young epicormics, large & fine deadwood.
G	<i>Eucalyptus globoidea</i> (White Stringybark)	69+ 39= 79	9.5	3.4	18	N-S 12 E-W 16	Mat	High	10+	3	2	3	High	Ret	NSS. Drain within SRZ, road & fence within TPZ, asymmetrical bifurcation from base - repeated, large & fine deadwood, mature & young epicormics, main trunk broken & scarring, apical dieback.
H	<i>Eucalyptus globoidea</i>	52+ 45= 69	8.3	3.2	14	N-S 7 E-W 8	Mat	High	10+	3	2	3	High	Ret	NSS. Drain within SRZ, road within TPZ, symmetrical bifurcation from base – repeated, large & fine deadwood, scar E side.
I	<i>Eucalyptus fulgens</i>	47	5.6	2.5	12	N-S 7	Mat	High	7+	2	1	4	High	Ret	NSS. Drain & erosion within SRZ, road within TPZ, exposed SR, main

No.	Species	DBH cm	TPZ m	SRZ m	Hgt~ m	Wth~ m	L.S.	Sig.	ULE yrs	Struct	Roots	Cpy	Ret Value	R/ Ret	Notes
						E-W 8									trunk ~50° S, wide bifurcation, large & fine deadwood, mature & young epicormics.

Legend:

DBH = Diameter at Breast Height, in centimetres, BH=Breast Height L.O.T.= Large Old Tree, 70cm in EVC 16 TPZ = Tree Protection Zone SRZ = Structural Root Zone SR = Structural Roots Hgt = Height, measured in metres Wth = Width, measured in metres L.S. = Life stage: Young, Mat = Mature, Sen = Senescing Sig. = Significance, assessed as high, moderate or low ULE = Useful Life Expectancy, estimated in years Struct. = Structure, scored out of 5 Roots = root environment health, scored out of 5	Cpy = Canopy health, scored out of 5 Ret Value = Retention Value R/Ret = tree proposed to be R=Removed/Ret=Retained NGL = Natural Ground Level RZ = Root Zone NS = Nature-strip ND = Next Door property to N, S, E, W TOB = Top of Bank DS = Defendable Space CS = Canopy Separation LCR = Live Crown Ratio
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Tree retention/removal/offset justification table

No.	Species	DBH cm	Sig.	ULE yrs	Ret Value	R/ Ret	Offset Y/N	Notes	Permit required
1	<i>Eucalyptus globoidea</i> (White Stringybark)	91 L.O.T	High	10+	High	Ret	Y	Offset as consequential loss due to proximity of boundary	No -retained
2	<i>Cupressus x leylandii</i> (Leyland's Cypress)	21	Mod	15+	Low	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2

No.	Species	DBH cm	Sig.	ULE yrs	Ret Value	R/ Ret	Offset Y/N	Notes	Permit required
3	<i>Cupressus x leylandii</i>	40+ 28+ 27= 56	Mod	15+	Mod	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
4	<i>Cupressus x leylandii</i>	32+ 32+ 32+ 23= 60	Mod	15+	Mod	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
5	<i>Betula alba</i> (Silver Birch)	6+ 21= 22	Mod	7+	Low	R	N	Exotic planted species exempt from offsetting	No-exempt -not substantial tree
6	<i>Betula alba</i>	19+ 10+ 10+ 10= 26	Mod	5+	Low	R	N	Exotic planted species exempt from offsetting	No-exempt -not substantial tree
7	<i>Quercus robur</i> (English Oak)	51	Mod	15+	Mod	R	N	Exotic planted species exempt from offsetting	Yes
8	<i>Betula alba</i>	22	Mod	7+	Low	R	N	Exotic planted species exempt from offsetting	No-exempt-not substantial tree
9	<i>Quercus robur</i>	43	Mod	15+	Mod	R	N	Exotic planted species exempt from offsetting	Yes
10	<i>Eucalyptus globoides</i>	140 <small>Estimated L.O.T</small>	Mod	15+	High	Ret	N	NDW. Third party ownership	No - retained
11	<i>Robinia pseudoacacia</i> (Black Locust)	24+ 24= 34 <small>Est.</small>	Mod	15+	Low	Ret	N	NDW. Third party ownership	No - retained
12	<i>Cupressus x leylandii</i>	38+	Mod	15+	Mod	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2

No.	Species	DBH cm	Sig.	ULE yrs	Ret Value	R/ Ret	Offset Y/N	Notes	Permit required
		110 = 116 Est.							
13	<i>Photinia robusta</i> (Red-leaf Photinia)	12+ 12+ 12+ 10+ 8= 24 Est.	Mod	15+	Mod	R	N	Exotic planted species exempt from offsetting	No- exempt under 52.12-2
14	<i>Alnus glutinosa</i> (Common Alder)	18+ 8+ 10+ 10= 24 Est.	Mod	5+	Low	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
15	<i>Photinia robusta</i>	12+ 12+ 16+ 14+ 12= 30 Est.	Mod	15+	Mod	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
16	<i>Cupressus x leylandii</i>	100 Est.	Mod	7+	Low	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
17	<i>Photinia robusta</i>	8+8 +8+ 8+8 =18 Est.	Mod	12+	Mod	R	N	Exotic planted species exempt from offsetting	No- exempt under 52.12-2

No.	Species	DBH cm	Sig.	ULE yrs	Ret Value	R/ Ret	Offset Y/N	Notes	Permit required
18	<i>Cupressus x leylandii</i>	42 Est.	Mod	12+	Mod	R	N	Exotic planted species exempt from offsetting	No- exempt under 52.12-2
19	<i>Photinia robusta</i>	6+6 +8+ 8+ 10= 17 Est.	Mod	15+	Mod	R	N	Exotic planted species exempt from offsetting	No- exempt under 52.12.2
20	<i>Cupressus x leylandii</i>	62 Est.	Mod	12+	Mod	Ret	N	Exotic planted species exempt from offsetting	No- exempt under 52.12-2
21	<i>Alnus glutinosa</i>	28 Est.	Mod	7+	Low	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
22	<i>Photinia robusta</i>	6+6 +8+ 8+ 10= 17 Est.	Mod	12+	Mod	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
23	<i>Alnus glutinosa</i>	22+ 24+ 3+4 =33 Est.	Mod	10+	Low	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
24	<i>Photinia robusta</i>	4+4 +9+ 12= 16 Est.	Mod	12+	Low	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
25	<i>Alnus glutinosa</i>	21+ 21+ 38= 48 Est.	Mod	5+	Low	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2

No.	Species	DBH cm	Sig.	ULE yrs	Ret Value	R/ Ret	Offset Y/N	Notes	Permit required
26	<i>Photinia robusta</i>	9+6 +4+ 4+4 =13 Est.	Mod	12+	Mod	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
27	<i>Cupressus x leylandii</i>	50+ 18+ 24= 58 Est.	Mod	15+	Mod	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
28	<i>Cupressus x leylandii</i>	54+ 22= 58 Est.	Mod	15+	Mod	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
29	<i>Cupressus x leylandii</i>	55+ 20+ 20= 62 Est.	Mod	15+	Mod	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
30	<i>Alnus glutinosa</i>	32 Est.	Mod	7+	Low	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
31	<i>Photinia robusta</i>	8+6 +10 +12 =19 Est.	Mod	12+	Low	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
32	<i>Cupressus x leylandii</i>	54 Est.	Mod	15+	Mod	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
33	<i>Cupressus x leylandii</i>	46 Est.	Mod	12+	Low	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
34	<i>Photinia robusta</i>	9+9 +8+ 12=	Mod	12+	Low	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2

No.	Species	DBH cm	Sig.	ULE yrs	Ret Value	R/ Ret	Offset Y/N	Notes	Permit required
		19 Est.							
35	<i>Cupressus x leylandii</i>	46+ 18= 49 Est.	Mod	15+	Mod	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
36	<i>Photinia robusta</i>	4+6 +4+ 4+4 =10 Est.	Mod	15+	Mod	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
37	<i>Callistemon salignus</i> (Willow Bottlebrush)	20+ 10+ 10+ 19= 31 Est.	Mod	12+	Mod	R	N	Exotic planted species exempt from offsetting	No-exempt under 52.12-2
38	<i>Betula alba</i>	18	Mod	10+	Low	R	N	Exotic planted species exempt from offsetting	No- exempt- not substantial tree
39	<i>Eucalyptus viminalis</i> ssp. <i>pyroriana</i> (Gippsland Manna Gum)	36+ 36+ 60= 79	High	15+	High	R	Y	Offset as will be lost with dam works.	Yes
40	<i>Eucalyptus obliqua</i> (Messmate)	54	High	15+	High	R	Y	Offset as will be lost with dam works.	Yes
41	<i>Eucalyptus viminalis</i> ssp. <i>pyroriana</i>	14+ 41= 43	High	12+	High	R	Y	Offset as will be lost with dam works.	Yes
42	<i>Eucalyptus globoidea</i>	43	High	12+	High	R	Y	Offset as will be lost with dam works.	Yes

No.	Species	DBH cm	Sig.	ULE yrs	Ret Value	R/ Ret	Offset Y/N	Notes	Permit required
43	Dead	52			Low	R	Y	Offset as will be lost with dam works.	Yes
44	<i>Eucalyptus fulgens</i> (Green Scentbark)	41	High	12+	Mod	R	Y	Offset as will be lost with dam works.	Yes
45	<i>Eucalyptus fulgens</i>	50	High	15+	High	R	Y	Offset as will be lost with dam works.	Yes
46	<i>Eucalyptus fulgens</i>	33	High	12+	Low	R	Y	Offset as will be lost with dam works.	Yes
47	<i>Eucalyptus fulgens</i>	110 VLOT	High	12+	High	R	Y	Offset as will be lost with dam works.	Yes
48	<i>Eucalyptus obliqua</i>	130 Est. VLOT	High	7+	High	Ret	N	Retained	No- retained
49	<i>Eucalyptus obliqua</i>	144 L.O.T	High	12+	High	Ret	N	Retain >4m from new boundary -high retention value habitat tree within proposed conservation reserve	No- retained
50	<i>Eucalyptus globoidea</i>	82 L.O.T	High	12+	High	Ret	N	Retain >4m from new boundary high retention value habitat tree within proposed conservation reserve	No- retained
51	<i>Eucalyptus globoidea</i>	18	High	7+	Low	Ret	N	Retain	No- retained
52	<i>Eucalyptus globoidea</i>	13+ 15= 20	High	7+	Low	Ret	N	Retain	No- retained
53	Dead	81 L.O.T				Ret	N	Retain >4m from new boundary high retention value habitat tree within proposed conservation reserve	No- retained
54	<i>Eucalyptus globoidea</i>	87 L.O.T	High	15+	High	Ret	N	Retain >4m from new boundary high retention value habitat tree within proposed conservation reserve	No- retained

No.	Species	DBH cm	Sig.	ULE yrs	Ret Value	R/ Ret	Offset Y/N	Notes	Permit required
55	<i>Eucalyptus globoidea</i>	54	High	7+	Low	Ret	N	Retain	No- retained
56	<i>Eucalyptus globoidea</i>	94+ 111 = 147 L.O.T	High	12+	High	Ret	N	Retain >4m from new boundary high retention value habitat tree within proposed conservation reserve	No- retained
57	<i>Eucalyptus radiata</i> (Narrow-leaf Peppermint)	74 L.O.T	High	5+/ ~	Low	Ret	N	Retain >4m from new boundary high retention value habitat tree within proposed conservation reserve	No- retained
58	<i>Eucalyptus globoidea</i>	96 L.O.T	High	12+	High	Ret	Y	NS. Third party ownership. Retain	No- retained
59	<i>Eucalyptus fulgens</i>	42	High	7+	Mod	Ret	Y	NS. Third party ownership. Retain	No- retained
60	<i>Eucalyptus fulgens</i>	23+ 16= 28	High	10+	Low	Ret	Y	NS. Third party ownership. Retain	No -retained
61	<i>Eucalyptus fulgens</i>	39	High	7+	Mod	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
62	<i>Eucalyptus globoidea</i>	19	High	7+	Low	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
63	<i>Eucalyptus fulgens</i>	21	High	10+	Mod	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
64	<i>Eucalyptus globoidea</i>	58	High	10+	High	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes

No.	Species	DBH cm	Sig.	ULE yrs	Ret Value	R/ Ret	Offset Y/N	Notes	Permit required
65	<i>Eucalyptus globoidea</i>	31	High	7+	Low	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
66	<i>Eucalyptus viminalis</i> ssp. <i>pryoriana</i>	46	High	10+	Mod	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc..	Yes
67	<i>Eucalyptus fulgens</i>	21+ 10= 23	High	5+	Low	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
68	<i>Eucalyptus viminalis</i> ssp. <i>pryoriana</i>	170 VLOT	High	12+	High	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
69	<i>Eucalyptus fulgens</i>	47	High	5+	Low	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
70	<i>Eucalyptus fulgens</i>	41	High	5+	Low	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
71	<i>Eucalyptus fulgens</i>	22	High	5+	Low	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
72	<i>Eucalyptus fulgens</i>	38	High	5+	Low	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
73	<i>Eucalyptus fulgens</i>	30	High	5+	Low	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
74	<i>Eucalyptus fulgens</i>	28	High	5+	Low	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes

No.	Species	DBH cm	Sig.	ULE yrs	Ret Value	R/ Ret	Offset Y/N	Notes	Permit required
75	<i>Eucalyptus fulgens</i>	32	High	5+	Low	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
76	<i>Eucalyptus fulgens</i>	28	High	5+	Low	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
77	<i>Eucalyptus fulgens</i>	32+ 36+ 29= 56	High	7+	Low	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
78	<i>Eucalyptus fulgens</i>	36+ 23+ 17= 46	High	10+	High	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
79	<i>Eucalyptus fulgens</i>	54	High	7+	Low	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
80	<i>Eucalyptus fulgens</i>	21	High	5+	Low	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
81	<i>Eucalyptus fulgens</i>	50	High	7+	Mod	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
82	<i>Eucalyptus fulgens</i>	42 36= 55	High	7+	Mod	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
83	<i>Eucalyptus fulgens</i>	33	High	10+	Mod	R	Y	NS. Third party ownership. Offset as will be considered lost due to unavoidable works for crossovers etc.	Yes
84	<i>Eucalyptus fulgens</i>	111 VLOT	High	15+	High	R	Y	Offset as will be considered lost due to works. Check for fauna and hollow occupancy.	Yes

No.	Species	DBH cm	Sig.	ULE yrs	Ret Value	R/ Ret	Offset Y/N	Notes	Permit required
85	<i>Eucalyptus viminalis</i> ssp. <i>pyroriana</i>	12+ 11+ 12+ 11+ 6= 28	High	7+	Low	R	Y	Offset as will be considered lost due to works.	Yes
86	Dead	132 VLOT	Mod	Na	High	Ret	Y	Offset as will be considered lost due to works. Check for fauna and hollow occupancy.	Yes- considered lost
A	<i>Eucalyptus fulgens</i>	41	High	10+	High	Ret	N	NS. Third party ownership. Retain with encroachment from works for crossovers unlikely.	No- retained
B	<i>Eucalyptus fulgens</i>	44	High	~	Mod	Ret	N	Retain – dead unaffected NS. Third party ownership. Retain with no encroachment from works for crossovers	No- retained
C	<i>Eucalyptus fulgens</i>	59	High	7+	High	Ret	N	NS. Third party ownership. Retain with minor encroachment from works for crossovers etc.	No- retained
D	<i>Eucalyptus fulgens</i>	74 LOT	High	10+	High	Ret	N	Large old tree -protect during works. NS. Third party ownership. Retain with minor encroachment from works for crossovers to access lots 211 and services	No- retained
E	<i>Eucalyptus fulgens</i>	63+ 50= 80	High	7+	High	Ret	N	Protect during works. NS. Third party ownership. Retain with encroachment from works for crossovers to access lots 211/212.	No- retained
F	<i>Eucalyptus fulgens</i>	50	High	5+	High	Ret	N	NS. Third party ownership. Retain with encroachment from works for crossovers unlikely.	No- retained
G	<i>Eucalyptus globoidea</i>	69+ 39= 79	High	10+	High	Ret	N	Protect during works. NS. Third party ownership. Retain with encroachment from works for crossovers to access lots 212/213.	No- retained

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No.	Species	DBH cm	Sig.	ULE yrs	Ret Value	R/ Ret	Offset Y/N	Notes	Permit required
H	<i>Eucalyptus globoidea</i>	52+ 45= 69	High	10+	High	Ret	N	NS. Third party ownership. Retain with minor encroachment from works for crossovers likely.	No- retained
I	<i>Eucalyptus fulgens</i>	47	High	7+	High	Ret	N	NS. Third party ownership. Retain with encroachment from works for crossovers unlikely.	No- retained

Pictorial Assessment



Tree 1 root zone



Tree 1 canopy



Tree 2 root zone



Tree 2 canopy



Tree 3 root zone



Tree 3 canopy



Tree 4 root zone



Tree 4 canopy



Tree 5 root zone



Tree 5 canopy



Tree 6 root zone



Tree 6 canopy



Tree 7 root zone



Tree 7 canopy



Tree 8 root zone



Tree 8 canopy



Rabbit warren under #8.



Sweet Pittosporum & Cherry Plum in paddock



Tree 9 root zone



Tree 9 canopy



Tree 10 root zone



Tree 10 canopy



Tree 11 root zone



Tree 11 canopy



Tree 12 root zone



Tree 12 canopy



Tree 13 root zone



Tree 13 canopy



Tree 14 root zone



Tree 14 canopy



Tree 15 root zone



Tree 15 canopy



Tree 16 root zone



Tree 16 canopy



Tree 17 root zone



Tree 17 canopy



Tree 18 root zone



Tree 18 canopy



Tree 19 root zone



Tree 19 canopy



Tree 20 canopy



Tree 20 trunk



Tree 21 canopy



Tree 21 trunk



Tree 22 canopy



Tree 22 trunk



Tree 23 canopy



*Tree 23 trunk
Guttering on top of limbs*





Tree 24 canopy



Tree 24 trunk



Tree 25 canopy



Tree 25 trunk



Tree 26 canopy



Tree 26 trunk



Tree 27 canopy



Tree 27 trunk



Tree 28 canopy



Tree 28 trunk



Tree 29 canopy



Tree 29 trunk



Tree 30 canopy



Tree 30 trunk



Tree 31 canopy



Tree 31 trunk



Tree 32 canopy



Tree 32 trunk



Tree 33 canopy



Tree 33 trunk



Tree 34 canopy



Tree 34 trunk



Tree 35 root zone



Tree 35 canopy



Tree 36 root zone



Tree 36 canopy



Tree 37 root zone



Tree 37 canopy



Tree 38 root zone



Tree 38 canopy



Tree 39 root zone



Tree 39 canopy



Tree 40 root zone



Tree 40 canopy



Tree 41 root zone



Tree 41 canopy



Tree 42 root zone



Tree 42 canopy



Tree 43



Tree 44 root zone



Tree 44 canopy



Tree 45 root zone



Tree 45 canopy



Tree 46 root zone



Tree 46 canopy



Tree 47 root zone



Tree 47 canopy



Tree 48 root zone



Tree 48 canopy



Tree 49 root zone



Tree 49 canopy



Tree 50 root zone



Tree 50 canopy



Trees 51, 52 & 53 root zone



Trees 51, 52 & 53 canopies



Trees 54 & 55 root zone



Trees 54 & 55 canopies



Tree 56 root zone



Tree 56 canopy



Tree 49 root zone



Tree 49 trunk



Tree 54 root zone



Tree 54 canopy



Tree 55 root zone



Tree 55 canopy



Tree 56 root zone



Tree 56 canopy



Tree 57 root zone



Tree 57 canopy



Tree 58 root zone



Tree 58 canopy



Tree 59 root zone



Tree 59 canopy



Tree 60 root zone



Tree 60 canopy



Tree 61 root zone



Tree 61 canopy



Tree 62, 63, 64 root zone



Tree 62, 63, 64 canopy



Tree 65 root zone



Tree 65 canopy



Tree 66 root zone



Tree 66 canopy



Tree 67 root zone



Tree 67 canopy



Tree 68 root zone



Tree 68 canopy



Tree 68 root zone



Tree 69 root zone



Tree 69 canopy



Tree 70 root zone



Tree 70 canopy



Tree 71 root zone



Tree 71 canopy



Tree 72 root zone



Tree 73 root zone



Tree 74 root zone



Tree 75 root zone



Trees canopies 72-75



Tree 76 root zone



Tree 77 root zone



Tree 78 root zone



Trees 76-78 canopies



Trees 76-78 canopies



Trees 79-83 root zone & canopies



Trees 81- 83 canopies



Trees 81-83 root zones



Tree 79-81 canopies



Tree 79-81 root zones



Trees 75-83 root zone and canopies



Tree 84 root zone



Tree 84 canopy



Tree 85 root zone



Tree 85 canopy



Tree 86 root zone



Tree 86 canopy



Tree A root zone



Tree A canopy



Tree B branching



Tree B



Tree C root zone



Tree C canopy



Tree D root zone



Tree D canopy



Tree E root zone & fungi



Tree E canopy



Tree F root zone



Tree F canopy



Tree G root zone



Tree G canopy



Tree H root zone



Tree H canopy



Tree I root zone & drain



Tree I canopy





Petty Rd facing west.



Petty Rd facing east



Facing E, SE, S, SW



Facing NW, N, NE



Facing NE, E, SE, windbreak planting.

Shrubs in southern section



Windbreak - shrubs in southern section, facing NE & SE



Windbreak facing N, E, S



Windbreak facing E, SE



Eastern paddock facing N

Recommendations & Conclusions

4.0

This proposal to sub-divide the property into 30 house lots will see the loss of trees, including L.O.T./V.L.O.Ts (Large and Very Large Old Trees) as is often the case with any development, therefore a compromise must be reached.

Vegetation on 2/3 of the property has long been managed as pasture and grazed by sheep and horses prior to being orchards many decades ago.

The other 1/3 of the property is predominantly indigenous vegetation which has been limited to a 1.334Ha to the west of the property, and currently has the highest indigenous floral biodiversity on the site. Many Large and Very Large trees in this area have avoided removal, loss and offsetting by the location of the proposed road and it is proposed that this area be set aside permanently as a reserve, to serve as a sanctuary for fauna and flora and public open space recreation for new residents.

While it is never ideal to lose indigenous vegetation, the reservation of approximately 1/3 of the site to conservation is an excellent result. This is an important bio-link as a habitat corridor. The other properties and lots in the immediate area are very much cleared and have also recently been or in the process of being subdivided and this proposal will fit with the broader neighbourhood character which is being established as a residential area.

Trees proposed for removal (74 trees total)

Trees # 2-9 are exotic planted trees located on the north-western part of the property and proposed for removal to facilitate the development of the smaller residential lots #301-303.

Trees #12-37 are exotic planted trees located on the subject property and form part of a planted mixed boundary screen along the eastern boundary. These trees (some of which are in poor condition) will require removal for the establishment of the lots 307-311 plus 202 for their BAL ratings and building envelopes.

Tree #38 is an exotic planted tree at the top of the dam, which requires removal for the dam works to establish a retarding basin during construction and then be established as a house lot 215.

Trees #39-47 are indigenous trees located to the south on the subject property located around the existing dam area, many self-seeded into the dam wall. These trees will require removal due to the earth works involved in establishing the retarding basin during construction and the subsequent establishment of lots 211-215 as residential blocks. These trees will require offsetting and have been mapped in the NVR report.

Trees #61-83 are indigenous trees located on the nature-strip which were assessed for potential impact, and unfortunately these trees will require removal for the establishment of the road, installation of underground services and the creation of a crossovers to the lots 209-213 from Petty Rd. Some of these trees #61-67 are located on the nature-strip below the existing dam (to be modified and removed) and will be considered lost also due to these works. Trees # 68-83 should be retained as long as possible until the establishment of the house lots 209-212 requires their removal to construct crossovers. By this stage it is hoped that the conservation reserve will have accommodated for any habitat loss. These trees have been mapped in the NVR report and considered lost and are proposed to be offset.

Trees #84 & 86 are Very Large Old Trees located on the subject property to the south-east located as scattered trees in the existing paddock. Tree #84 is an indigenous Green Scentbark of high habitat and retention value but will be lost to the establishment of the new access road and its retention will render this subdivision in accessible and not able to be developed or extended to the east in the future due to its large size and TPZ. Tree # 86 is a Very Large Habitat stag located to the south of the proposed lots 205/206 and within mapped new road. This tree will also be considered lost to the development. Both trees have been mapped as scattered Large Trees in the NVR report to be offset. Tree #86 is being considered for retention as a feature and habitat stag but will require a pull test and significant upper limb reduction.

Tree #85 is an indigenous species, located in lot 201, it is of low retention value and poor form having fallen over from root plate failure and growing laterally along the ground. This tree will require offsetting and has been mapped in the NVR report.

Trees proposed for retention (21 trees) **With no proposed TPZ incursion**

With <10% incursion into TPZ -proposed/existing

Tree #1 is a Large Old Tree located to the north-west of the site and can be retained with some extensive work in lot 301. This tree has been offset however, due to the consequential loss from the division of the site into smaller lots (<4000m²). New encroachment is calculated as 8.1%.

Trees #10 & 11 are located on the neighbouring property to the west. Lots 304 & 305 building envelopes have been designed to have a less than 10% TPZ incursion for Tree #10 which is deemed acceptable under AS4970 (2009). New encroachment is calculated as 2.6% & 1.2% respectively for Trees 10 & 11.

Trees #48-57 are indigenous trees located to the south-west of the subject property and are proposed for retention as part of the conservation reserve. Of these trees #48, 49, 50, 53, 54, 57 & 56 are Very Large & Large Old Trees with high retention value. These trees have high habitat value, and they can be retained within the proposed conservation reserve. TPZ fencing should be erected for the development

of the adjacent lots 213 & 214. Tree 48, new encroachment has been calculated as 1.2% and Tree 49, new encroachment as 1.2 %.

Tree #58 is an indigenous Large Old Tree located on the Petty Rd nature-strip to the south of the site. This tree can be retained no new impact anticipated from works.

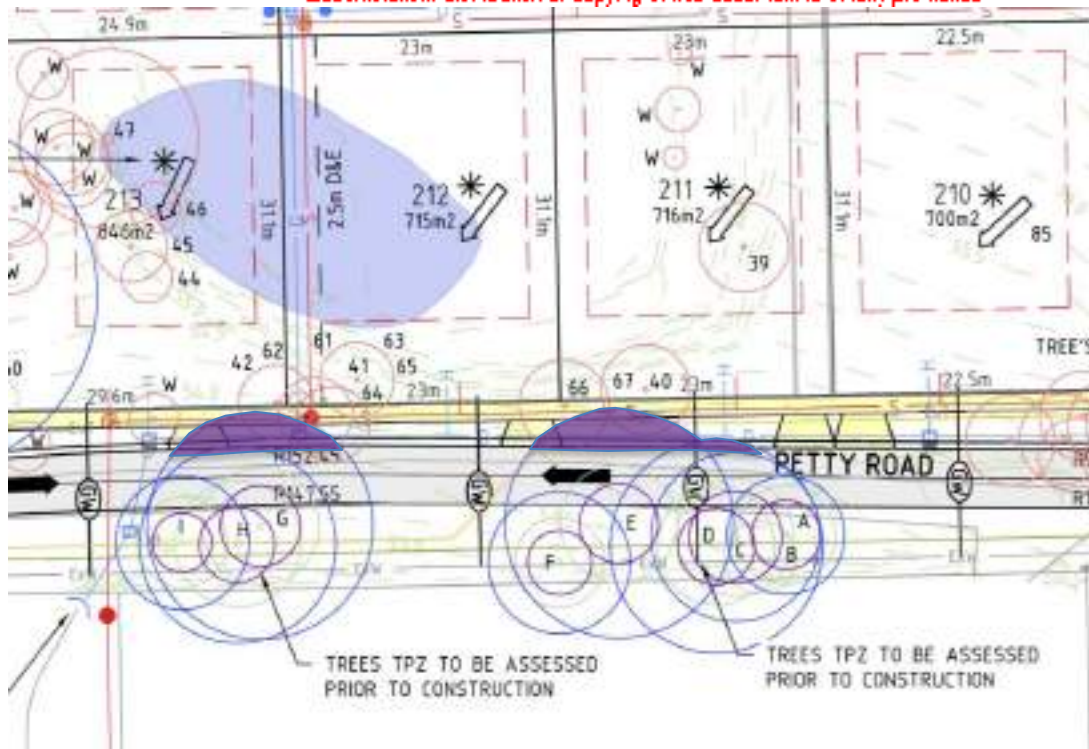
Additionally, it is hoped that trees to the south side of Petty Road (not assessed previously as greater than 15m from shown works) can be retained with new encroachment limited from the works. Works include the crossovers, formalised drainage, service installation and footpaths.

A further updated assessment of these trees in June 2025 now numbered A-I on the site plan against updated development plans V. 14, shows that TPZ incursion with no SRZ encroachment from new works to the north side of Petty road is possible for Trees C, D, E, G & H as a result of the development. This assumes that works to surface the road (being the area of existing compaction) will be at or above existing grade and thus remain the same.

All of the trees along the south side of Petty Rd have existing major incursion into their TPZ and SRZs from the existing compacted road surface and drainage swales existing on either side of the road. New encroachment for trees C, D, E, G & H is likely with % encroachments detailed below.

Tree ID	Existing encroachment %	Proposed encroachment %	NEW encroachment % estimated from works to construct crossovers, set formalised drainage infrastructure levels, install services and footpaths= Proposed % minus Existing%	Distance to new works (excluding road surfacing at or above grade)
A	28% TPZ inc. SRZ	28%	0%	NA
B	Dead	Dead	0%	NA
C	31% TPZ inc. SRZ	35%	<10% (4%)	5.9m
D	29% TPZ	37%	<10% (8%)	6.5m
E	41% TPZ inc. SRZ	59%	>10% (18%)	5m
F	5% TPZ	5%	0%	NA
G	40% TPZ inc. SRZ	58%	>10% (18%)	5m
H	28% TPZ	34%	<10% (6%)	6.5m
I	21% TPZ	21%	0%	NA

Table 2: Tree existing encroachment % is shown in column 2 and then proposed % encroachment in column 3. New works % encroachment in column 4 has been calculated by subtracting existing % from proposed % thus determining the estimated new encroachment % in column 4.



F & L plan detail with NEW encroachment north side road show in purple.

When viewed in 2D on plans, trees with the largest % new encroachment are Trees C, D, E, G & H, with Trees C, D & H likely to be a minor incursion (<10% new) and Trees E & G likely to be a major incursion pending the works detail within the TPZ areas. It is hoped that all these trees can be retained, and root sensitive excavation methods employed, especially within the TPZ areas of Tree E & G, however it must be noted that Tree E is showing signs of decline at present with Bracket Fungi infestation evident from fruiting sporophores limiting the ULE.

It must be noted that due to the regular contracted council excavation works to clean out the swale drain on Petty Rd, it is likely that roots present in this area would have already been disturbed and cut over time, making it more unlikely that works on the subject property development (north side of Petty Rd) would incur TPZ areas any greater than existing conditions for trees C, D & H. For Trees E & G, it will be important to undertake non-invasive root investigation methods and implement root sensitive excavations within the TPZ area via air spade or hydro excavator and to have a project arborist present to implement tree protection strategies in order to ensure that encroachment is kept to a minimum extent as possible.

If it is deemed that these trees are considered lost then an updated NVR report will be provided as conditioned within the planning permit.

Avoid Minimise Offset

Tree removal cannot be avoided on this site. Many indigenous trees will require removal to establish the subdivision with nine trees of high retention value being proposed for removal (#39, 40, 41, 42, 45, 47 & 84) with three of these Very Large or Large Old Trees (# 47, 84 & 85) trees.

Trees #48-57 are a patch of high retention value trees for habitat provision which will be secured as a sanctuary within the conservation reserve. Of these seven (trees

#48, 49, 50, 53, 54, 57 & 56) are Very Large & Large Old Trees with high retention value.

It is proposed that vegetation remain in situ as long as possible to establish the conservation reserve, install nest boxes and habitat corridors. The staged development of this site does minimise the impact on habitat, and native vegetation proposed for removal or considered consequentially lost has been mapped to calculate the offset in the NVR report submitted with this application. A third-party OTC vegetation credit will be purchased to satisfy this offset once the planning process has progressed.

Tree Protection

To protect trees onsite whilst construction takes place, Tree Root Protection Zones (TPZ) should be fenced off and a thick layer of protective mulch applied to 100mm depth and to be placed to the dripline of trees. Tree protection zones are marked on the site plan. Fencing must comply with the Shire's specifications for TPZ and AS4970-2009. Development zone fencing &/or Conservation reserve fencing will alleviate the need for individual TPZ fences.

Of particular note for protection are Trees #49 & 50 which are Large Old Trees located on the site and nature-strip respectively. These will require specific TPZ fencing protection and must not be damaged during works.

Trees #47, 68 & 84 are Very Large Trees proposed for removal, and if approved should be checked thoroughly for habitat hollow occupancy prior to removal. A qualified wildlife carer should be present at their removal, to administer assistance should any fauna require.

The conservation reserve should be fenced and established prior to any works beginning on the subject site with nest boxes installed to provide additional habitat options. Refer to Ecological Assessment Report for details.

The proposed path through the reserve will be constructed at or above grade and remain a permeable surface. No major encroachment for trees #48-58 is anticipated.

Ecological Management

An ecological management strategy should be developed from the Ecological Assessment Report (Healesville Plants, 2023) once the planning process has progressed to grant a permit and a development construction plan and works timeframe has been established for the road development and subdivision into lots. This will prevent any unwanted damage to indigenous flora and fauna and should also include the timing of works to remove native vegetation and also weed species such as Blackberry thickets which may provide habitat for Southern Brown Bandicoots.

Of course, it is imperative to watch and maintain the health of all remaining trees, during and post works. The integrity of the trees may be altered through this development process and some may thrive, while others may decline, regular monitoring is essential.

References

5.0

Cardinia Shire Council:

<https://www.cardinia.vic.gov.au>

<https://cardinia.pozi.com/>

DELWP (Department of Environment, Land, Water and Planning) *Naturekit*.

<http://maps.biodiversity.vic.gov.au/viewer/?viewer=NatureKit>

DELWP (Department of Environment, Land, Water and Planning) VicPlan

<https://mapshare.vic.gov.au/vicplan/>

DT&P (Department of Transport and Planning) *Bushfire Protection Exemptions – Clause 52.12 and Bushfire management Overlay Clause 44.06*

<https://planning->

[schemes.app.planning.vic.gov.au/Victoria%20Planning%20Provisions/ordinance/52.12?_ga=2.237337032.913473817.1674020365-293654440.1674020365](https://planning-schemes.app.planning.vic.gov.au/Victoria%20Planning%20Provisions/ordinance/52.12?_ga=2.237337032.913473817.1674020365-293654440.1674020365)

and

<https://planning-schemes.app.planning.vic.gov.au/Victoria%20Planning%20Provisions/ordinance/44.06>

Standards Australia. (2009) AS 4970-2009 *Protection of Trees on Development Sites*.

Treetec (2014) *TPZ/SRZ Calculator*. www.treetec.net.au



Native Vegetation Removal Report

NVRR ID: 311_20240815_JGB

This report provides information to support an application to remove, destroy or lop native vegetation in accordance with the [Guidelines for the removal, destruction or lopping of native vegetation](#) (the Guidelines). This report is **not an assessment by DEECA** of the proposed native vegetation removal. Offset requirements have been calculated using modelled condition scores.

Report details

Date created: 15/08/2024

Local Government Area: CARDINIA SHIRE

Registered Aboriginal Party: Bunurong

Coordinates: 145.70861, -38.09227

Address: 8 WATTLETREE ROAD BUNYIP 3815

Regulator Notes

Removal polygons are located:

Summary of native vegetation to be removed

Assessment pathway	Intermediate Assessment Pathway		
Location category	Location 1		
	The native vegetation extent map indicates that this area is not typically characterised as supporting native vegetation. It does not meet the criteria to be classified as Location Category 2 or 3. The removal of less than 0.5 hectares of native vegetation in this area will not require a Species Offset.		
Total extent including past and proposed removal (ha) <small>Includes endangered EVCs (ha): 0</small>	0.363	Extent of past removal (ha)	0
		Extent of proposed removal - Patches (ha)	0.152
		Extent of proposed removal - Scattered Trees (ha)	0.211
No. Large Trees proposed to be removed	4	No. Large Patch Trees	1
		No. Large Scattered Trees	3
No. Small Scattered Trees	0		



Offset requirements if approval is granted

Any approval granted will include a condition to secure an offset, before the removal of native vegetation, that meets the following requirements:

General Offset amount ¹	0.152 General Habitat Units
Minimum strategic biodiversity value score ²	0.442
Large Trees	4
Vicinity	Melbourne Water CMA or CARDINIA SHIRE LGA

NB: values within tables in this document may not add to the totals shown above due to rounding.

The availability of third-party offset credits can be checked using the Native Vegetation Credit Register (NVCR) Search Tool - <https://nvcr.delwp.vic.gov.au>

1. The General Offset amount required is the sum of all General Habitat Units in Appendix 1.

2. Minimum strategic biodiversity value score is 90 per cent of the weighted average score across habitat zones where a General Offset is required.



Application requirements

Applications to remove, destroy or lop native vegetation must include all the below information. If an appropriate response has not been provided the application is not complete.

Application Requirement 1 - Native vegetation removal information

If the native vegetation removal is mapped correctly, the information presented in this Native Vegetation Removal Report addresses Application Requirement 1.

Application Requirement 2 - Topographical and land information

This statement describes the topographical and land features in the vicinity of the proposed works, including the location and extent of any ridges, hilltops, wetlands and waterways, slopes of more than 20% gradient, low-lying areas, saline discharge areas or areas of erosion.

The 10 acre property is located on Wattletree RD Bunyip backing onto Petty RD it is ~65m ASL with a southerly aspect and currently consist of a shed, loosebox, lawn and garden areas having long been cleared for pasture with a windbreak section of planted vegetation, large dam and bushland area. The property slopes gently downwards to the south from Wattletree rd to Petty RD and is in a well-established area with a mix of residential and rural properties adjacent to it. There are large and smaller properties in the immediate surrounds connected by fragmented treed and natural areas which are mostly heavily disturbed. Many of the larger adjacent properties are already or currently being subdivided into smaller residential lots due to the re-zoning by Council. A small amount of naturally established native vegetation requires offsetting for this proposal and a large portion of this land is being proposed to be set aside as a conservation bushland reserve - this area of the site has the largest number of VLOTs and LOTs and the highest quality of vegetation for biodiversity and habitat provision.

Application Requirement 3 - Photographs of the native vegetation to be removed

Application Requirement 3 is not addressed in this Native Vegetation Removal Report. All applications must include recent, timestamped photos of each Patch, Large Patch Tree and Scattered Tree which has been mapped in this report.

Application Requirement 4 - Past removal

If past removal has been considered correctly, the information presented in this Native Vegetation Removal Report addresses Application Requirement 4.

Application Requirement 5 - Avoid and minimise statement

This statement describes what has been done to avoid and minimise impacts on native vegetation and associated biodiversity values.

The removal of self-sown native vegetation cannot be avoided as much of it will be considered lost due to impact from the installation of underground services along Petty Rd being within the SRZs of many of the Nature-strip trees. Some additional trees within this remnant will be lost due to the establishment of building envelopes for the subdivided lots. The block has long been managed for fuel reduction, used for grazing and for the most part is covered by exotic pasture grasses (many pasture improvement species) and herbaceous weeds. Some trees offset in the NVR are only offset due to their consequential and are actually proposed for retention (#1). Much effort and redesign has resulted in fewer LOTs and VLOTs being removed, and the establishment of a bushland reserve will benefit both local flora and fauna biodiversity.



Application Requirement 6 - Property Vegetation Plan

This requirement only applies if an approved Property Vegetation Plan (PVP) applies to the property. Does a PVP apply to the proposal?

No

Application Requirement 7 - Defendable space statement

Where the removal of native vegetation is to create defendable space, this statement:

- Describes the bushfire threat; and
- Describes how other bushfire risk mitigation measures were considered to reduce the amount of native vegetation proposed for removal (this can also be part of the avoid and minimise statement).

This statement is not required if, if the proposed defendable space is within the Bushfire Management Overlay (BMO), and in accordance with the 'Exemption to create defendable space for a dwelling under Clause 44.06 of local planning schemes' in Clause 52.12-5.

No tree removal for defendable space applies. BAL for future construction on the subdivided lots has been considered and designed appropriately to avoid tree loss.

Application Requirement 8 - Native Vegetation Precinct Plan

This requirement is only applicable if you are removing native vegetation from within an area covered by Native Vegetation Precinct Plan (NVPP), and the proposed removal is not identified as 'to be removed' within the NVPP.

Does an NVPP apply to the proposal?

No

Application Requirement 9 - Offset statement

This statement demonstrates that an offset is available and describes how the required offset will be secured. The Applicant's Guide provides information relating to this requirement.

A first party offset is not an option on this site due to the proximity of neighbouring dwellings. A conservation reserve (1.3Ha) has been proposed as part of this application, however this cannot be used as an offset site due to the proximity to dwellings. A third party OTC vegetation credit will be sourced and secured once the planning process has progressed. Credits are available and the land owners are aware of this cost.



Next steps

Applications to remove, destroy or lop native vegetation must address all the application requirements specified in the Guidelines. If you wish to remove the mapped native vegetation you are required to apply for approval from the responsible authority (e.g. local Council). This Native vegetation removal report must be submitted with your application and meets most of the application requirements. The following requirements need to be addressed, as applicable.

Application Requirement 3 - Photographs of the native vegetation to be removed

Recent, dated photographs of the native vegetation to be removed **must be provided** with the application. All photographs must be clear, show whether the vegetation is a Patch of native vegetation, Patch Tree or Scattered Tree, and identify any Large Trees. If the area of native vegetation to be removed is large, provide photos that are indicative of the native vegetation.

Ensure photographs are attached to the application. If appropriate photographs have not been provided the application is not complete.

Application Requirement 6 - Property Vegetation Plan

If a PVP is applicable, it must be provided with the application.



Appendix 1: Description of native vegetation to be removed

General Habitat Units for each zone (Patch, Scattered Tree or Patch Tree) are calculated by the following equation in accordance with the Guidelines:

General Habitat Units = extent without overlap x condition score x general landscape factor x 1.5, where the general landscape factor = $6.5 + (\text{strategic biodiversity value score}/2)$

The General Offset amount required is the sum of all General Habitat Units per zone.

Native vegetation to be removed

Information provided by or on behalf of the applicant			Information calculated by NVR Map							
Zone	Type	DBH (cm)	EMC code (modelled)	Bioregional conservation status	Large Tree(s)	Condition score (modelled)	Polygon extent (ha)	Extent without overlap (ha)	SBV score	General Habitat Units
I	Patch	-	HSP_0018	Least Concern	3	0.587	0.152	0.152	0.589	0.104
A	Scattered Tree	83	HSP_0018	Least Concern	3	0.280	0.070	0.070	0.526	0.016
B	Scattered Tree	132	HSP_0018	Least Concern	3	0.280	0.070	0.070	0.550	0.018
C	Scattered Tree	111	HSP_0018	Least Concern	3	0.280	0.070	0.070	0.559	0.016

Appendix 2: Images of mapped native vegetation

1. Property in context



2. Aerial photograph showing mapped native vegetation



3. Location Risk Map



4. Strategic Biodiversity Value Score Map



5. Condition Score Map





6. Endangered EVCs

Not Applicable

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Ecological Assessment Report

8 WATTLETREE RD, BUNYIP, 3815



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Introduction

This report has been prepared for Nobelius Land Surveyors on behalf of the owners who wish to subdivide properties within a small area in Bunyip and undertake a staged subdivision of the 3 landholdings i.e. land under three different ownerships (5 addresses refer below table) into 85 residential lots and the subsequent removal of native vegetation.

The proposed developments are located at 8 Wattletree Rd, 22 Wattletree Rd, 9-15 Petty Rd and 24 Nylander Rd in the Cardinia Shire Council area. This proposal is comprised of 5 'lots' (see table below), Zoning is General Residential Zone – Schedule 1 (GRZ1) there are no planning overlays associated with any of these properties.

A pre-application meeting with council was held on the 25th of October 2022 (Council allocation number GE220663). As part of the proposal a ~1.3Ha area of native vegetation, on the western third of the property at 8 Wattletree Rd, has been earmarked to become a nature reserve with a focus on creating and enhancing habitat for the Southern Brown Bandicoot (SBB). It is hoped that the other properties will allow some connecting vegetation (existing/proposed) to the reserve to act as a bio-link for any SBB movement.

Address	Council No.	Lot No.	SPI	Vicroads
8 Wattletree Rd	5000016494	Lot 2 PS708283	2\PS708283	718 E9
22 Wattletree	4908150500	Lot 1 TP423192	1\TP423192	718 E9

9-11 Petty Rd	4686700300	Lot 28 LP5157	28\LP5157	718 F10
13-15 Petty Rd	4686700400	Lot 1 TP431424	1\TP431424	718 F10
24 Nylander Rd	4635400800	Lot 37 LP5888	37\LP5888	718 F10

The DELWP (Department of Environment, Land, Water & Planning) ecological vegetation community (EVC) mapped on the property is: Highland Southern Fall EVC 16 Lowland Forest (Naturekit Biodiversity Mapping). This has been ground truthed.

This Ecological Assessment report has been written to address Council's concerns regarding potential impact on the Southern Brown Bandicoot -SBB (*Isoodon obesulus*). It will document the vascular plant species present on the site, and to ascertain whether the vegetation loss will adversely affect potential SBB habitat or the habitat of any rare and threatened species (refer Tables 1 & 2) and how any impact could be avoided or mitigated.

An Arboricultural Report was undertaken by Arbkey Arboriculture and Urban Forest Consultants for 22 Wattletree Rd, 9-11 Petty Rd, 13-15 Petty Rd and 24 Nylander Rd. Healesville Plants has undertaken NVR reports to ascertain the vegetation loss not covered by any exemptions on these sites, as well as the Arboricultural report for 8 Wattletree Rd to assess the remnant vegetation onsite and along the roadsides connecting the properties earmarked for subdivision to ascertain the capacity to link to the western section of 8 Wattletree Road remnant vegetation that will be set aside as a reserve.

RFI from Cardinia Council

4. Vegetation & Ecological assessments:

...

b. An NVIM assessment under Clause 52.17 for Victorian native vegetation to be removed (where not exempt).

c. An Ecological Assessment prepared by a suitably qualified person for the subdivision works. The Assessment must address the impacts of any vegetation removal (including weeds, grasses and shrubs) on any habitat corridors (in particular in relation to the Southern Brown Bandicoot).

*** (Amendment C229 inserted into Schedule 7 of Clause 42.01 – ESO (Ecological Significance Overlay) – not on these properties. As of September 2020, assessment is in progress.)***

Site description

1.0

The ~22.14-acre properties (that is 10.03 + 0.98 + 5.02 + 1.14 + 4.97 acres for each of the five addresses) are located on Wattletree Rd, Petty Rd and Nylander Rd, Bunyip. The blocks are somewhat rectangular in shape and 8 Wattletree is a 'T' shape, it is relatively flat, with the aspect being north, the altitude is ~40m ASL. The proposed reserve site sits amongst other large properties mainly used as pasture or domestic uses, there is fragmented treed areas. The possible habitat linkages include Bunyip Native Sanctuary 54 Doran Rd, Bunyip ~2.7km, Bunyip River – east ~2.9km, Longwarry – Nar Nar Goon Road Reserve – South ~713m and Tea Tree Creek northwest ~800m.



Map 1. Aerial image (Source VicPlan, 2018)



Map 1a). Close up aerial image 8 Wattletree Rd (Source VicPlan, 2018)



Map 1b). Close up aerial image 22 Wattletree Rd (Source VicPlan, 2018)



Map 1c). Close up aerial image 9-11 Petty Rd (Source VicPlan, 2018)



Map 1d). Close up aerial image 13-15 Petty Rd (Source VicPlan, 2018)



Map 1e). Close up aerial image 24 Nylander Rd (Source VicPlan, 2018)



Map 1f). Close up aerial image of all 5 lots (Source VicPlan, 2018)



Map 1g). Aerial image of Petty Rd naturestrip (Source Cardinia Pozi Mapping, 2023)

Regional and local planning context

2.0

Note: Full details of the Cardinia Planning Scheme describing all zones and overlays can be accessed on the DELWP website at: <https://planning-schemes.app.planning.vic.gov.au/Cardinia/ordinance>

2.1 Zoning

The block is General Residential Zone – Schedule 1 (GRZ1) with no planning overlays.



Map 2. Zoning on property and surrounding areas.

Vegetation and habitat assessment

3.0

3.1 Inspection and methods

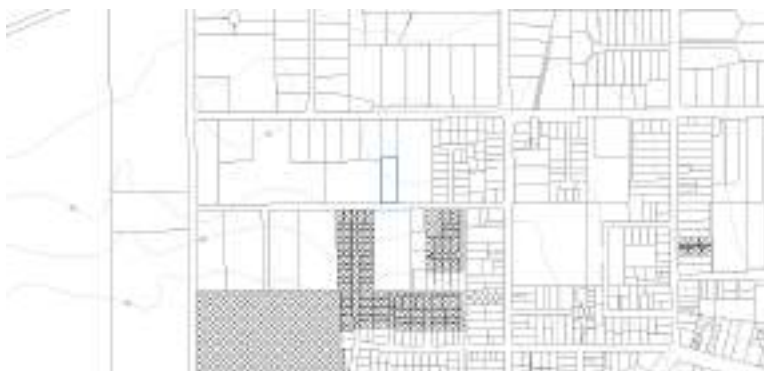
The property was surveyed in February 2023 by Healesville Plants. A flora list was compiled of all vascular plants found on the site (refer Appendix A) and all recognised weeds in PPWPCMA then listed separately in Appendix B.

All assessments were made visually, and the accuracy of this assessment is not absolute, given the time available, the whole area could not be covered in fine detail at a soil (regeneration) level. Furthermore, some species may not have been visually obvious at the time of year when the survey was conducted (i.e. indigenous orchid and lily species). Despite these limitations, the overview provided is completely adequate for the proposed development.

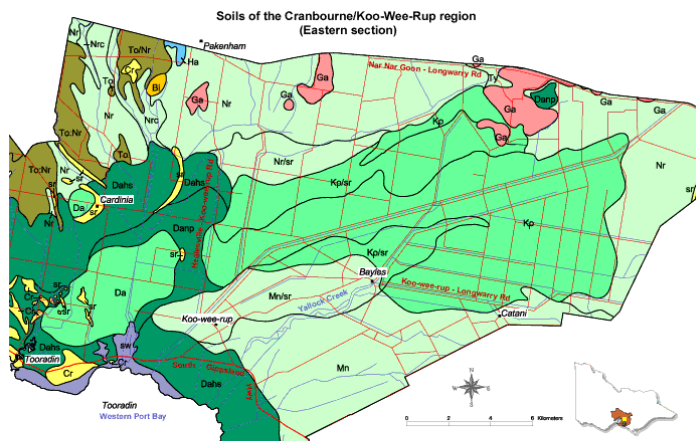
The species found were then compared to those found in the literature (as cited in references) and information from EVC lists which allowed the site to be assessed further for its value in the local and regional context.

3.2 Geology and soils

The soil onsite is a sandy clay loam, derived from Devonian Granodiorite. The subsoil is mottled yellow brown to grey in colour and heavy clay subsoil (400-600mm) and medium to heavier clays occur further down the profile from 600-800mm. Soil profile is likely to be quite gritty. Soil area mapped on Map 4. is Garfield Sandy Clay Loam noted a pink.



Map 3. Contours at 1m intervals, property ~40m-70m ASL, VicPlan 2022



Map Symbol	Unit Name	Geology	Landform
Bi	Bittern sandy loam	Tertiary sediments	Undulating rises
Bi/Bis	Bittern sandy loam and Bittern sand	Tertiary sediments	Undulating rises
Bis	Bittern sandy loam with Bittern sand	Tertiary sediments	Undulating rises
Bis/Cr	Bittern sand and Cranbourne sand	Pleistocene aeolian and Tertiary sediments	Undulating rises/dunefield
Bis/Cr	Bittern sand with Cranbourne sand	Pleistocene aeolian and Tertiary sediments	Undulating rises/dunefield
sr	sandy rises	Recent alluvium and aeolian	Alluvial plain
Cr	Cranbourne sand	Pleistocene aeolian	Dunefield
Cr-Pe	Cranbourne sand and Pearceville sandy clay loam	Pleistocene aeolian and Recent alluvium	Dunefield
Cr-To	Cranbourne sand and Toomuc sand	Pleistocene aeolian and Recent alluvium	Dunefield
Da	Dalmore clay	Recent lacustrine	Swamp
Da/Kp	Dalmore clay and Koo-Wee-Rup peaty clay	Recent lacustrine	Swamp
Kp	Koo-Wee-Rup peaty clay	Recent lacustrine	Swamp
Kp/r	Koo-Wee-Rup peaty clay with sandy rises	Recent lacustrine	Swamp
Dahs	Dalmore clay (heavy surface)	Recent lacustrine	Swamp
Dahs/Dal	Dalmore clay (heavy surface) with Dalmore clay (sandy loam surface)	Recent lacustrine	Swamp
Danp	Dalmore clay (non peaty)	Recent lacustrine	Swamp
Ga	Garfield sandy clay loam	Devonian granite	Rolling low hills
Ha	Hallam loam	Silurian sediments	Rolling low hills
La	Langwarrin loam	Silurian sediments	Rolling low hills
La/Cr	Langwarrin loam with Cranbourne sand	Silurian sediments and Pleistocene aeolian	Rolling low hills
La/Las	Langwarrin loam with Langwarrin sand	Silurian sediments	Rolling low hills
La/Las/Cr	Langwarrin loam with Langwarrin sand and Cranbourne sand	Silurian sediments and Pleistocene aeolian	Rolling low hills
Las	Langwarrin sand	Silurian sediments	Rolling low hills
Mn	Monometh clay loam	Recent alluvium	Alluvial plain
Mn/r	Monometh clay loam with sandy rises	Recent alluvium	Alluvial plain
Nr	Narre clay loam	Recent alluvium	Alluvial plain
Nr/r	Narre clay loam with sandy rises	Recent alluvium	Alluvial plain
Nic	Narre clay	Recent alluvium	Alluvial plain
Pe	Pearcedale sandy clay loam	Recent alluvium	Alluvial plain
Ty	Tynong sandy clay loam	Recent alluvium	Alluvial valley
To	Toomuc sandy loam	Recent alluvium	Alluvial plain
To/Cr	Toomuc sandy loam with Cranbourne sand	Recent alluvium	Alluvial plain
To/Nr	Toomuc sandy loam with Narre clay loam	Recent alluvium	Alluvial plain
To/Nr	Toomuc sandy loam with Narre clay loam	Recent alluvium	Alluvial plain
sq	sand quarry		
sw	swamp	Recent lacustrine	Swamp

Map 4. Soils onsite (Victoria Agriculture, 2023)

3.3 Land use history

These properties have been long cleared in a previously zoned agricultural area of Bunyip, used as apple, pear and stone fruit orchards and grazing purposes. The properties at 8 Wattletree Rd, 24 Nylander Rd and 9-15 Petty RDs have been in the same ownership since at least the early 1980's. The property at 22 Wattletree RD has been in the current ownership since December 2021. The addresses of 22 Wattletree & 24 Nylander currently have dwellings on them, the others are mostly cleared for agricultural sheds and paddocks. There has been some boundary tree planting but no other apparent developments.

The sites are currently grazed by horses and sheep with little pasture improvement or weed management.

There is no fire history onsite, further to the north in the Bunyip State Forest area there has been quite recent bushfire and planned burns. It is of note that no SBB have been sighted in the Bunyip State Forest since 2016 (VNPA 2022).



Map 5. Bushfire history in the area (Source Naturekit 2023)



Map 6. Planned burn history in the area (Source Naturekit 2023)

3.4 General vegetation and habitat condition

There is very little indigenous vegetation remaining on the long-cleared properties and road reserve / nature-strip along Petty Rd that links them to the reserve.

Within the reserve area the number and coverage are below natural state expectations, with 5~30% indigenous, ~57% high threat weeds species and 13% garden species: ~9% soil crust exists. There were 77 species identified onsite, with 22 of these species indigenous to the Lowland Forest / Zone 4 Heathy Woodland Complex Ecological Vegetation Classes (EVC's), 10 garden species and 44 weed species. Many of the indigenous species were single specimens with very little coverage. There were many logs and upright stags, hollowed areas within vegetation, including Blackberries that could serve as SBB habitat.

The area around the existing dam would be ideal to remain as part of the reserve but is currently earmarked for eventual removal (prior to being used as a retarding basin) to facilitate the entry point of connecting roads as detailed per existing easement which would also fragment this dam area from the proposed reserve. The area is frequented by rabbits, foxes, deer and possibly feral cats and domestic dogs. There are vast areas of Blackberry infestation and monocultures of Sweet Pittosporum.



Soil Crust & litter



Soil profile in dam embankment – old rabbit warren



Logs, some cut but still useful habitat elements.



Logs, and hollowed out areas in vegetation.



Fox scats.



Rabbit scats on log.



Dam vegetation, Parrot Feather & Water Lilies are exotic species



Looking into reserve area to west, thickets of Sweet Pittosporum



Facing South, southwest, into reserve area west.



Reserve area, eastern corner.



Reserve area, western corner.

Beneath Sweet Pittosporum – nothing else growing

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Naturestrip Petty Rd, rear of 22 Wattletree Rd



Naturestrip Petty Rd, rear of 24 Nylander Rd



Naturestrip Petty Rd, rear of 24 Nylander Rd towards 'reserve'

3.5 Flora and Ecological Vegetation Classes

These properties fall within the Highland Southern Fall Bioregion EVC 16 Lowland Fall that is considered Least Concern conservation status.

Neighbourhood EVCs

EVC 17: Riparian Scrub/Swampy Riparian Woodland Complex

Bioregion: Highlands - Southern Fall

EVC 18: Riparian Forest (Vulnerable)

Bioregion: Gippsland Plain

EVC 23: Herb-rich Foothill Forest (Least Concern)

Bioregion: Highlands - Southern Fall

EVC 53: Swamp Scrub (Endangered)

Bioregion: Gippsland Plain

EVC 83: Swampy Riparian Woodland (Endangered)

Bioregion: Gippsland Plain

EVC 159: Clay Heathland/Wet Heathland/Riparian Scrub Mosaic

Bioregion: Gippsland Plain

EVC 175: Grassy Woodland (Depleted)

Bioregion: Highlands - Southern Fall

EVC 793: Damp Heathy Woodland

Bioregion: Highlands - Southern Fall

EVC 937: Swampy Woodland (Endangered)

Bioregion: Gippsland Plain

There were 76 species noted onsite, 22 were indigenous, 10 garden plants and 44 weed species. These numbers may differ slightly if surveys were taken at different times of the year; however, it is deemed that differences would be minimal. The main 'weed' issues are

predominantly the Pasture grasses, Spear Thistle, Blackberry, Mediterranean Broom and Sweet Pittosporum, in general the site is in a 'disturbed' condition.

Blackberry (*Rubus fruticosus*) is listed as a WONS Weeds of National Significance. Listed as **noxious** under the **Catchment and Land Protection Act 1994**, this means it is Regionally Controlled and there exists a legal obligation to control these weeds on their property and the surrounding road reserves area: Spear Thistle (*Cirsium vulgare*). The best method of control for such weeds is chemical, via the use of herbicide such as Glyphosate during the months of September to May; an additional accelerant such as 'Brush Off' or 'Basta' may be included for added strength for more resistant weed species. Any chemicals stronger than 'Glyphosate' must be applied by a professional, with an ACUP (Agricultural Chemical Users Permit) using appropriate equipment and observing correct safety precautions.



Map 7. EVC distribution map onsite in 1750 (Naturekit)

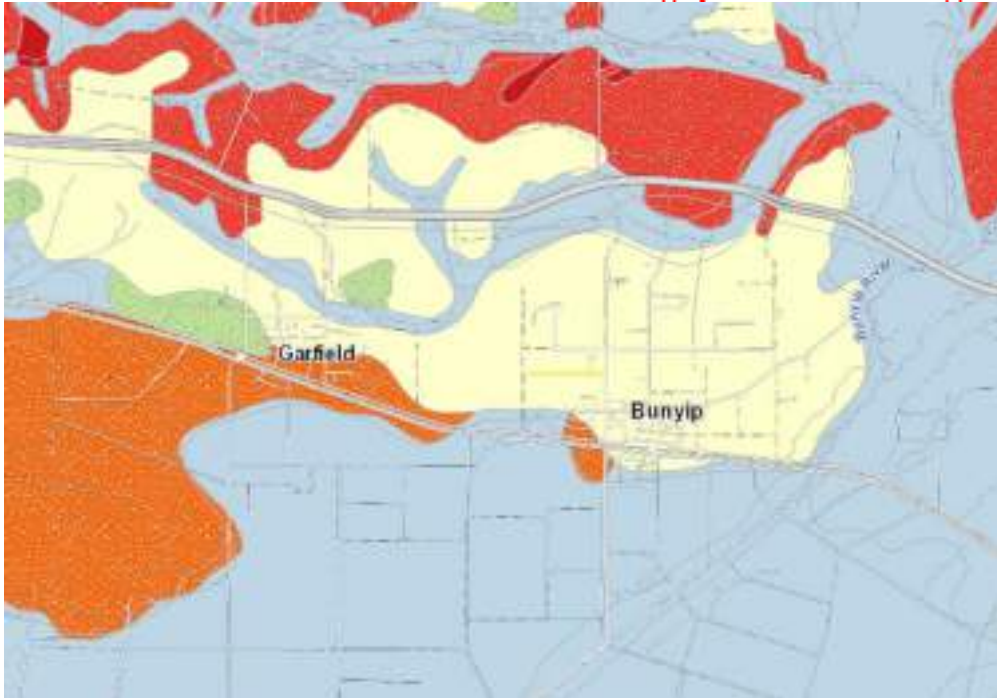
LF =Lowland Forest

EVC 16 Lowland Forest

Description:

Eucalypt forest to 25 m tall on relatively fertile, moderately well-drained soils in areas of relatively high rainfall. Characterised by the diversity of life forms and species in the understorey including a range of shrubs, grasses and herbs.

DSE 2004



Map 7a. *EVC distribution map in 1750 (Naturekit)*

-  EVC 16: Lowland Forest
-  EVC 17: Riparian Scrub/Swampy Riparian Woodland Complex
-  EVC 18: Riparian Forest
-  EVC 23: Herb-rich Foothill Forest
-  EVC 53: Swamp Scrub
-  EVC 83: Swampy Riparian Woodland
-  EVC 159: Clay Heathland/Wet Heathland/Riparian Scrub Mosaic
-  EVC 175: Grassy Woodland
-  EVC 793: Damp Heathy Woodland
-  EVC 937: Swampy Woodland

3.6 Conservation significance of vegetation

A desktop search of potential threatened flora and fauna was undertaken, and the following tables indicate species that have been noted in the past within a 10km (to capture Bunyip State Park) radius of this property.

Scientific Name	Common Name	Last Record	FFG	DELWP listing	EBPC Act listing
Birds					
<i>Accipiter novaehollandiae</i>	Grey Goshawk	2018	End	Vul	
<i>Anthochaera phrygia</i>					CrEnd
<i>Ardea alba</i>	Great Egret	2000		Vul	
<i>Ardea alba modesta</i>	Eastern Great Egret	2019	Vul	Vul	
<i>Ardea intermedia plumifera</i>	Plumed Egret	1994	CrEnd	End	
<i>Aythya australis</i>	Hardhead	2019	Vul	Vul	
<i>Biziura lobata</i>	Musk Duck	1991	Vul	Vul	
<i>Botaurus poiciloptilus</i>	Australasian Bittern	1978	CrEnd	End	End
<i>Calidris ferruginea</i>	Curlew Sandpiper				CrEnd
<i>Callocephalon fimbriatum</i>	Gang-Gang Cockatoo	2005			End
<i>Ceyx azureus</i>	Azure Kingfisher	2001		NThr	
<i>Charadrius leschenaultii</i>	Greater Sand Plover				Vul
<i>Cinclosoma punctatum</i>	Spotted Quail-thrush	1993		NThr	
<i>Dupetor flavicollis</i>	Black Bittern	2008	End	Vul	
<i>Falco hypoleucos</i>	Grey Falcon				Vul
<i>Gallinago hardwickii</i>	Latham's Snipe	2019		NThr	
<i>Grantiella picta</i>	Painted Honeyeater				Vul
<i>Hieraaetus morphnoides</i>	Little Eagle	2000	Vul	Vul	
<i>Hirundapus caudacutus</i>	White-throated Needletail	2001	Vul	Vul	Vul
<i>Lathamus discolor</i>	Swift Parrot				CrEnd
<i>Lewinia pectoralis</i>	Lewin's Rail	2012	Vul	Vul	
<i>Lichenostomus melanops cassidix</i>	Helmeted Honeyeater	2004	CrEnd	CrEnd	CrEnd
<i>Ninox connivens</i>	Barking Owl	1988	CrEnd	End	
<i>Ninox strenua</i>	Powerful Owl	2018	Vul	Vul	
<i>Numenius madagascariensis</i>	Eastern Curlew				CrEnd
<i>Nycticorax caledonicus</i>	Nankeen Night-Heron	1992		NThr	

Scientific Name	Common Name	Last Record	FFG	DELWP listing	EBPC Act listing
<i>Oxyura australis</i>	Blue-billed Duck	1981	Vul	End	
<i>Phalacrocorax varius</i>	Pied Cormorant	2019		NThr	
<i>Platalea regia</i>	Royal Spoonbill	2020		NThr	
<i>Plegadis falcinellus</i>	Glossy Ibis	1977		NThr	
<i>Pycnoptilus floccosus</i>	Pilotbird				Vul
<i>Rostratula australis</i>	Australian Painted Snipe				End
<i>Spatula rhynchotis</i>	Australasian Shoveler	1990	Vul	Vul	
<i>Tyto novaehollandiae</i>	Masked Owl	1993	CrEnd	End	
<i>Tyto tenebricosa</i>	Sooty Owl	2017	End	Vul	
Amphibians					
<i>Engaeus sternalis</i>	Warragul Burrowing Crayfish	2020	CrEnd		
<i>Engaeus urostrictus</i>	Dandenong Burrowing Crayfish	1962	CrEnd		
<i>Galaxiella pusilla</i>	Dwarf Galaxias	2012	End	End	Vul
<i>Litoria raniformis</i>	Growling Grass Frog	2020	Vul	End	Vul
<i>Nannoperca obscura</i>	Yarra Pygmy Perch				Vul
<i>Prototroctes maraena</i>	Australian Grayling	1998	End	Vul	Vul
<i>Pseudophryne semimarmorata</i>	Southern Toadlet	1993	End	Vul	
<i>Sminthopsis leucopus</i>	White-footed Dunnart	1990	Vul	NThr	
Mammals/Marsupials					
<i>Antechinus minimus</i>	Swamp Antechinus				Vul
<i>Dasyurus maculatus</i>	Spot-tailed Quoll				End
<i>Gymnobelideus leadbeateri</i>	Leadbeater's Possum	1915	CrEnd	End	CrEnd
<i>Isodon obesulus obesulus</i>	Southern Brown Bandicoot	2018	End	NThr	End
<i>Mastacomys fuscus mordicus</i>	Broad-toothed Rat	1993	Vul	End	Vul
<i>Ornithorhynchus anatinus</i>	Platypus	2003	Vul	Vul	

Scientific Name	Common Name	Last Record	FFG	DELWP listing	EPBC Act listing
<i>Petauroides volans</i>	Southern Greater Glider	2019	Vul	Vul	End
<i>Petaurus australis</i>	Yellow-bellied Glider				Vul
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	1960	Vul	Vul	
<i>Potorous tridactylus trisulcatus</i>	Long-nosed Potoroo				Vul
<i>Pseudomys fumeus</i>	Smoky Mouse				End
<i>Pteropus poliocephalus</i>	Grey-headed Flying Fox				Vul
Reptiles					
<i>Varanus varius</i>	Lace Monitor	2021	End	End	
Invertebrates					
<i>Synemon plana</i>	Golden Sun Moth				Vul
<i>Megascolides australis</i>	Giant Gippsland Earthworm				Vul

Table 1a. Threatened Fauna Source (Naturekit - Victorian Biodiversity Atlas data 2023 & EPBC Act Protected Matters Report, 2023).

Legend:

FFG = Flora and Fauna Guarantee Act

DELWP – Department of Environment, Land, Water & Planning

EPBC = Environment Protection and Biodiversity Conservation Act 1999

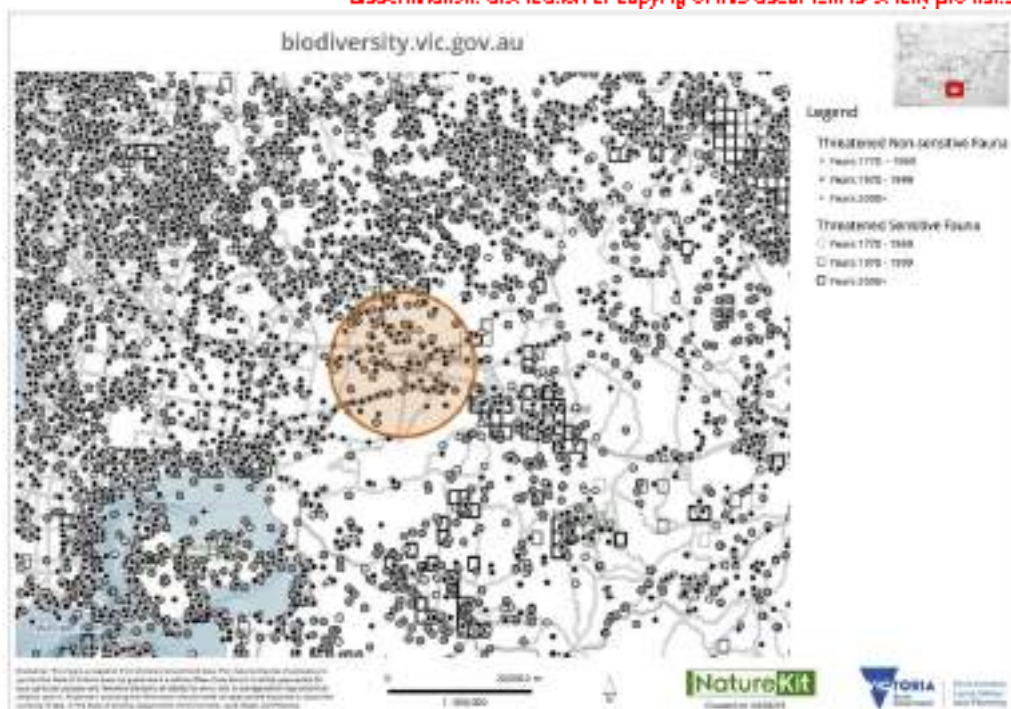
Vul = Vulnerable

End = Endangered

CrEnd = Critically Endangered

PK = Poorly Known

NThr = Near Threatened



Map 8. Threatened Fauna within 10km radius of property. (Source (Naturekit - Victorian Biodiversity Atlas data 2023))

Botanical Name	Common Name	Last Record	FFG listed	DELWP listing	EBPC Act listing
Trees					
<i>Eucalyptus fulgens</i>	Green Scentbark	2015	End	Rare	
<i>Eucalyptus strzeleckii</i>	Strzelecki Gum	2019	CrEnd	Vul	Vul
<i>Eucalyptus yarraensis</i>	Yarra Gum	1853	CrEnd	Rare	
Shrubs					
<i>Acacia leprosa</i> var. <i>uninervia</i>	Large-leaf Cinnamon Wattle	2005	End	Rare	
<i>Correa reflexa</i> var. <i>lobata</i>	Powelltown Correa	2009	End	Rare	
<i>Olearia asterotricha</i>	Rough Daisy-bush	1770	End	Rare	
<i>Pomaderris vaciniifolia</i>	Round-leaf Pomaderris				CrEnd
<i>Pultenaea juniperina</i> s.s.	Prickly Beauty	1932	Vul	Rare	
<i>Pultenaea weindorferi</i>	Swamp Bush-pea	1990	End	Rare	
Scramblers/Climbers					

Botanical Name	Common Name	Last Record	FFG listed	DELWP listing	EBPC Act listing
<i>Billardiera scandens s.s.</i>	Velvet Apple-berry	1917	End	Rare	
Herbs					
<i>Bossiaea riparia</i>	River Leafless Bossiaea	1986	End	Rare	
<i>Burnettia cuneata</i>	Lizard Orchid	1770	End	Rare	
<i>Caladenia flavovirens</i>	Christmas Spider-orchid	1986	CrEnd		
<i>Caladenia orientalis</i>	Eastern Spider-orchid				End
<i>Caladenia tessellata</i>	Thick-lipped Spider-orchid				Vul
<i>Corybas aconitiflorus</i>	Spurred Helmet-orchid	1934	End	Rare	
<i>Desmodium varians</i>	Slender Tick-trefoil	2005		PK	
<i>Glycine latrobeana</i>	Clover Glycine				Vul
<i>Lepidium aschersonii</i>	Spiny Pepper-cress				Vul
<i>Prasophyllum pyriforme s.s.</i>	Silurian Leek-orchid	1968		End	
<i>Prasophyllum spicatum</i>	Dense Leek-orchid				Vul
<i>Pterostylis chlorogramma</i>	Green-striped Greenhood	2007	End	Vul	Vul
<i>Pterostylis cucullata</i>	Leafy Greenhood				Vul
<i>Senecio psilocarpus</i>	Swamp Fireweed				Vul
<i>Thelymitra longiloba</i>	Marsh Sun-orchid	1941	CrEnd	End	
<i>Thesium australe</i>	Austral Toadflax				Vul
<i>Xanthosia tasmanica</i>	Southern Xanthosia	1984	End	Rare	
<i>Xerochrysum palustre</i>	Swamp Everlasting				Vul
Ferns					

Botanical Name	Common Name	Last Record	FFG listed	DELWP listing	EPBC Act listing
<i>Abrodictyum caudatum</i>	Jungle Bristle-fern	1977	End	Rare	
<i>Lastreopsis hispidula</i>	Bristly Shield-fern	1934	End	Rare	
<i>Tmesipteris parva</i>	Small Fork-fern	1995	End	Rare	
Graminoids					
<i>Amphibromus fluitans</i>	River Swamp Wallaby-grass				Vul
<i>Astelia australiana</i>	Tall Astelia				Vul
<i>Dianella amoena</i>	Matted Flax-lily				End
<i>Dianella sp. aff. longifolia (Benambra)</i>	Arching Flax-lily	2009	Thr	Vul	
<i>Lepidosperma canescens</i>	Hoary Rapier-sedge	1992	End	Rare	

Table 1b. Threatened Flora. Source (Naturekit - Victorian Biodiversity Atlas data 2023 & EPBC Act Protected Matters Report, 2023).

Legend:

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DELWP – Department of Environment, Land, Water & Planning

EPBC = Environment Protection and Biodiversity Conservation Act 1999

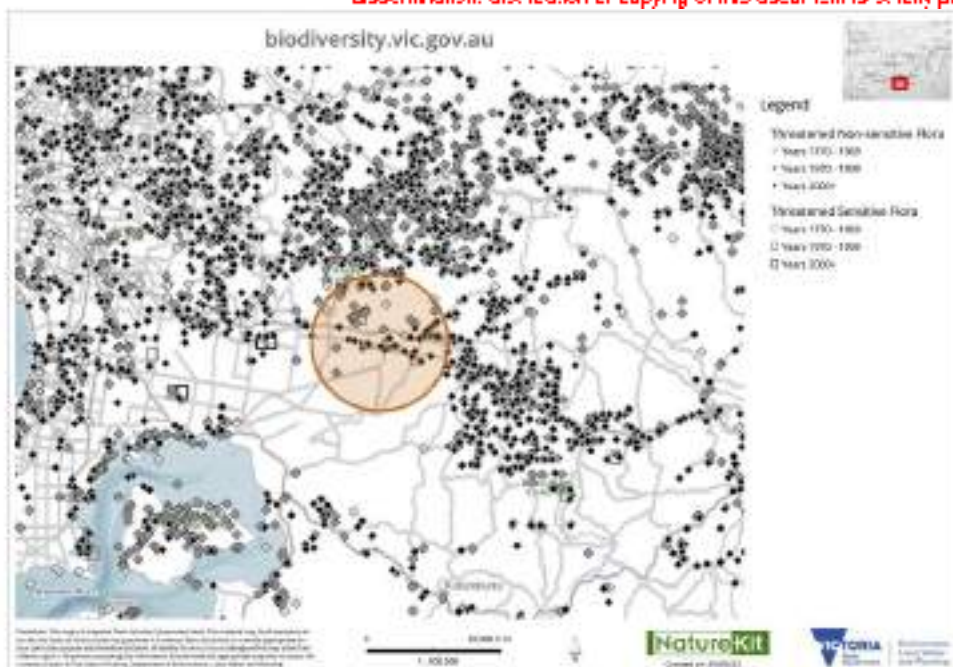
Vul = Vulnerable

End = Endangered

CrEnd = Critically Endangered

PK = Poorly Known

NThr = Near Threatened



Map 9. Threatened Flora within 10km radius of property. (Source (Naturekit - Victorian Biodiversity Atlas data 2022))

Threatened Fauna

After reviewing the list of threatened fauna in Table 1a, the habitat provision onsite, and the development proposal, species (if present) which are most likely to be affected by works are:

Swamp Antechinus, Broad-toothed Rat, Southern Brown Bandicoot & Brush-tailed Phascogale – possible habitat in Blackberry thickets, roadside understorey, abandoned rabbit warrens and hollow logs.

Threatened Flora

After reviewing the list of threatened flora in Table 1b, the species onsite, and the development proposal, species (if present) which are most likely to be affected by works are:

Green Scentbark (*Eucalyptus fulgens*) which is present on the properties and the road reserve, some of which may require removal for the establishment of crossovers and access to the new sub-divided lots and has therefore been offset (refer NVR report). Many of these trees are in poor condition, but the Saw sedge understorey and logs have created a thicket together with weed species and do offer some habitat options which may be inhabited by Marsupial species. It is possible that these trees may be able to be retained as a patch, as their TPZs are rather small and should not affect or restrict any development on the new 'lots' and these trees and the understorey should be retained for as long as possible until the reserve area has been established with alternative habitat provision

Development proposal and impacts

4.0

The development at 8 Wattletree RD Bunyip consists of a subdivision of ~2/3's of the property into 31 lots; the property at 22 Wattletree Rd into 4 lots; 9-11 Petty Rd into 23 lots; 13-15 Petty Rd into 3 lots; and 24 Nylander Rd into 24 lots, all with road and other infrastructure as required.

These properties will, for the most part lose their tree layer, however the ground story consists of exotic pasture grasses and herbaceous species (mostly exotic) and some woody weeds. There are some large shrub remnants and tree patches along some of Petty Road that could act as a habitat corridor, these have been offset as part of the NVR reports, however, ideally would be retained where possible between individual 'lot' crossovers (with specialised habitat pipework conduits installed for faunal traffic) pending subdivision approval.

The road reserves need to be enhanced where possible to lead to the Conservation area noted as Public Open Space reserve on 8 Wattletree Rd as a bio-link area (refer Map 10 below).

The loss of vegetation will be offset by the individual landholders via an offsite offset and has been calculated in three NVR reports for each of the three landholdings.



Map 10. Existing site plan showing location of Public Open Space Reserve (Nobelius, 2023)

There is always a conflict between development and conservation of vegetation. However, on this particular property the allocation of a bushland conservation reserve as a 'good faith' gesture due to the subdivision of the greater property and landholding is an excellent

outcome with indigenous vegetation impacts minimised where possible and potential habitat provision conserved and protected.

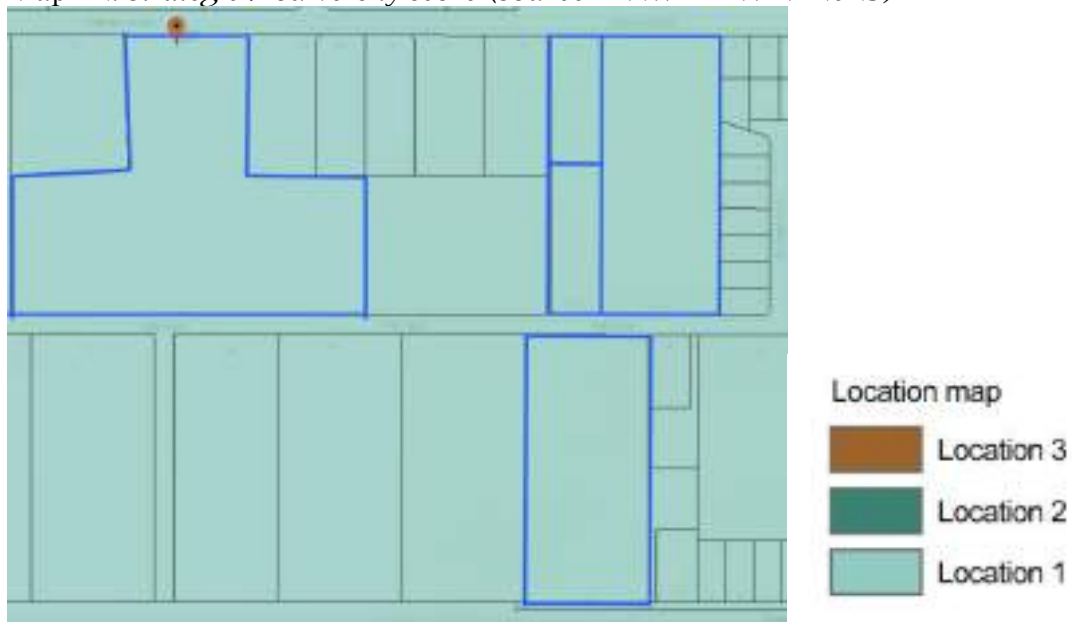
The implemented weed control and environmental weed removal measures will result in environmental gains by managing the land, and preventing the weed spread further afield to other properties in the area. The current management of the property as a whole is grazing of pasture grasses and firewood collection from the ‘reserve’ area. It appears that although the reserve area is fenced off stock have been allowed at times to graze the ground flora, by eliminating this and spraying exotic species as they appear, together with the removal of the woody environmental weed species with fleshy fruit such Sweet Pittosporums, it is anticipated that the window of opportunity for indigenous species will be opened, both via regeneration from the soil seed bank and revegetation efforts.



Map 11. *Native vegetation condition score (Source DELWP – NVIM 2023)*



Map 12. *Strategic biodiversity score* (Source DELWP – NVIM 2023)



Map 13. *Location Map* (Source DELWP – NVIM 2023)



Map 14. Proposed reserve of 8 Wattletree Rd, with approximate management grid sections.

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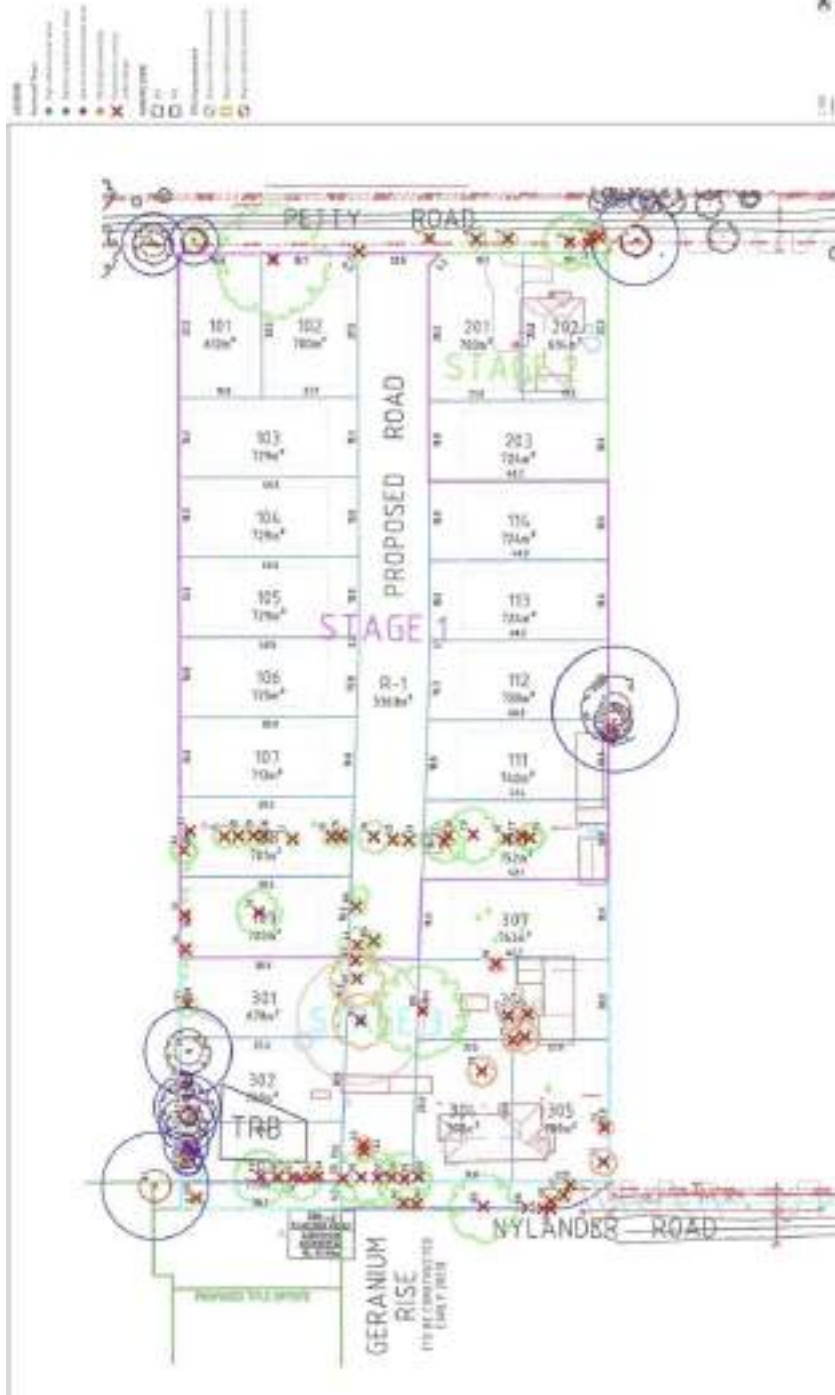


Map 15. Proposed site plan subdivision (Nobelius 2023)

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Map 16. Proposed subdivision of 22 Wattletree Rd, 9-11 and 13-15 Petty Rd.



Map 17. Proposed subdivision of 24 Nylander Rd.

4.2 Managing the Reserve for Southern Brown Bandicoots & other threatened fauna

Background

Land clearing for agriculture, housing and roads, alterations to hydrology, the introduction of predators – feral and domestic animals, and the fragmentation of habitat corridors has seen the dramatic decline of Southern Brown Bandicoot numbers in the wild. Figures indicate a reduction in their range of 50-90% since European settlement due to the highly fragmented landscape.

The loss of successful population viability into the future relies on genetic diversity to increase the ability to adapt to changes in the environment. By creating isolated habitat areas, i.e. not linked to other core areas reduces the chances of viable populations surviving into the future. The challenge is to keep populations safe, disallowing predators but allowing SBB movement.

Citizen Science group within VNPA (Victorian National Parks Association) noted that SBB had not been seen since 2016 in the Bunyip State Park some ~8.3km north of this site. There were significant bushfires in 2019 that would have further negatively impacted any possible SBB populations.

Competition and pest animals

Rabbits degrade habitat – the creation of their warrens causes soil erosion & disturbance, even destroying SBB habitat. Rabbits also attract foxes that also prey on SBB's. Restrict dog & cat access. Cats can transmit Toxoplasmosis that can also be detrimental to SBB's.

Tracking & monitoring for presence (SBB)

Surveys & monitoring – signs - digging, scats, spotlighting, hair tubing, predator scats, surveillance cameras, cape trapping. Connect with local environment groups, such as Bunyip Landcare Group, Cardinia Environment Coalition & CEC nursery and Friends of Bunyip State Park, along with VNPA.

Southern Brown Bandicoot

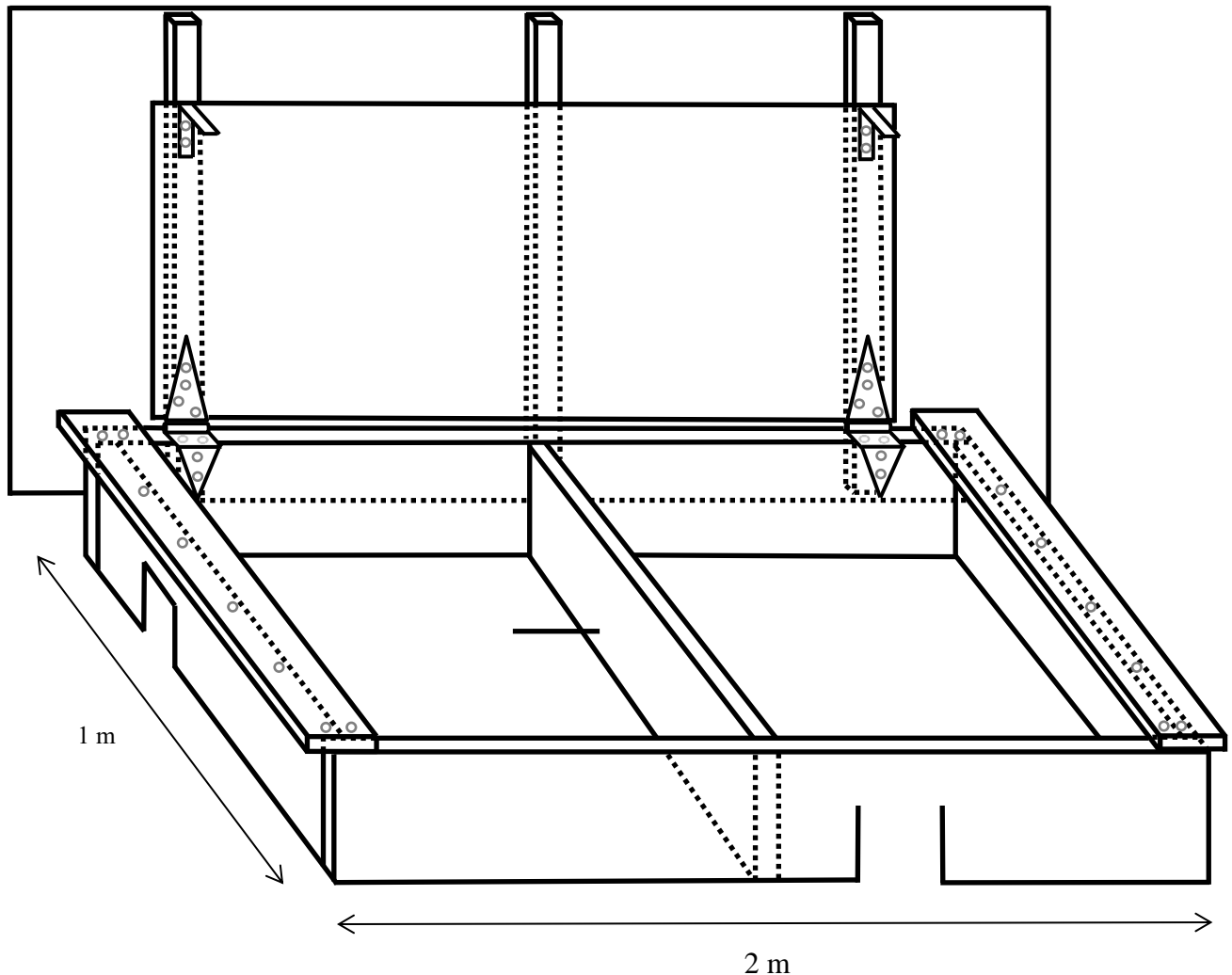
Reserve will need to be managed specifically tailored to support to specific needs of the SBB, this will also encourage other native species to inhabit. Ground dwelling solitary nocturnal marsupial, their breeding regime depends on the conditions, i.e. food availability and climate. They can produce between 1-4 offspring in a litter up to 3 times per year. They reach sexual maturity at ~60 days and live between 3-4 years. Populations expected to occur in very low densities ~ 0.5-5ha (20-200 individuals per km²). They dig in leaf litter and soil for insects, fungi, plant root nodules and bulbs, as well as enjoying fruit seed and other plant materials. They nest under plants or use other species' burrows, in dense vegetation, wetland fringes and heathland vegetation types within native and exotic shrubs, including Blackberry. Therefore, a staged vegetation management regime is required to not remove all the weedy species at once, but leaving areas that could provide desirable conditions.

Vegetation Management for optimal SBB habitat

The allocated reserve area has monocultured areas of Blackberry and Sweet Pittosporum, the removal of these should be managed carefully to not expose vast areas all at once. Revegetation of indigenous species that will provide similar conditions should be installed in more open areas before weed removal. The Bushland Reserve area can be theoretically divided into ~20m² patches to be targeted in a staged manner. (see Map 14).

Road reserves, mainly along Petty Rd, to link the other proposed subdivided estates to this reserve will require revegetation with shrub, preferably prickly species, and ground flora to create a habitat link. New crossovers should have pipes installed as conduits for safe SBB movement along the Petty Rd verge to the conservation public open space reserve. Whilst staged weed removal and indigenous vegetation removal is undertaken artificial shelters could be installed – see diagram below.

Southern Brown Bandicoot Artificial shelter (hide) – plan with dimensions.



Cardinia Shire Council plans.

4.3 Land Management Plan

Table 2:

Public Open Space Conservation Bushland Zone		
Land-use Commitment		
* Commit to protecting the land for habitat provision, to enhance and maintain biodiversity.		
* Retain all standing large trees (dead or alive) – Indigenous species		
* Install arboreal & terrestrial nest boxes prior to permitted tree removal.		
* Retain all other standing trees (dead or alive) – Indigenous species		
* Ensure all hollow bearing trees are protected.		
* Allow natural indigenous species regeneration.		
* Control rabbits, foxes, deer and other pest herbivores (if any)		
* Manage domestic pets (cats and dogs) and agricultural animals within this zone.		
* Ensure that all weeds and any other threats that may impact on native flora/fauna are controlled.		
* Ensure no vehicles enter zone, unless absolutely necessary for restoration works, and ensure only existing accessway is used with no additional permanent tracks.		
* Maintain existing tracks for vegetation management, no unnecessary new tracks to be created.		
* Retain all fallen leaf litter, twigs, branches and logs within the zone, unless for firewood purposes.		
* Ensure no planting of non-indigenous flora exists.		
* Ensure no soil or indigenous vegetation disturbance or stockpiling occurs in this zone.		
* Ensure that no storage or accumulation of rubbish or materials occurs.		
* Ensure habitat fencing is installed between the reserve and the subdivision correctly and maintained and perimeter fencing maintained or replaced where necessary if applicable.		
Management Commitment		
Years from Commencement	Management actions to be completed	Timing of activity (if applicable)
One to Three	<ul style="list-style-type: none"> • Maintain existing perimeter fencing. • Install habitat fencing between this reserve and residential subdivision area • Liaise with local Landcare groups and VNPA citizen Science groups for ongoing SBB monitoring for presence and general environmental collaboration. • Install nest boxes and terrestrial boxes for alternative habitat provision for Southern Brown Bandicoot, Swamp Antechinus, Broad-toothed Rat & Brush-tailed Phascogale and any other arboreal marsupials such as gliders, possums and micro-bats. • Check all trees for habitat hollows and occupancy prior to removal. Have Licensed Wildlife carer onsite during permitted tree removal works for hollow bearing trees. • Undertake selective removal of weed species, ensuring weed cover does not increase beyond the current level: <ul style="list-style-type: none"> * implement grassy and herbaceous weed control using spot-spraying, burning, hand-weeding (in sensitive areas if applicable); control weeds prior to seed maturation/seed set; * control woody weed species such as using hand pulling, cutting & painting and drill & fill. Undertake Sweet Pittosporum & Blackberry control in ~10m² patches at a time while revegetation grows to develop habitat niches. * Be aware of any new weed species appearing, see Appendices for expected species. 	<p>* All Year</p> <p>* Spring – Summer – Autumn</p>

	<ul style="list-style-type: none"> • Allow natural recruitment of indigenous species • Monitor pest animals across the zone and implement pest animal management works if necessary. • Retain all standing trees, dead or alive, especially protecting hollow bearing trees. • Remove any rubbish or other materials that are present within zone. • Ensure vehicular access is kept to a minimum, especially once initial weed control and revegetation has taken place. • Work through grid area for weed removal ensuring Blackberry thicket cover is not reduced too quickly thus preventing SBB habitat provision. Refer Table 4. 	
Four to Ten	<ul style="list-style-type: none"> • Continue to ensure no unnecessary vehicles or other land disturbances activity permitted, and no storage or accumulation of rubbish or materials occurs. • Monitor condition of fences, repair/replace where necessary • Continue to retain all standing trees, dead or alive, especially protecting hollow bearing trees. • Continue to monitor pest animals across the zone and implement pest animal management works if necessary. • Maintain revegetation areas and replace any dead plants with the same or approved species. • Work through grid area for weed removal ensuring Blackberry thicket cover is not reduced too quickly thus preventing SBB habitat provision. • Continue to control weed species: <ul style="list-style-type: none"> * control woody weed species such as using hand pulling, cutting & painting and drill & fill. * Be aware of any new weed species appearing, see Appendices for expected species. 	<p>* All Year</p> <p>* Spring – Summer – Autumn</p>
Ongoing	<ul style="list-style-type: none"> • Continue to control weed species: as they appear: <ul style="list-style-type: none"> * implement grassy and herbaceous weed control using spot-spraying, burning, hand-weeding (in sensitive areas if applicable); control weeds prior to seed maturation/seed set; * control woody weed species such as using hand pulling, cutting & painting and drill & fill. • Maintain revegetation areas and replace any dead plants with the same or approved species. • Continue to monitor pest animals across the zone and implement pest animal management works if necessary. • Work through grid area for weed removal ensuring Blackberry thicket cover is not reduced too quickly thus preventing SBB habitat provision Refer Table 4. • Continue to ensure no unnecessary vehicles or other land disturbance activities permitted, and no storage or accumulation of rubbish or materials occurs. • Monitor fencing for repair/replacement. <p>* Be aware of any new weed species appearing, see Appendices for expected species.</p>	<p>* Spring – Summer – Autumn</p> <p>* All Year</p>

Table 3. Land Management Plan Action works

Action	Location	Method	Herbicide/Chemical Use	Timing	Priority
Obtain required planning permits & endorsed plans	8 Wattletree Rd, Bunyip	Apply to Council	NA	As endorsed	High
Remove approved trees for DS (see Arb reports)	Paddock areas – to be subdivided	Install arboreal and terrestrial nest boxes. Employ a qualified Arborist. Have Wildlife carer present and check all hollows for occupancy.	NA	Once permits approved	High
Eradicate woody weeds – especially berry fruiting species	Across the site, in small sections at a time using grid area – Table 4.	* Cut & paint larger plants * Hand pull young plants	Glyphosate based product or employ a contractor with an ACUP	Spr-Aut	High
Development & construction	Construction zone	NA	NA	Once permits approved	High
Fence off construction zone to reserve, protect trees with TPZ fencing esp. #1 & 58.	Construction zone	Fencing must comply with the Council's specifications for TPZ and AS4970-2009, care taken whilst removing trees for DS	NA	Once permits approved	High
Control herbaceous & grassy weeds	Entire property	Spray or hand pull	Glyphosate based herbicide, as per product instructions	All year	Medium
Rabbits	Any active warrens to be located & mapped	* Baiting/ferreting of rabbit warrens after approved risk assessment has been undertaken. * Maintain warrens as potential Bandicoot habitat. * Neighbourhood	NA Ferrets are preferred option as Pindone is poisonous to SBB.	Late Summer All Year Late Summer All Year	High

Action	Location	Method	Herbicide/Chemical Use	Timing	Priority
		baiting program * Monitor for return of rabbits or presence of Bandicoots			
Retention of large logs	Public Open Space conservation reserve Zone	Leave in-situ unless crossing an accessway	NA	All Year	Medium
Maintain existing tracks for maintenance	Public Open Space conservation reserve Zone	Keep tracks clear of debris and weeds for management purposes	Weeds – Glyphosate based product	All Year	Medium

Table 4. Action & timing of works process plan

Revegetation staged in area sections and species used, see Revegetation Table 5.

Sections to be managed in a staged approach:

Timing ~ year	Section	Weed control	Revegetation
0-1	A, E, U, O & Y	✓	✓
1-2	B, D, F, J, P, T, V, X	✓	✓
2-3	C, G, I, K, N, Q, S, W	✓	✓
3-4	H, L, M, N, R	✓	✓
4-5	A, E, U & Y	✓	✓
5-6	B, D, F, J, P, T, V, X	✓	✓
6-7	C, G, I, K, N, Q, S, W	✓	✓
7-8	H, L, M, N, R	✓	✓
8-9	All sections	✓	✓
9-10	All sections	✓	✓

Table 4. Grid Revegetation/weed control timing

4.4 Indigenous species

A suggested revegetation and in-fill plant list is below, the tree species will provide a younger generation to come though, as there are quite a few dead stags, also good habitat but will eventually fall to become log habitat. The stags look to establish some overstorey species not currently on-site and prickly bushes, ground covers and grasses to create habitat niches for the SBB as weed control begins. Then increasing diversity to provide great food opportunities and habitat options. Stage 3 sees more diversity and allows for any gaps that have developed to be in-filled. Table 5.

Botanical Name	Common Name	Stage 1	Stage 2	Stage 3
Trees				
<i>Acacia dealbata</i>	Silver Wattle			
<i>Acacia mearnsii</i>	Black Wattle			
<i>Acacia melanoxylon</i>	Blackwood			

Botanical Name	Common Name	Stage 1	Stage 2	Stage 3
<i>Allocasuarina littoralis</i>	Black Sheoak			
<i>Eucalyptus baxteri</i>	Brown Stringybark			
<i>Eucalyptus cephalocarpa</i>	Silver-leaf Stringybark			
<i>Eucalyptus dives</i>	Broad-leaf Peppermint			
* <i>Eucalyptus fulgens</i>	Green Scentbark			
* <i>Eucalyptus globoidea</i>	White Stringybark			
<i>Eucalyptus macrorhyncha</i>	Red Stringybark			
* <i>Eucalyptus obliqua</i>	Messmate Stringybark			
* <i>Eucalyptus radiata</i>	Narrow-leaf Peppermint			
<i>Eucalyptus sieberi</i>	Silvertop Ash			
* <i>Eucalyptus viminalis</i> subsp. <i>pryoriana</i>	Coast Manna-gum			
Shrubs				
<i>Acacia brownii</i>	Heath Wattle			
<i>Acacia genistifolia</i>	Spreading Wattle			
<i>Acacia paradoxa</i>	Hedge Wattle			
<i>Banksia marginata</i>	Silver Banksia			
<i>Banksia spinulosa</i> var. <i>cunninghamii</i>	Hairpin Banksia			
<i>Bauera rubioides</i>	Wiry Bauera			
* <i>Bursaria spinosa</i>	Sweet Bursaria			
<i>Cassinia aculeata</i>	Common Cassinia			
<i>Cassinia longifolia</i>	Shiny Cassinia			
<i>Coprosma hirtella</i>	Rough Coprosma			
<i>Coprosma quadrifida</i>	Prickly Currant-bush			
<i>Correa reflexa</i>	Common Correa			
<i>Daviesia latifolia</i>	Hop Bitter-pea			
<i>Daviesia leptophylla</i>	Narrow-leaf Bitter-pea			
<i>Dillwynia cinerascens</i> s.l.	Grey Parrot-pea			
<i>Epacris impressa</i>	Common Heath			
<i>Hakea decurrens</i>	Bushy Needlewood			
<i>Hakea nodosa</i>	Yellow Hakea			
<i>Hakea ulicina</i>	Furze Hakea			
<i>Indigofera australis</i> subsp. <i>australis</i>	Austral Indigo			
<i>Leptospermum continentale</i>	Prickly Tea-tree			
<i>Leptospermum lanigerum</i>	Woolly Tea-tree			
<i>Leucopogon virgatus</i>	Common Beard-heath			
<i>Lomatia ilicifolia</i>	Holly Lomatia			
<i>Olearia lirata</i>	Snowy Daisy-bush			

Botanical Name	Common Name	Stage 1	Stage 2	Stage 3
<i>Olearia phlogopappa</i>	Dusty Daisy-bush			
<i>Ozothamnus ferrugineus</i>	Tree Everlasting			
<i>Pimelea humilis</i>	Common Rice-flower			
<i>Pimelea linifolia</i>	Slender Rice-flower			
<i>Polyscias sambucifolia</i>	Elderberry Panax			
<i>Pultenaea gunnii</i>	Golden Bush-pea			
* <i>Solanum aviculare</i>	Kangaroo Apple			
<i>Spyridium parvifolium</i>	Dusty Miller			
<i>Tetratheca ciliata</i>	Pink-bells			
Climbers				
<i>Billardiera mutabilis</i>	Common Appleberry			
* <i>Clematis aristata</i>	Mountain Clematis			
<i>Hardenbergia violacea</i>	Purple Coral-pea			
<i>Rubus parvifolius</i>	Native Raspberry			
Ferns				
<i>Adiantum aethiopicum</i>	Common Maidenhair			
<i>Blechnum cartilagineum</i>	Gristle Fern			
<i>Blechnum fluviatile</i>	Ray Water-fern			
<i>Blechnum minus</i>	Soft Water-fern			
<i>Blechnum nudum</i>	Fishbone Water-fern			
<i>Blechnum parrisiae</i>	Common Rasp-fern			
<i>Blechnum wattsii</i>	Hard Water-fern			
<i>Polystichum proliferum</i>	Mother Shield-fern			
Herbaceous				
<i>Acaena echinata</i>	Sheep's Burr			
<i>Acaena novae-zelandiae</i>	Bidgee-widgee			
<i>Acrotriche prostrata</i>	Trailing Ground-berry			
<i>Acrotriche serrulata</i>	Honey-pots			
<i>Australina pusilla</i> subsp. <i>muelleri</i>	Shade Nettle			
<i>Brunonia australis</i>	Blue Pincushion			
<i>Dichondra repens</i>	Kidney-weed			
<i>Geranium potentilloides</i>	Soft Crane's-bill			
<i>Geranium solanderi</i> s.l.	Austral Crane's-bill			
<i>Goodenia humilis</i>	Swamp Goodenia			
<i>Goodenia lanata</i>	Trailing Goodenia			
<i>Hackelia latifolia</i>	Forest Hound's-tongue			
<i>Kennedia prostrata</i>	Running Postman			
<i>Pelargonium australe</i>	Austral Stork's-bill			

Botanical Name	Common Name	Stage 1	Stage 2	Stage 3
<i>Veronica calycina</i>	Hairy Speedwell			
<i>Veronica plebeia</i>	Trailing Speedwell			
<i>Viola hederacea</i>	Ivy-leaf Violet			
<i>Wahlenbergia gracilis</i>	Sprawling Bluebell			
<i>Xanthosia dissecta s.l.</i>	Cut-leaf Xanthosia			
<i>Xerochrysum bracteatum</i>	Golden Everlasting			
Grasses & Lilies				
<i>Arthropodium milleflorum</i>	Vanilla Lily			
<i>Arthropodium strictum</i>	Chocolate Lily			
<i>Austrodanthonia setacea</i>	Small-flowered Wallaby-grass			
<i>Austrostipa densiflora</i>	Dense Spear-grass			
<i>*Austrostipa rudis</i>	Veined Spear-grass			
<i>Bulbine bulbosa</i>	Bulbine Lily			
<i>Burchardia umbellata</i>	Milkmaids			
<i>Dianella longifolia s.l.</i>	Pale Flax-lily			
<i>*Dianella revoluta s.l.</i>	Black-anther Flax-lily			
<i>Dianella tasmanica</i>	Tasman Flax-lily			
<i>Dichelachne rara</i>	Common Plume-grass			
<i>Echinopogon ovatus</i>	Common Hedgehog-grass			
<i>*Gahnia sieberiana</i>	Red-fruit Saw-sedge			
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush			
<i>*Microlaena stipoides var. stipoides</i>	Weeping Grass			
<i>Poa ensiformis</i>	Purple-sheath Tussock-grass			
<i>Poa labillardierei</i>	Common Tussock-grass			
<i>Poa tenera</i>	Slender Tussock-grass			
<i>*Rytidosperma caespitosum</i>	Common Wallaby-grass			
<i>Rytidosperma geniculatum</i>	Kneed Wallaby-grass			
<i>Rytidosperma pallidum</i>	Silvertop Wallaby-grass			
<i>Stackhousia monogyna s.l.</i>	Creamy Stackhousia			
<i>Themeda triandra</i>	Kangaroo Grass			
<i>Wurmbea dioica</i>	Common Early Nancy			

*Indicates species found on-site.

	Stage 1 – Primary colonisers and prickly plants
	Stage 2 – increased biodiversity
	Stage 3 – increased biodiversity and infill of any gaps with species from stages 1 & 2

NB: Ferns may regenerate once canopy cover is met and established to reinstate microclimatic niches and weeds removed.

Table 5. Revegetation/Species list



Various Eucalypt species, including log habitat onsite



Sweet Bursaria.



Black-anther Flax-lily



Wattle mat-rush.



Velvet Grass

4.5 Weed classification

One of the most crucial negative impacts on the site is the proliferation and threat of environmental weeds.

The following categories exist for weed species in Victoria and Australia. Many of the onsite weeds discussed below fall into these categories, and definitions are defined as follows:

State Prohibited Weeds are either not currently present in Victoria but pose a significant threat if they were to be introduced; or are present and already pose a significant threat and it is reasonable that these weeds could be eventually eradicated from the State with vigilant controls. Control of these weeds is the responsibility of DPI across Victoria.

Regionally Prohibited Weeds are those not widely distributed across the region (Port-Phillip and Westernport) but capable of further spread. It is reasonable to assume that these weeds could be eventually eradicated from the region with vigilant controls. Control is the responsibility of both public and private land managers on their land and VicRoads on declared roads under Victorian Transport Act 1983, and DPI on roadside areas.

Regionally Controlled Weeds are those that exist in the region (Port Phillip and Westernport) and are usually widespread. Continued control measures are required to prevent further spread onto clean land. Control is the responsibility of both public and private land managers on their land, and VicRoads on declared roads under the Victorian Transport Act 1983.

Restricted Weeds are considered a threat to primary production, Crown Land, community health and the natural environment either in the State of Victoria or adjoining states having the great potential to spread in Victoria. There is no legal requirement for landholders to

control these weeds, however they cannot be traded or transported within Victoria (seed included). Although some restricted weeds are also classified as Declared Noxious Weeds and this status takes precedence.

Declared Noxious Weeds are those which do require control under the Catchment and Land Protection Act 1994, which states that all landowners and occupiers are responsible for managing noxious weeds on their land, as the plants have the potential to cause serious economic and/or environmental harm. These weeds should be reported to the local Shire if found on public land. Further information is available at www.dpi.vic.gov.au.

Weeds of National Significance are weeds which have been identified as part of a national initiative known as the National Weeds Strategy whereby 20 weeds of national significance were identified across all Australian states and territories, with a view to reducing the impact of these species on productive capacity and natural ecosystems. Selection criteria were as follows: invasiveness; impact; potential to spread; & socio-economic and environmental values.

Weed Species

Botanical Name	Common Name	Weed Status
Trees		
<i>Acacia longifolia</i>	Sydney Golden Wattle	DSE RS 131
<i>Fraxinus angustifolia</i>	Desert Ash	DSE RS 11
<i>Pinus radiata</i>	Monterary Pine	DSE RS 6
<i>Pittosporum undulatum</i>	Sweet Pittosporum	DSE RS 10
<i>Robinia pseudoacacia</i>	Black Locust	DSE RS 75
Shrubs		
<i>Genista linifolia</i>	Mediterranean Broom	DSE RS 12, CALP Act
<i>Hakea salicifolia</i>	Willow-leaf Hakea	DSE RS 201
<i>Prunus cerasifera</i>	Cherry Plum	DSE RS 96
<i>Rubus fruticosus</i>	Blackberry	WONS benchmark species High impact high invasive, Regionally Controlled
Climbers/ Creepers		
<i>Asparagus asparagoides</i>	Bridal Creeper	DSE RS 10
<i>Hedera helix</i>	English Ivy	DSE RS 1
<i>Tradescantia fluminensis</i>	Wandering Trad	DSE RS 20
<i>Vinca major</i>	Blue Periwinkle	DSE RS 15
Herbaceous		
<i>Acanthus mollis</i>	Oyster Plant	DSE RS 156
<i>Acetosella vulgaris</i>	Sheep Sorrel	DSE RS 43
<i>Amaryllis belladonna</i>	Belladonna Lily	
<i>Chenopodium murale</i>	Nettleleaf Goosefoot	DSE RS 241
<i>Centaurea erythraea</i>	Common Centaury	DSE RS 115
<i>Cirsium vulgare</i>	Spear Thistle	DSE RS 115, CALP Ac, RC.
<i>Crocsmia x crocosmiiflora</i>	Montbretia	DSE RS 3
<i>Euphorbia characias</i>	Mediterranean Spurge	
<i>Hypochaeris radicata</i>	Cats Ear	DSE RS 115
<i>Lysmachia arvensis</i>	Scarlet Pimpernell	DSE RS 133
<i>Lotus corniculatus</i>	Bird's-foot Trefoil	DSE RS 176
<i>Medicago lupulina</i>	Black Medic	DSE RS 47

Botanical Name	Common Name	Weed Status
<i>Melissa officinalis</i>	Lemon Balm	DSE RS 102
<i>Myosotis arvensis</i>	Forget-me-not	DSE RS 239
<i>Myriophyllum aquaticum</i>	Parrot's Feather	
<i>Nymphaea mexicana</i>	Yellow Water-lily	
<i>Plantago lanceolata</i>	Ribwort	DSE RS 179
<i>Rumex</i> spp.	Dock	DSE RS 143
<i>Solanum nigrum</i>	Black Nightshade	DSE RS 124
<i>Trifolium repens</i>	White Clover	DSE RS 41
<i>Viola odorata</i>	Fragrant Violet	DSE RS 203
<i>Zantedeschia aethiopica</i>	Arum Lily	DSE RS 21
Grasses		
<i>Agrostis capillaris</i>	Brown-top Bent-grass	DSE RS 94
<i>Anthoxanthum odoratum</i>	Sweet Vernal grass	DSE RS 31
<i>Cynodon dactylon</i>	Couch grass	DSE RS 186
<i>Cyperus eragrostis</i>	Umbrella Sedge	DSE RS 53
<i>Dactylis glomerata</i>	Cocksfoot Grass	DSE RS 97
<i>Ehrharta erecta</i>	Panic Veldt Grass	DSE RS 40
<i>Holcus lanatus</i>	Yorkshire Fog Grass	DSE RS 52
<i>Lolium perenne</i>	Perennial Ryegrass	DSE RS 212
<i>Paspalum dilatatum</i>	Paspalum	DSE RS 214
<i>Pennisetum clandestinum</i>	Kikuyu	DSE RS 159

Table 6: Weeds found onsite

DSE RS = Department of Sustainability & Environment (DELWP) Ranking Score (1-243)

Ranking Score range
 1–30 Very High Risk Weeds
 31–60 High Risk Weeds
 61–90 Moderately High Risk Weeds
 91–120 Medium Risk Weeds
 121–243 Lower Risk Weeds

EVC = Ecological Vegetation Class
 RC= Regionally Controlled
 RW = Restricted Weed
 CALP Act = Catchment and Land protection Act 1994
 NH = Neighbourhood weed
 WONS = Weed of National Significance

Weed Species – particular control measures.

Woody Weeds

Many of these species were planted as ornamental species, however, they could potentially have offspring, therefore they should be monitored. Small seedling plants can be hand pulled, and large mature specimens can be cut and painted whereby the freshly cut stump is quickly painted with herbicide (undiluted glyphosate, use 'dabber' bottle).

Sweet Pittosporum

This species is present as monocultures in sections of the block, and a few seedlings noted, beginning to expand its current range. It has the potential to become the dominant weed species if left unmanaged, as once a mature specimen establishes only its own babies will grow beneath it. This species is also posing a significant increase of fire threat. To control it, seedlings can be hand pulled when soils are moist while larger trees need to be cut and immediately painted. Failure to 'paint' the freshly cut stump with herbicide (undiluted glyphosate, use 'dabber' bottle) will result in the stump 'coppicing' (re-shooting) and very dense, multi-stemmed plants resulting. Painting should be done as soon as possible (within 30 seconds) after cutting so the poison is drawn down with the sap.

Blackberry

Present onsite as thickets, it is essential to control, however due to the potential of SBB or other native fauna using the thickets the removal should be undertaken in stages and with care, monitoring for any native fauna utilising the brambles as habitat. This should coincide with revegetation of prickly shrubs to offer replacement habitat.

Small plants can be dug out or spot sprayed. With larger brambles, the best option is to 'cut and paint' the stems using a 'dabber' with undiluted Glyphosate. The fruit is spread by water and eaten by birds and small mammals; brambles can also propagate from self-layering rhizomatous stems (daughter plantlets) and also from the weed seed bank. Seeds are generally low viability and seedlings are susceptible to competition and shading from indigenous vegetation, therefore the aim would be to control rogue outbreaks in bush areas and encourage indigenous regeneration to out compete. Chemical control is best implemented between the months of October to May. It can be confused with the indigenous Native Raspberry (*Rubus parvifolius*), which is much smaller in leaf, fruit, flower and stem, and often inhabits the same niche. The landholder has a legal obligation to control this weed.

Climbing weeds

The creeping/climbing species spread via seed and vegetatively from dumped garden waste, if left unmanaged they will smother indigenous species while establishing underground stems and stored seed that potentially will become impermeable for desirable species and water penetration. They have been plants used in gardens with uses in flower arranging and ornamental uses, however they can quickly invade bushland areas. Young plants can be dug out by hand; larger infestations can be sprayed with a Glyphosate herbicide prior to flowering or just as flowering begins. Careful follow up is required as it is very likely to regrow from the extensive underground rhizomes and seed.

Ground covering and herbaceous weeds

The herbaceous species do not pose an immediate threat to the biodiversity however, as other major infestations of weeds are cleared and controlled, this will present the opportunity for such species to colonise and therefore their presence and potential control measures should be noted. As they proliferate, they smother any indigenous vegetation as their growth rate is faster and they also prevent any plants attempting to emerge.

One of the best control methods for these species is to establish natural vigorous regeneration of pioneer indigenous species extremely effective control. Careful spot spraying with herbicide, or hand pulling can easily control small outbreaks. On-going monitoring is vital to prevent re-infestations.

Exotic Grass species

There are a wide variety of exotic grasses used as pasture species. Most have light seed that is easily spread via wind and water. Paspalum has sticky seeds that also be spread via people or animals walking past and taking the seed with them, also it is more persistent in the soil so follow up is essential for successful eradication. The best way to control these plants in fringe areas is through competition by healthy indigenous vegetation. Where removal is required hand pulling and chemical controls can be undertaken. The running type grasses; such as Kikuyu may require several applications to eradicate the repeated regrowth that occurs from underground roots. The Umbrella Sedge produces masses of seed and the leaves are quite waxy so a wetting agent added to an herbicide treatment would be beneficial. Treatment of all species is best undertaken prior to seed set.

Weed Species – pictorial account



Desert Ash (& Spurge & Dock)



Sydney Golden Wattle



Sweet Pittosporum, Blackberry & Bracken.



Mediterranean Broom,
Sweet Pittosporum & Red-fruit Saw-sedge



Planted Sweet Pittosporum in fence area.



Bridal Creeper



Ivy



Arum Lily



Giant Taro



Montbretia



Belladonna Lily.



Spear Thistle



Forget-me-not.



Black Medic



Black Nightshade, Cape Weed, Panic Veldt.



Umbrella Sedge



Wandering Trad.



Nettleleaf Goosefoot



Centaury.



Paspalum



Fragrant Violet



Pasture grasses & Bird's-foot Trefoil

Conclusions

There is very little indigenous vegetation remaining on the long-cleared properties and road reserve / nature-strip along Petty Rd that links them to the reserve. What is present is providing some habitat for fauna. There were many logs and upright stags, hollowed areas within vegetation, including Blackberries that could serve as Southern Brown Bandicoot habitat, although none were seen, neither was any evidence of them ie. scats.

The site at 8 Wattletree RD Bunyip (including reserve) is currently covered by more than 50% high threat weed species and of the total of 77 plant species documented onsite 55 out of 77 were weed species (71%).

There were 22 indigenous species identified (22/77=29%) which amounted to 30% coverage onsite. Many of the indigenous species were single specimens with very little coverage, however most were at maturity enough to set seed, which is encouraging.

Of the 22 indigenous species, only one of these *Eucalyptus fulgens* (Green Scentbark) is considered rare/endangered, across Victoria but is actually locally ubiquitous and easily propagated. The removal of these species onsite and on the road reserve is not preferable however may be necessary to facilitate access to the lots. It is recommended that these trees remain in situ for as long as possible whilst the reserve is being established as alternative habitat. These trees have been offset as a measure of good faith to ensure no net loss of vegetation (Cl.52.17). This species and other indigenous ones should however be part of any landscaping onsite (in gardens) and revegetation of road reserve areas and use as street trees.

Development onsite being the subdivision of the paddock area into residential lots seems inevitable due to the residential zoning and development of the local area and suburb. The reservation of the conservation area as a public open space will mitigate as much of the habitat loss and adverse impact as possible by setting aside a safe area of the land holding to remain as natural bushland and conserve floral and faunal biodiversity, Large Old Trees as well as habitat provision and bio-link.

This is an excellent result considering the amount of development in the immediate area, despite the removal and loss of Large and Very Large Old Trees. In fact, if the development facilitates proper management of the site through staged weed removal to prevent habitat

loss and instates revegetation and supports regeneration of the public open space using species indigenous to the Lowland Forest EVC 16, and species identified in this survey, outcomes for the site will be positive as will the outcomes for the Southern Brown Bandicoot if they choose to inhabit this area.

Glossary

Biodiversity – the variety of all life-forms, the different plants, animals and micro-organisms, the genes they contain, and the ecosystems of which they form a part.

EVC – Ecological Vegetation Class – a type of native vegetation classification that is described through a combination of its floristic, life form, and ecological characteristics, and through an inferred fidelity to particular environmental attributes.

TPZ – Tree Protection Zone

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Appendix A: Vascular Plants at 8 Wattletree Rd, Bunyip, 3815

Survey conducted March, 2023 by Healesville Plants.

Key:	*	Non-indigenous species, natives of Australia
	**	Non-indigenous species, exotics from other countries
	EW	Environmental Weed
	Nox	Declared Noxious Weed
	RC	Regionally Controlled
	WNS	Weed of National Significance
	g	Garden plant, species occurs in garden beds or similar situation
VROT Conservation status		
EPBC	EX	Extinct
	EN	Endangered
FFG	L	Listed as Threatened
DSE advisory	x	Extinct in Victoria
	v	Vulnerable in Victoria
	k	Poorly known in Victoria and suspected to be Threatened
	CR	Critically Endangered
	VU	Vulnerable
	N	Nominated for listing as Threatened
	e	Endangered in Victoria
	r	Rare in Victoria

Family	Scientific Name	Common Name	Notes
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FERNS AND FERN ALLIES

DENNSTAEDIACEAE	<i>Pteridium esulentum</i>	Bracken Fern	
LEMNACEAE	<i>Lemna disperma</i>	Duckweed	

MONOCOTYLEDONS

AMARYLLIDACEAE	<i>Amaryllis belladonna</i>	Belladonna Lily	**EW
	<i>Crinum</i> spp.	Crinum Lily	**g
	<i>Cyperus eragrostis</i>	Drain Flat-sedge.	**EW
	<i>Eleocharis sphacelata</i>	Tall Spike-rush	
	<i>Gahnia radula</i>	Thatch Saw-sedge	
	<i>Gahnia sieberiana</i>	Red-fruit Saw-sedge	
IRIDACEAE	<i>Crocasmia x crocosmiiflora</i>	Montbretia	**EW
LILIACEAE	<i>Dianella revoluta</i>	Black-anther Flax-lily	
JUNCACEAE	<i>Juncus gregiflorus</i>	Green Rush	
	<i>Juncus pallidus</i>	Pale Rush	
	<i>Juncus planifolius</i>	Broad-leaf Rush	
POACEAE	<i>Agrostis capillaris</i>	Brown-top Bent	**EW
	<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass	**EW

	<i>Austrostipa rudis</i>	Veined Spear Grass	
	<i>Cynodon dactylon</i>	Couch	**EW
	<i>Dactylis glomerata</i>	Cocksfoot	**EW
	<i>Ehrharta erecta</i>	Panic Veldt Grass	** EW
	<i>Holcus lanatus</i>	Yorkshire Fog Grass	**EW
	<i>Joycea pallida</i>	Silvertop Wallaby Grass	
	<i>Lolium perenne</i>	Ryegrass	**EW
	<i>Microlaena stipoides</i>	Weeping Grass	
	<i>Paspalum dilatatum</i>	Paspalum	**EW
	<i>Pennisetum clandestina</i>	Kikuyu	**EW
	<i>Poa morrisii</i>	Velvet Grass	
	<i>Rytidosperma caespitosum</i>	Common Wallaby-grass	
XANTHORRHOAECEAE	<i>Lomandra filiformis</i>	Wattle Mat-rush	
DICOTYLEDONS			
ACANTHACEAE	<i>Acanthus mollis</i>	Oyster Plant	**EW
AMARANTHACEAE	<i>Chenopodium murale</i>	Nettleleaf Goosefoot	**EW
APOCYNACEAE	<i>Vinca major</i>	Blue Periwinkle	**EW
	<i>Zantedeschia aethiopica</i>	Arum Lily	**EW
ARACEAE	<i>Alocasia macrorrhiza</i>	Giant Taro	**g
ARALIACEAE	<i>Hedera helix</i>	English Ivy	**EW
ASPARAGACEAE	<i>Asparagus asparagoides</i>	Bridal Creeper	**EW
ASTERACEAE	<i>Arctotheca calendula</i>	Cape Weed	**EW
	<i>Cirsium vulgare</i>	Spear Thistle	**RC
	<i>Hypochoeris radicata</i>	Cat's Ear / Flatweed	** EW
BETULACEAE	<i>Betula alba</i>	Silver Birch	**g
BORAGINACEAE	<i>Myosotis arvensis</i>	Forget-me-not	**EW
CASUARINACEAE	<i>Allocasuarina paludosa</i>	Swamp She-oak	
COMMELINACEAE	<i>Tradescantia fluminensis</i>	Wandering Trad	**EW
EUPHORBIACEAE	<i>Euphorbia characias</i>	Mediterranean Spurge	**EW
FABACEAE	<i>Genista linifolia</i>	Mediterranean Broom	**EW
	<i>Lotus corniculatus</i>	Bird's-foot Trefoil	**EW
	<i>Medicago lupulina</i>	Black Medic	**EW
	<i>Robinia pseudoacacia</i>	Black Locust	**EW
	<i>Trifolium repens</i>	White Clover	**EW
GENTIANACEAE	<i>Centaurium erythraea</i>	Common Centaury	**EW
HALORAGACEAE	<i>Gonocarpus tetragynus</i>	Common Raspwort	
	<i>Myriophyllum aquaticum</i>	Parrot's Feather	**EW
LAMIACEAE	<i>Melissa officinalis</i>	Lemon Balm	*EW
LYTHRACEAE	<i>Lythrum hyssopifolia</i>	Lesser Loosestrife	
MIMOSACEAE	<i>Acacia longifolia</i>	Sallow Wattle	*EW
	<i>Acacia melanoxylon</i>	Blackwood	
MYRTACEAE	<i>Acmena smithii</i> var. <i>minor</i>	Small-leaved Lily-pily	*g
	<i>Callistemon citrinus</i>	Crimson Bottlebrush	*g

	<i>Callistemon viminalis</i>	Weeping Bottlebrush	*g
	<i>Eucalyptus fulgens</i>	Green Scentbark	
	<i>Eucalyptus globoidea</i>	White Stringybark	
	<i>Eucalyptus obliqua</i>	Messmate	
	<i>Eucalyptus radiata</i>	Narrow-leaf Peppermint	
	<i>Leptospermum</i> cv.	Purple-leaf Tea-tree	*g
NYMPHAEACEAE	<i>Nymphaea mexicana</i>	Yellow Water-lily	**EW
OLEACEAE	<i>Fraxinus angustifolia</i>	Desert Ash	**EW
PHYLLANTHACEAE	<i>Poranthera microphylla</i>	Small Poranthera	
PINACEAE	<i>Pinus radiata</i>	Radiata Pine	**EW
PITTOSPORACEAE	<i>Bursaria spinosa</i>	Sweet Bursaria	
	<i>Pittosporum undulatum</i>	Sweet Pittosporum	*EW
PLANTAGINACEAE	<i>Plantago lanceolata</i>	Ribwort	**EW
POLYGONACEAE	<i>Persicaria decipiens</i>	Slender Knotweed	
	<i>Rumex acetosella</i>	Sheep Sorrel	**EW
	<i>Rumex</i> spp.	Dock	**EW
PRIMULACEAE	<i>Lysmachia arvensis</i>	Scarlett Pimpernell	**EW
PROTEACEAE	<i>Banksia spinulosa</i> cv.	Giant Candles Banksia	*g
	<i>Hakea salicifolia</i>	Willow-leaf Hakea	*EW
RANUNCULACEAE	<i>Clematis aristata</i>	Austral Clematis	
ROSACEAE	<i>Malus domestica</i>	Apple	**g
	<i>Prunus cerasifera</i>	Cherry Plum	**EW
	<i>Rubus fruticosus</i>	Blackberry	** WONS, RC
SOLANACEAE	<i>Solanum aviculare</i>	Kangaroo Apple	
	<i>Solanum nigrum</i>	Black Nightshade	**EW
VIOLACEAE	<i>Viola odorata</i>	Fragrant Violet	**EW
VITACEAE	<i>Parthenocissus quinquefolia</i>	Virginia Creeper	**g

Appendix B: Weed List~ Port Phillip and Westernport CMA

List of declared noxious weeds in Port Phillip and Western Port region

The following table contains weed species in the Port Phillip and Western Port region that were gazetted under the CaLP Act (Government Printer for Victoria 2010). The table displays each gazetted weed, their noxious weed category, and listings as a very high risk environmental weed (DSE 2009 a-e) and/or Weed of National Significance.

S=State Prohibited; P=Regionally prohibited; C=Regionally controlled; R=Regionally restricted.

* Branched Broomrape is also a declared exotic disease under the Plant Health and Plant Products Act 1995.

** Except *Salix alba* var. *caerulea*, *Salix alba* x *matsudana*, *Salix babylonica*, *Salix X calodendron*, *Salix caprea* 'Pendula', *Salix matsudana* 'Aurea', *Salix matsudana* 'Tortuosa', *Salix myrsinifolia* and *Salix X reichardtii*.

Present onsite

Common name	Weed species	Common name Category of noxious weed species gazetted under CaLP Act	Very high risk environmental weed	Weed of National Significance (WON)
African Boxthorn	<i>Lycium ferocissimum</i>	C	•	
African Daisy	<i>Senecio pterophorus</i>	C		
African Feather-grass	<i>Pennisetum macrourum</i>	P	•	
African Love-grass	<i>Eragrostis curvula</i>	C	•	
Alligator Weed	<i>Alternanthera philoxeroides</i>	S	•	•
Amsinckia	<i>Amsinckia spp.</i>	C		
Angled Onion	<i>Allium triquetrum</i>	R	•	
Apple of Sodom	<i>Solanum linnaeanum</i>	C		
Artichoke Thistle	<i>Cynara cardunculus</i>	C		
Athel Pine, Tamarisk	<i>Tamarix aphylla</i>	R		•
Bathurst Burr	<i>Xanthium spinosum</i>	C		
Bear-skin Fescue	<i>Festuca gautieri</i>	S		
Bindweed	<i>Convolvulus arvensis</i>	C		
Black Knapweed	<i>Centaurea nigra</i>	S		
Blackberry	<i>Rubus fruticosus</i>	C		•
Boneseed/Bitou bush	<i>Chrysanthemoides monilifera</i>	C	•	•
Branched Broomrape*	<i>Orobanche ramosa</i>	S		
Bridal Creeper	<i>Asparagus asparagoides</i>	R	•	•
Buffalo Burr	<i>Solanum rostratum</i>	P		
Cabomba	<i>Cabomba caroliniana</i>	R	•	•
Californian/Perennial Thistle	<i>Cirsium arvense</i>	C		
Caltrop	<i>Tribulus terrestris</i>	P		
Camel Thorn	<i>Alhagi maurorum</i>	S		
Cape Broom/ Montpellier Broom	<i>Genista monspessulana</i>	C	•	
Cape Tulip (one-leaf)	<i>Moraea flaccida</i>	C		
Cape Tulip (two-leaf)	<i>Moraea miniata</i>	C		
Chilean Cestrum	<i>Cestrum parqui</i>	P		
Chilean Needle-grass	<i>Nassella neesiana</i>	R	•	•
Devil's Claw (Purpleflower)	<i>Proboscidea louisianica</i>	P		
Devil's Claw (Yellowflower)	<i>Proboscidea lutea</i>	P		
Dodder	<i>Cuscuta spp.</i>	C		
English Broom	<i>Cytisus scoparius</i>	C	•	
Fennel	<i>Foeniculum vulgare</i>	R	•	
Flax-leaved Broom	<i>Genista linifolia</i>	C	•	
Giant Knotweed	<i>Fallopia sachalinensis</i>	S	•	
Giraffe Thorn	<i>Acacia erioloba</i>	S		
Golden Thistle	<i>Scolymus hispanicus</i>	C		
Gorse/Furze	<i>Ulex europaeus</i>	C	•	•
Great Mullein	<i>Verbascum thapsus</i>	R		
Hardheads/ Russian Knapweeds	<i>Rhaponticum repens</i>	P		
Hawkweed	<i>Hieracium spp.</i>	S	•	
Hawthorn	<i>Crataegus monogyna</i>	C	•	
Hemlock	<i>Conium maculatum</i>	C		
Hoary Cress	<i>Lepidium draba</i>	C		
Horehound	<i>Marrubium vulgare</i>	C	•	
Horsetail	<i>Equisetum spp.</i>	S	•	
Hymenachne/ Olive Hymenachne	<i>Hymenachne amplexicaulis</i>	R		•
Illyrian Thistle	<i>Onopordum illyricum</i>	P		
Ivy-leaved Sida	<i>Malvella leprosa</i>	S		
Japanese Knotweed	<i>Fallopia japonica</i>	S	•	
Japanese Knotweed hybrid	<i>Fallopia x bohemica</i>	S		
Karoo Thorn	<i>Acacia karroo</i>	S	•	
Khaki Weed	<i>Alternanthera pungens</i>	P		
Lagarosiphon	<i>Lagarosiphon major</i>	S		
Lantana	<i>Lantana camara</i>	R		•
Lobed Needle Grass	<i>Nassella charruana</i>	S	•	
Marijuana	<i>Cannabis sativa</i>	S		
Mesquite	<i>Prosopis spp.</i>	S		
Mexican Feather Grass	<i>Nassella tenuissima</i>	S	•	

Common name	Weed species	Common name Category of noxious weed species gazetted under CaLP Act	Very high risk environmental weed	Weed of National Significance (WON)
Mimosa	<i>Mimosa pigra</i>	R		•
Nodding Thistle	<i>Carduus nutans</i>	S		
Noogoora Burr/ Californian Burr	<i>Xanthium strumarium</i>	C		
Onion Weed	<i>Asphodelus fistulosus</i>	R		
Ox-eye Daisy	<i>Leucanthemum vulgare</i>	C		
Pampas Lily-of-the-Valley	<i>Salpichroa origanifolia</i>	C		
Parkinsonia	<i>Parkinsonia aculeata</i>	R		•
Parthenium Weed	<i>Parthenium hysterophorus</i>	S		•
Paterson's Curse	<i>Echium plantagineum</i>	C		
Perennial Ragweed	<i>Ambrosia psilostachya</i>	S	•	
Pond Apple	<i>Annona glabra</i>	R		•
Poverty Weed	<i>Iva axillaris</i>	S		
Prairie Ground Cherry	<i>Physalis hederifolia</i>	C		
Prickly Acacia	<i>Acacia nilotica subsp. Indica</i>	R		•
Prickly Pear (drooping)	<i>Opuntia monacantha</i>	C		
Prickly Pear (erect)	<i>Opuntia stricta</i>	C		
Ragwort	<i>Senecio jacobaea</i>	C		
Rubber Vine	<i>Cryptostegia grandiflora</i>	R		•
Saffron Thistle	<i>Carthamus lanatus</i>	C		
Salvinia	<i>Salvinia molesta</i>	S	•	•
Sand Rocket/Sand Mustard	<i>Diplotaxis tenuifolia</i>	C		
Scotch/Heraldic Thistle	<i>Onopordum acanthium</i>	P		
Serrated Tussock	<i>Nassella trichotoma</i>	C	•	•
Silverleaf Nightshade	<i>Solanum elaeagnifolium</i>	P		
Skeleton Weed	<i>Chondrilla juncea</i>	P		
Slender/Shore Thistle	<i>Carduus tenuiflorus</i> <i>/C.pycnocephalus</i>	C		
Soldier Thistle	<i>Pichomon acarna</i>	P		
Soursob	<i>Oxalis pes-caprae</i>	R	•	
Spear Thistle	<i>Cirsium vulgare</i>	C		
Spiny Broom	<i>Calicotome spinosa</i>	P		
Spiny Burr Grass/ Gentle Annie	<i>Cenchrus longispinus</i>	P		
Spiny Emex	<i>Emex australis</i>	P		
Spiny Rush	<i>Juncus acutus</i>	C	•	
St Barnaby's Thistle	<i>Centaurea solstitialis</i>	P	•	
St John's Wort	<i>Hypericum perforatum</i>	C		
St Peter's Wort	<i>Hypericum tetrapterum</i>	C		
Star Thistle	<i>Centaurea calcitrapa</i>	P		
Stemless Thistle	<i>Onopordum acaulon</i>	P		
Stinkwort	<i>Dittrichia graveolens</i>	C		
Sweet Briar	<i>Rosa rubiginosa</i>	C		
Tangled Hypericum	<i>Hypericum triquetrifolium</i>	S		
Thorn Apple (Common)	<i>Datura stramonium</i>	C		
Thorn Apple (Long-spine)	<i>Datura ferox</i>	C		
Thorn Apple (Recurved)	<i>Datura inoxia</i>	P		
Topped Lavender	<i>Lavandula stoechas</i>	R		
Tree of Heaven	<i>Ailanthus altissima</i>	C		
Tufted Honeyflower	<i>Melianthus comosus</i>	C		
Tutsan	<i>Hypericum androsaemum</i>	C		
Variegated Thistle	<i>Silybum marianum</i>	C		
Viper's Bugloss	<i>Echium vulgare</i>	C		
Water Hyacinth	<i>Eichhornia crassipes</i>	S	•	
Wheel Cactus	<i>Opuntia robusta</i>	P		
White Crack Willow	<i>Salix x rubens</i>	R		
Wild Garlic	<i>Allium vineale</i>	R		
Wild Mignonette	<i>Reseda luteola</i>	R		
Wild Teasel	<i>Dipsacus fullonum</i>	C		
Wild Watsonia	<i>Watsonia meriana var. bulbillifera</i>	C	•	
Willows**	<i>Salix spp.</i>	R	•	•

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Locally significant weeds to Cardinia Shire

RP = Regionally Prohibited, RC = Regionally Controlled, WONS = Weeds of National Significance, R = Restricted in the whole of the state.

**Threat ratings (where rated) are derived from the risk rating score in the DELWP Advisory list of environmental weeds in Victoria 2018

Cardinia Shire environmental and declared noxious weed list

Scientific name	Common name	**Threat rating (Low, Medium, Medium High, High, Very high)	State classifications (where listed in a noxious weed category)
<i>Acacia baileyana</i>	Coolamundra Wattle	MH	
<i>Acacia decurrens</i>	Early Black Wattle		
<i>Acacia elata</i>	Cedar Wattle	H	
<i>Acacia floribunda</i>	White Sallow Wattle		
<i>Acacia longifolia</i>	Sallow Wattle	VH	
<i>Acacia longifolia subsp. sophorae</i>	Coast Wattle		
<i>Acacia saligna</i>	Golden Wreath Wattle		
<i>Acer pseudo-platanus</i>	Sycamore Maple	H	
<i>Agapanthus praecox orientalis</i>	Agapanthus / African Lily	H	
<i>Allium triquetrum</i>	Angled Onion	H	R
<i>Astromeria aurea</i>	Peruvian Lily	H	
<i>Amaryllis belladonna</i>	Belladonna Lily	H	
<i>Anredera cordifolia</i>	Madeira vine	H	R
<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass	H	
<i>Arctotheca calendula</i>	Cape Weed	M	
<i>Asparagus asparagoides</i>	Bridal Creeper	H	WONS, R
<i>Asparagus scandens</i>	Asparagus Fern	H	WONS, R
<i>Berberis darwinii</i>	Darwin's Berberry	H	
<i>Briza minor</i>	Shivery Grass	MH	
<i>Briza maxima</i>	Quaking Grass	MH	
<i>Buddleia variabilis</i>	Butterfly Bush	H	
<i>Callicotome spinosa</i>	Spiny broom	H	Noxious (RP)

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Scientific name	Common name	**Threat rating (Low, Medium, Medium High, High, Very high)	State classifications (where listed in a noxious weed category)
<i>Carduus tenuiflorus</i>	Slender Thistle		Noxious (RC)
<i>Castanea</i> spp.	Chestnut		
<i>Cestrum elegans</i>	Red Cestrum	VH	
<i>Chamaecytisus palmensis</i>	Tree Lucerne	VH	
<i>Chrysanthemoides monilifera</i> var <i>monilifera</i>	African Boneseed	H	Noxious (RC), WDNS
<i>Chrysanthemum maximum</i>	Shasta Daisy		
<i>Cirsium vulgare</i>	Spear thistle	MH	Noxious (RC)
<i>Clematis vitalba</i>	Old Man's Beard	VH	
<i>Conium maculatum</i>	Hemlock	MH	Noxious (RC)
<i>Coryza bonariensis</i>	Tall Fleabane		
<i>Coprosma repens</i>	Minor Bush	VH	
<i>Coprosma robusta</i>	Karamu	VH	
<i>Cordyline australis</i>	Cabbage Tree	H	
<i>Cornus capitata</i>	Evergreen Dogwood		
<i>Cortaderia selkiana</i>	Pampas Grass	H	
<i>Cotoneaster</i> spp.	Cotoneaster	VH	
<i>Crataegus monogyna</i>	Hawthorn	H	Noxious (RC)
<i>Crocosmia x crocosmiifolia</i>	Montbretia	VH	
<i>Cytisus palmensis</i>	Tree Lucerne		
<i>Cytisus scoparius</i>	English Broom	H	Noxious (RC)
<i>Cyperus eragrostis</i>	Drain Flat Sedge	M	
<i>Delairea odorata</i>	Cape Ivy	VH	
<i>Dipogon ligosus</i>	Common Dipogon (Dolichos Pea)	VH	
<i>Dodonea viscosa</i>	Sticky Hop Bush	L	
<i>Echium plantagineum</i>	Patersons Curse	H	Noxious (RC)
<i>Ehrharta erecta</i>	Panic Veldt Grass	VH	

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Scientific name	Common name	**Threat rating (Low, Medium, Medium High, High, Very high)	State classifications (where listed in a noxious weed category)
<i>Ehrharta longiflora</i>	Annual Veldt grass	VH	
<i>Erica beccaria</i>	Berry-flower Heath	VH	
<i>Erica lusitanica</i>	Spanish Heath	VH	
<i>Euryops abrotanifolius</i>	Euryops	H	
<i>Foeniculum vulgare</i>	Fennel	VH	R
<i>Fraxinus ornus</i>	Manna Ash	VH	
<i>Fraxinus angustifolia</i>	Desert Ash		
<i>Fraxinus oxycarpa</i>	Caucasian Ash	H	
<i>Gallium aparine</i>	Cleavers	H	
<i>Genista linifolia</i>	Flax Leaf Broom	VH	Noxious (RC)
<i>Genista monspessulana</i>	Cape/Montpellier Broom	VH	Noxious (RC)
<i>Glyceria maxima</i>	Red Sweet Grass	VH	
<i>Hakea salicifolia</i>	Willow Hakea	VH	
<i>Hakea suaveolens</i>	Sweet Hakea	M	
<i>Hedra helix</i>	English Ivy	VH	
<i>Holcus lanatus</i>	Yorkshire Fog	H	
<i>Hypericum androsaemum</i>	Tutsan	H	Noxious (RC)
<i>Hypericum perforatum</i>	St John's Wort	MH	Noxious (RC)
<i>Hypericum tetrapetrum</i>	St. Peter's Wort	MH	Noxious (RC)
<i>Ilex aquifolium</i>	Holly	VH	
<i>Ipomoea indica</i>	Blue Morning Glory	H	
<i>Juncus acutus</i>	Spiny Rush	M	Noxious (RC)
<i>Lathyrus latifolius</i>	Sweet Pea	L	
<i>Leptospermum laevigatum</i>	Coast Tea Tree	VH	
<i>Leycesteria Formosa</i>	Himalayan Honeysuckle	VH	
<i>Ligustrum vulgare</i>	European Privet	VH	
<i>Lonicera japonica</i>	Japanese Honeysuckle	VH	

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Scientific name	Common name	**Threat rating (Low, Medium, Medium High, High, Very high)	State classifications (where listed in a noxious weed category)
<i>Lythrum ferocissimum</i>	African Boxthorn	VH	Noxious (RC)
<i>Marrubium vulgare</i>	Horehound	H	Noxious (RC)
<i>Melaleuca armillaris</i>	Giant Honey Myrtle	VH	
<i>Melaleuca hypericifolia</i>	Honey Myrtle	H	
<i>Moraea floccida</i>	Cape Tulip	MH	Noxious (RC)
<i>Myosotis sylvatica</i>	Common Forget-me-not	M	
<i>Nassella trichotoma</i>	Serrated Tussock	VH	Noxious (RC)
<i>Oenothera stricta</i>	Common Evening Primrose	MH	
<i>Opuntia aurantiaca</i>	Prickly Pear	VH	
<i>Oxalis pes-caprae</i>	Soursoy	VH	R
<i>Portulaca oleracea</i>	Common Purslane		
<i>Paraserianthes lapantha</i>	Cape Wattle		
<i>Passiflora sp. aff. mollissima</i>	Banana Passionfruit	VH	
<i>Pentaglottis serpyllifera</i>	Alkanet		
<i>Phalaris aquatica</i>	Toowoomba Canary Grass	L	
<i>Phytolacca octandra</i>	Red Inkweed	H	
<i>Pinus radiata</i>	Monterey/Radiata Pine	VH	
<i>Pittosporum crassifolium</i>	Karo		
<i>Pittosporum undulatum</i>	Sweet Pittosporum	VH	
<i>Polygala myrtifolia</i>	Myrtle Leaf Milkwort	VH	
<i>Populus tremuloides</i>	American Aspen	H	
<i>Prunus cerasifera</i>	Cherry Plum	M	
<i>Prunus laurocerasus</i>	Cherry Laurel	H	
<i>Prunus lusitanica</i>	Portugal Laurel	VH	
<i>Psoralea pinnata</i>	Pinnate Scurf-Pea	H	
<i>Pyracantha spp.</i>	Firethorn	VH	
<i>Quercus robur</i> **	Oak		

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Scientific name	Common name	**Threat rating (Low, Medium, Medium High, High, Very high)	State classifications (where listed in a noxious weed category)
<i>Ranunculus repens</i>	Creeping Buttercup	VH	
<i>Rhamnus alaternus</i>	Italian Buckthorn		
<i>Ricinus communis</i>	Castor Oil Plant	M	
<i>Robinia pseudacacia</i>	Black Locust Tree	H	
<i>Romulea rosea</i> var <i>australis</i>	Onion Grass	M	
<i>Rosa rubiginosa</i>	Sweet Briar	H	Noxious (RC)
<i>Rubus fruticosus</i> spp. agg.	Blackberry	VH	Noxious (RC), WONS
<i>Salix babylonica</i>	Weeping Willow		
<i>Salix cinerea</i>	Willow	VH	WONS, R
<i>Scilla maritima</i>	Pampas Lily of the Valley	MH	Noxious (RC)
<i>Senecio madagascariensis</i>	African Fireweed	VH	R
<i>Senecio jacobaea</i>	Ragwort	MH	Noxious (RC)
<i>Solanum elaeagnifolium</i>	Silverleaf Nightshade	MH	Noxious (RP)
<i>Solanum elaeagnifolium</i>	Apple of Sodom	MH	Noxious (RC)
<i>Solanum mauritanium</i>	Tree Tobacco	MH	
<i>Solanum nigrum</i>	Black Nightshade	M	
<i>Solanum pseudocapsicum</i>	Madeira Winter Cherry	H	
<i>Solys heterophylla</i>	Blue-bell Creeper	VH	
<i>Spartina anglica</i>	Common Cord-grass		
<i>Tradescantia fluminensis</i>	Wandering Tradescantia	VH	
<i>Trapa solum majus</i>	Nasturtium	M	
<i>Ulex europaeus</i>	Gorse	H	Noxious (RC), WONS
<i>Ulmus procera</i>	English Elm	H	
<i>Verbascum thapsus</i>	Great Mullein	M	
<i>Viburnum tinus</i>	Laurestinus	L	
<i>Vinca major</i>	Blue Periwinkle	H	

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Scientific name	Common name	**Threat rating (Low, Medium, Medium High, High, Very high)	State classifications (where listed in a noxious weed category)
<i>Viola odorata</i>	Fragrant Violet	H	
<i>Viola riviniana</i>	Wood Violet		
<i>Watsonia borbonica</i>	Rosy Watsonia		
<i>Watsonia meriana</i> var. <i>bubalifera</i>	Bulb Watsonia	VH	Noxious (RC)
<i>Willow</i> spp	Willows	VH	
<i>Xanthium spinosum</i>	Bathurst Burr	M	Noxious (RC)
<i>Zantedeschia aethiopica</i>	White Arum Lily	VH	

Appendix C: EVC Lists

Department of
Sustainability and
Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Highlands – Southern Fall bioregion

EVC 16: Lowland Forest

Description:
Eucalypt forest to 25 m tall on relatively fertile, moderately well-drained soils in areas of relatively high rainfall. Characterised by the diversity of life forms and species in the understorey including a range of shrubs, grasses and herbs.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	70 on	20 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
30%	<i>Eucalyptus oblique</i>	Massmate Stringybark
	<i>Eucalyptus radiata</i> s.l.	Narrow-leaf Peppermint
	<i>Eucalyptus sieberi</i>	Silvertop Ash
	<i>Eucalyptus divers</i>	Broad-leaved Peppermint


Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	2	10%	T
Medium Shrub	9	30%	MS
Small Shrub	3	5%	SS
Prostrate Shrub	2	1%	PS
Large Herb	2	1%	LH
Medium Herb	5	10%	MH
Small or Prostrate Herb	2	1%	SH
Large Tufted Graminoid	2	5%	LTG
Large Non-tufted Graminoid	2	10%	LNG
Medium to Small Tufted Graminoid	4	10%	MTG
Medium to Tiny Non-tufted Graminoid	1	1%	MNG
Ground Fern	2	10%	GF
Scrambler or Climber	2	1%	SC
Bryophytes/Lichens	na	10%	BL

LF Code **Species typical of at least part of EVC range** **Common Name**

MS	<i>Epacris impressa</i>	Common Heath
MS	<i>Leprospermum continentale</i>	Prickly Tea-tree
MS	<i>Rubus odoratus</i>	Golden Bush-rose
MS	<i>Acacia mucronata</i> ssp. <i>longifolia</i>	Narrow-leaf Wattle
SS	<i>Antiplexis sphaeroloba</i> var. <i>sphaeroloba</i>	Broom Spurge
SS	<i>Lomatia laticarpa</i>	Holly Lomatia
PS	<i>Acrotriche prostrata</i>	Trailing Ground-berry
NH	<i>Gonolobus tetragynus</i>	Common Raspwort
NH	<i>Viola hederacea</i> var. <i>Willisii</i> (1972)	Ivy-leaf Violet
SH	<i>Goodenia laevata</i>	Trailing Goodenia
LTG	<i>Xanthorrhoea minor</i> ssp. <i>lutea</i>	Small Grass-tree
LTG	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
LNG	<i>Galina radula</i>	Thatch Saw-sedge
LNG	<i>Tetrarrhena juncea</i>	Forest Wire-grass
MTG	<i>Juncus pallidus</i>	Silvertop Wallaby-grass
MTG	<i>Poa australis</i> ssp. <i>agilis</i>	Tussock Grass
MTG	<i>Lomandra filiformis</i>	Wattle Mat-rush
MTG	<i>Lepidosperma laterale</i>	Variable Sword-sedge
MTG	<i>Dianella revoluta</i> s.l.	Black-anther Flax-lily
MNG	<i>Microseris stipoides</i> var. <i>stipoides</i>	Weeping Grass
GF	<i>Pteridium esculentum</i>	Austral Bracken
GF	<i>Lindsaea linearis</i>	Screw Fern
SC	<i>Blechnum scandens</i>	Common Apple-berry

Ecological Vegetation Class bioregion benchmark.



EVC 16: Lowland Forest Highlands – Southern Fall bioregion

Recruitment:
Continuous

Organic Litter:
40 % cover

Logs:
20 m/D.I. ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
HH	<i>Hypochaeris radicata</i>	Cot's Ear	high	low

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Cardinia Shire Council Zone 4 - Heathy woodland complex

Trees

-
- Acacia dealbata|Silver Wattle
 - Acacia implexa|Lightwood, Hickory Wattle
 - Acacia mearnsii|Black Wattle
 - Acacia melanoxylon|Blackwood
 - Allocasuarina littoralis|Black Sheoak
 - Eucalyptus baxteri|Brown Stringybark
 - Eucalyptus cephalocarpa|Silver-leaf or Mealy Stringybark
 - Eucalyptus cypellocarpa|Mountain Grey Gum
 - Eucalyptus dives|Broad-leaf Peppermint
 - Eucalyptus fulgens|Green Scentbark
 - Eucalyptus gonicalyx|Long-leaf Box, Bundy
 - Eucalyptus obliqua|Messmate
 - Eucalyptus ovata var. ovata|Swamp Gum
 - Eucalyptus radiata ssp. radiata|Narrow-leaf Peppermint
 - Eucalyptus viminalis ssp. viminalis|Manna or Ribbon Gum
 - Eucalyptus viminalis subsp. Pryoriana|Gippsland Manna Gum
 - Hedycarya angustifolia|Austral or Native Mulberry, Djelwuck
 - Pittosporum bicolor|Banyalla
 - Pomaderris aspera|Hazel Pomaderris
 - Prostanthera lasianthos var. lasianthos|Victorian Christmas Bush
 - Rapanea howittiana|Muttonwood
-

Shrubs

-
- Acacia brownii|Heath Wattle
 - Acacia genistifolia|Spreading Wattle
 - Acacia myrtifolia|Myrtle Wattle
 - Acacia oxycedrus|Spike Wattle
 - Acacia paradoxa|Hedge Wattle, Kangaroo Thorn
 - Acacia stricta|Hop Wattle
 - Acacia suaveolens|Sweet Wattle
 - Acacia verticillata|Prickly Moses
 - Allocasuarina paludosa|Scrub or Swamp Sheoak
 - Amperea xiphoclada|Broom Spurge
 - Banksia marginata|Silver Banksia, Warrock
 - Banksia spinulosa var. cunninghamii|Hairpin Banksia
 - Bauera rubioides|Wiry Bauera, River or Dog Rose
 - Bedfordia arborescens|Blanket-leaf
 - Bossiaea cinerea|Showy Bossiaea
 - Bursaria spinosa ssp. spinosa|Sweet Bursaria, Kurwan, Tupy
 - Cassinia aculeata|Common Cassinia
 - Cassinia arcuata|Drooping Cassinia, Chinese Scrub
 - Coprosma quadrifida|Prickly Currant-bush
 - Correa reflexa var. reflexa|Common Correa, Native Fuchsia
 - Daviesia latifolia|Hop Bitter-pea
 - Dillwynia glaberrima|Smooth or Heath Parrot-pea
 - Dodonaea viscosa susp. spatulata|Sticky Hop-bush
-

- [Epacris impressa](#)|Common Heath
- [Gompholobium huegelii](#)|Common Wedge-pea, Karalla
- [Goodenia ovata](#)|Hop Goodenia
- [Goodia lotifolia var. pubescens](#)|Golden Tip
- [Hakea decurrens](#)|Bushy Needlewood
- [Hakea nodosa](#)|Yellow Hakea
- [Hakea ulicina](#)|Furze Hakea
- [Hibbertia riparia](#)|Erect Guinea-flower
- [Indigofera australis](#)|Austral Indigo
- [Kunzea ericoides](#)|Burgan
- [Leptospermum continentale](#)|Prickly Tea-tree
- [Leptospermum lanigerum](#)|Woolly Tea-tree
- [Leptospermum myrsinoides](#)|Heath or Silky Tea-tree
- [Lomatia myricoides](#)|River or Long-leaf Lomatia
- [Melaleuca ericifolia](#)|Swamp Paperbark
- [Melaleuca squarrosa](#)|Scented Paperbark
- [Olearia argophylla](#)|Musk Daisy-bush
- [Olearia lirata](#)|Snowy Daisy-bush
- [Olearia ramulosa var. ramulosa](#)|Twiggy Daisy-bush
- [Ozothamnus ferrugineus](#)|Tree Everlasting
- [Pimelea axiflora ssp. axiflora](#)|Bootlace Bush
- [Pimelea humilis](#)|Common Rice-flower
- [Platylobium formosum](#)|Handsome Flat-pea
- [Polyscias sambucifolia ssp. 3](#)|Elderberry Panax
- [Pultenaea gunnii ssp. gunnii](#)|Golden Bush-pea
- [Pultenaea hispidula](#)|Rusty Bush-pea
- [Pultenaea scabra](#)|Rough Bush-pea
- [Solanum laciniatum](#)|Large Kangaroo-apple
- [Spyridium parvifolium](#)|Dusty Miller
- [Tetradlea ciliata](#)|Pink-bells
- [Viminaria juncea](#)|Native Broom, Golden Spray

Grasses, sedges and rushes

- [Amphibromus nervosus](#)|Common Swamp Wallaby-grass
- [Austrodanthonia geniculata](#)|Knead Wallaby-grass
- [Austrodanthonia setacea](#)|Small-flowered or Bristly Wallaby-grass
- [Baloskion tetraphyllum ssp. tetraphyllum](#)|Tassel Cord-rush
- [Carex appressa](#)|Tall Sedge
- [Eleocharis acuta](#)|Common Spike-rush
- [Eleocharis sphacelata](#)|Tall Spike-rush
- [Ficinia nodosa](#)|Knobby Club-sedge
- [Gahnia sieberiana](#)|Red-fruit Saw-sedge
- [Juncus pallidus](#)|Pale Rush
- [Lomandra filiformis ssp. coriacea](#)|Wattle Mat-rush
- [Lomandra longifolia subsp. longifolia](#)|Spiny-headed Mat-rush, Karawun
- [Microlaena stipoides var. stipoides](#)|Weeping Grass
- [Poa ensiformis](#)|Purple-sheath or Sword Tussock-grass
- [Poa labillardierei var. labillardierei](#)|Common Tussock-grass
- [Poa morrisii](#)|Velvet Tussock-grass
- [Poa sieberiana var. sieberiana](#)|Grey Tussock Grass
- [Themeda triandra](#)|Kangaroo Grass

- Xanthorrhoea minor ssp. lutea|Small Grass-tree, Toolimerin

Climbers

- Billardiera scandens var. scandens|Common Apple-berry, Apple Dumpling
- Clematis aristata|Mountain or Austral Clematis, Old Man's Beard
- Clematis microphylla|Small-leaved Clematis, Kenam
- Comesperma volubile|Love Creeper
- Glycine clandestina|Twining Glycine
- Hardenbergia violacea|Purple Coral-pea
- Pandorea pandorana|Wonga Vine
- Rubus parvifolius|Small-leaf Bramble, Native Raspberry

Ferns

- Adiantum aethiopicum|Common Maidenhair

Ground covers and climbers

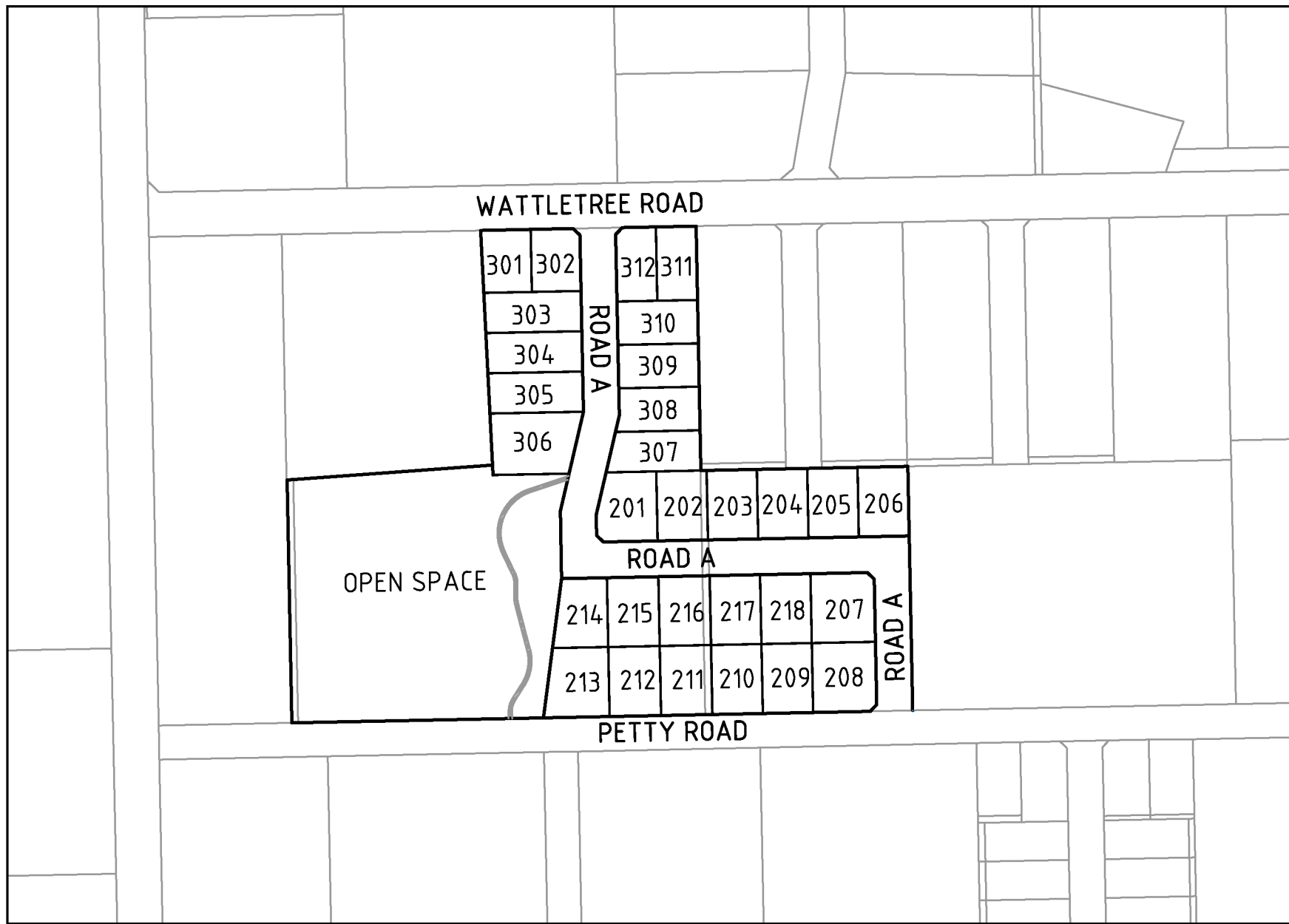
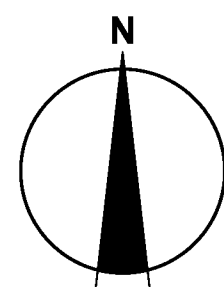
- Acaena novae-zelandiae|Bidgee-widgee
- Ajuga australis|Austral Bugle
- Arthropodium strictum|Chocolate Lily
- Brachyscome multifida|Cut-leaf Daisy
- Brunonia australis|Blue Pincushion
- Bulbine bulbosa|Bulbine Lily
- Burchardia umbellata|Milkmaids
- Dianella longifolia var. longifolia|Pale Flax-lily
- Dianella revoluta|Black-anther or Spreading Flax-lily
- Dianella tasmanica|Tasman Flax-lily
- Dichondra repens|Kidney-weed
- Diplarrena moraea|Butterfly Flag
- Geranium solanderi|Austral Crane's-bill
- Helichrysum scorpioides|Button Everlasting
- Hovea linearis|Common Hovea
- Kennedia prostrata|Running Postman
- Lythrum hyssopifolia|Lesser or Small Loosestrife
- Patersonia occidentalis|Long Purple-flag
- Platylobium obtusangulum|Common Flat-pea
- Stackhousia monogyna|Creamy Stackhousia
- Stylidium armeria|Grass Trigger-plant
- Thelymitra media|Tall Sun-orchid
- Thysanotus tuberosus ssp. tuberosus|Common Fringe-lily
- Viola hederacea|Ivy-leaf or Native Violet
- Wahlenbergia stricta|Tall Bluebell
- Wurmbea dioica ssp. dioica|Early Nancy

https://www.cardinia.vic.gov.au/directory/9/cardinia_indigenous_plant_guide/category/40

8 WATTLETREE ROAD, BUNYIP

FUNCTIONAL LAYOUT PLAN - ALL STAGES

CARDINIA SHIRE COUNCIL



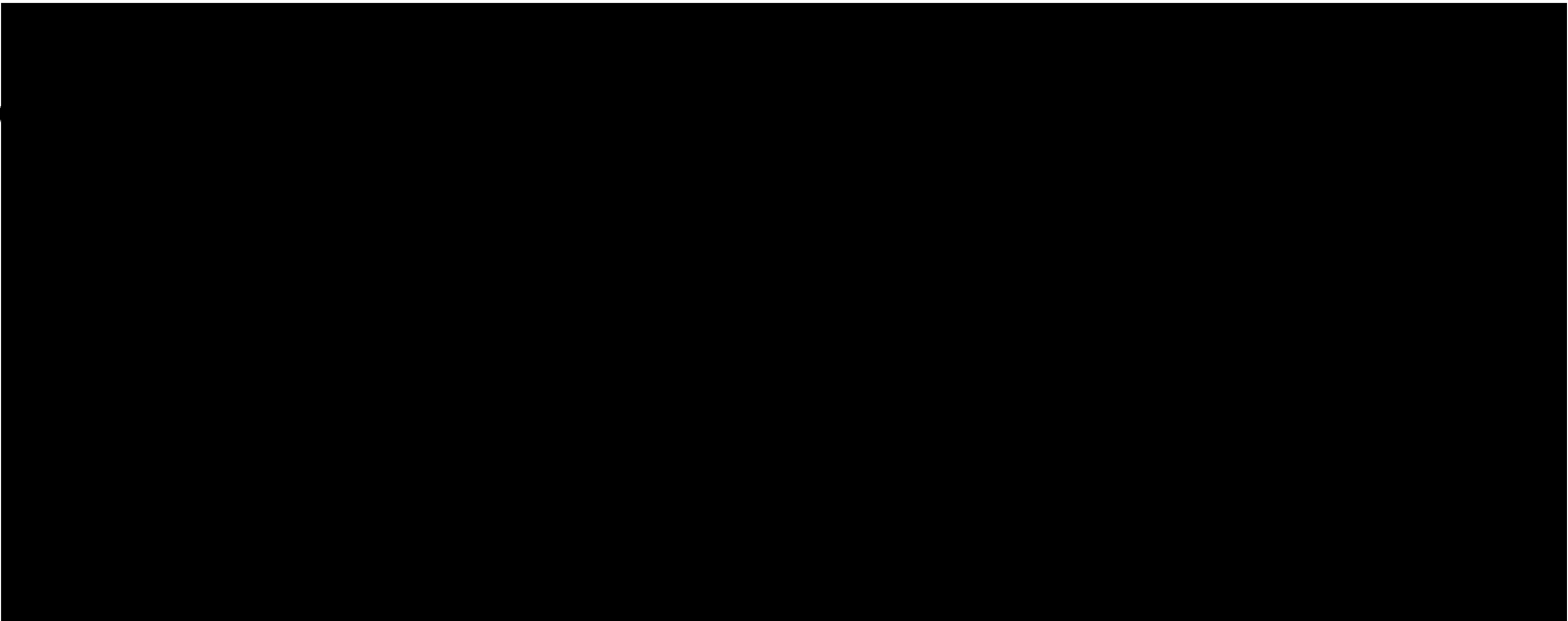
LOCALITY PLAN
VIC ROADS REF: 718 F10

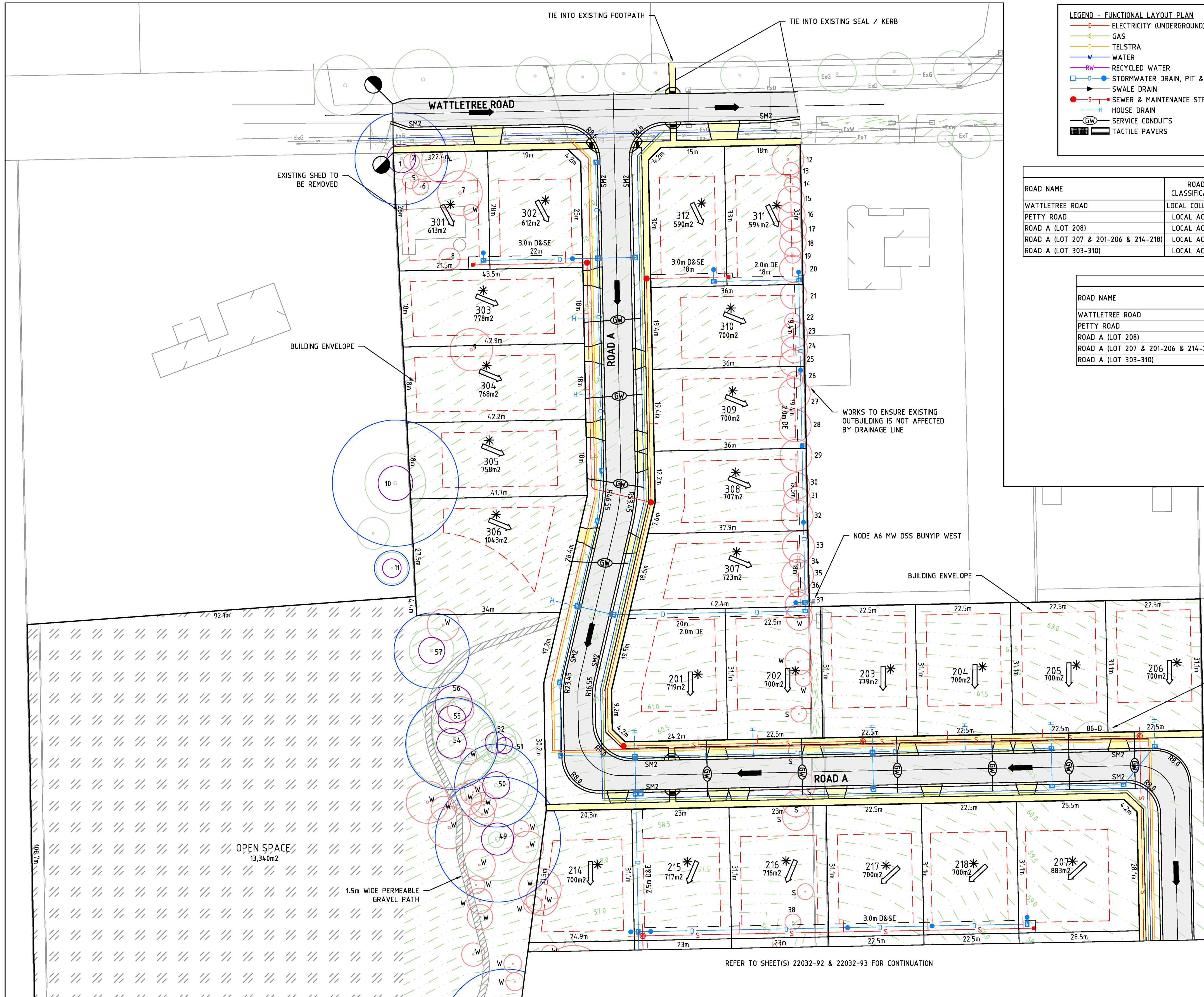
Drawing Index

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- 22032- 93 ULTIMATE LAYOUT PLAN - SHEET 2 OF 2
- 22032- 94 TYPICAL CROSS SECTIONS
- 22032- 95 SWEPT PATH DIAGRAMS

Principal

Neil Pascoe C/- Nobelius Land Surveyors Pty
PO Box 461
Pakenham, VIC, 3810





LEGEND - FUNCTIONAL LAYOUT PLAN

- E— EXISTING ELECTRICITY (UNDERGROUND)
- O/H E— EXISTING ELECTRICITY (OVERHEAD)
- G— EXISTING GAS
- T— EXISTING TELSTRA
- W— EXISTING WATER
- RW— EXISTING RECYCLED WATER
- S— EXISTING STORMWATER DRAIN, PIT & PROPERTY INLET
- SD— EXISTING SWALE DRAIN
- S— EXISTING SEWER
- H— EXISTING HOUSE DRAIN
- S— EXISTING SERVICE CONDUITS
- T— EXISTING TACTILE PAVERS
- Ex E— EXISTING ELECTRICITY (UNDERGROUND)
- O/H Ex E— EXISTING ELECTRICITY (OVERHEAD)
- Ex G— EXISTING GAS
- Ex T— EXISTING TELSTRA
- Ex W— EXISTING WATER
- Ex RW— EXISTING RECYCLED WATER
- Ex S— EXISTING STORMWATER DRAIN
- Ex SD— EXISTING SWALE DRAIN
- Ex S— EXISTING SEWER
- Ex H— EXISTING HOUSE DRAIN
- Ex S— EXISTING SERVICE CONDUITS
- T— EXISTING TACTILE PAVERS
- P— PAVEMENT TREATMENT
- D— DIRECTION OF FLOW
- O— OVERLAND FLOW
- A— ALLOTMENT TO BE GRADED EVENLY IN
- L— DIRECTION OF FALL TO LEVELS INDICATED
- C— CONCRETE EDGE STRIP WITH SUBSOIL DRAIN,
- N— "NO ROAD" SIGN & BARRIER
- L— LIMIT OF WORKS
- Ex RM— EXISTING TREE TO BE REMOVED
- T— TREE PROTECTION ZONE
- S— STRUCTURAL ROOT ZONE

ROAD NAME	ROAD CLASSIFICATION	RESERVE WIDTH (m)	ROAD WIDTH (m)			KERB TYPE		VERGE WIDTH (m)	
			LIP to LIP	INV to INV	BACK to BACK	NTH/WEST	STH/EAST	NTH/WEST	STH/EAST
WATTLE TREE ROAD	LOCAL COLLECTOR	20.00	6.40	7.00	7.60	SM2	SM2	VARIES	VARIES
PETTY ROAD	LOCAL ACCESS	15.20	4.90	5.50	6.10	SM2	-	VARIES	VARIES
ROAD A (LOT 208)	LOCAL ACCESS	16.00	6.90	7.50	7.95	SM2	B2	4.95	3.00
ROAD A (LOT 207 & 201-206 & 214-218)	LOCAL ACCESS	16.00	6.90	7.50	8.10	SM2	SM2	3.95	3.95
ROAD A (LOT 303-310)	LOCAL ACCESS	16.00	6.90	7.50	8.10	SM2	SM2	3.95	3.95

ROAD NAME	SIDE	GAS		WATER		ELECTRICITY		TELSTRA	
		OFFSET (m)	DEPTH (m)	OFFSET (m)	DEPTH (m)	OFFSET (m)	DEPTH (m)	OFFSET (m)	DEPTH (m)
WATTLE TREE ROAD	SOUTH	4.00	3.50	SOUTH	3.50	SOUTH	2.70	SOUTH	1.85
PETTY ROAD	SOUTH	3.00	1.50	SOUTH	1.50	NORTH/SOUTH	2.10	NORTH	1.50
ROAD A (LOT 208)	WEST	2.10	2.60	WEST	2.60	WEST	3.70	WEST	3.20
ROAD A (LOT 207 & 201-206 & 214-218)	SOUTH	2.10	2.60	SOUTH	2.60	NORTH	2.30	NORTH	1.80
ROAD A (LOT 303-310)	EAST	2.10	2.60	EAST	2.60	WEST	2.30	WEST	1.80

'##' - TREE ID NUMBER
'W' - WEED SPECIES
'S' - PLANTED SHRUB SPECIES

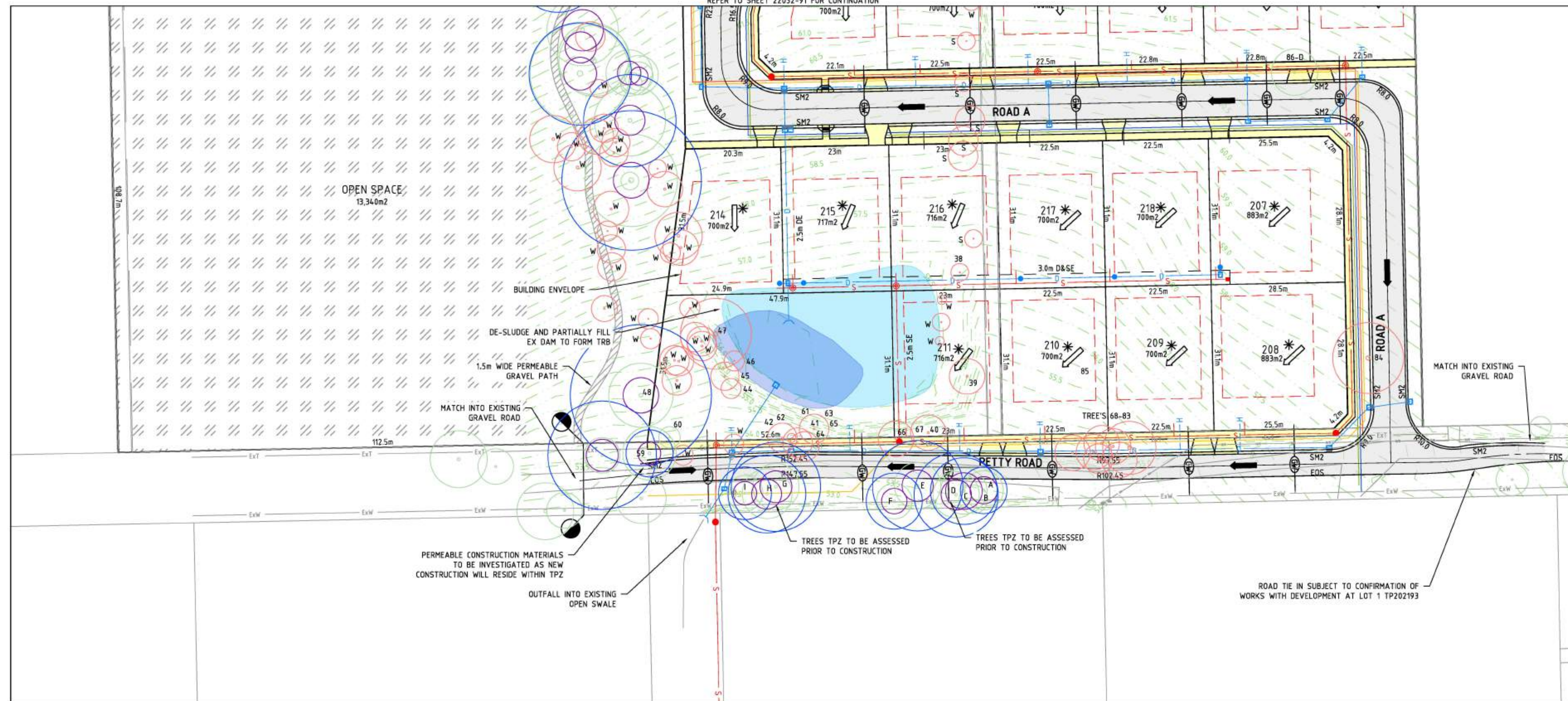
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REFER TO SHEET(S) 22032-92 & 22032-93 FOR CONTINUATION

I	AMENDED AS PER CONCEPT PLAN VER 14	15.08.25	AC/AC	NG	Principal Neil Pascoe C/- Nobellus Land Surveyors Pty Ltd PO Box 461 Pakenham, VIC, 3810	Designed A.Cantwell Drawn A.Cantwell Checked N.Green Authorised K.Taylor Date February 2023
H	AMENDED TO SHOW TREE IDS AS PER CONCEPT PLAN VER 10	14.05.25	AC/AC	NG		
G	AMENDED IN LINE WITH CONCEPT PLAN VER 10	12.05.25	AC/AC	NG		
F	AMENDED IN LINE WITH CONCEPT PLAN VER 9	04.03.25	AC/AC	NG		
E	AMENDED IN LINE WITH CONCEPT PLAN VER 6	09.09.24	AC/AC	NG		
D	AMENDED DRIVEWAY AS PER COUNCIL RFI DATED 25/07/2023	16.08.23	AC/AC	KT		
C	AMENDED ROAD A ALIGNMENT	19.06.23	AC/AC	KT	Coords: MGA Levels: AHD	© Taylor Miller Pty Ltd These designs and drawings are the copyright of Taylor Miller Pty Ltd. The drawing shall not be reproduced or copied, in whole or part, without the written permission of Taylor Miller Pty Ltd. The contents of this drawing are electronically generated, are confidential and may only be used for the purpose for which they were intended.
B	AMENDED AS PER CLIENT COMMENTS	27.04.23	AC/AC	KT		
A	INITIAL ISSUE	10.02.23	AC/AC	KT		
REVISION	DATE	DES/DT	APPD			

REFER ADJACENT FOR CONTINUATION

REFER TO SHEET 22032-91 FOR CONTINUATION



REFER ADJACENT FOR CONTINUATION

54 PETTY ROAD

45 PETTY ROAD

CONNECT TO EXISTING SEWER

LEGEND - FUNCTIONAL LAYOUT PLAN

- EXISTING ELECTRICITY (UNDERGROUND)
- EXISTING ELECTRICITY (OVERHEAD)
- EXISTING GAS
- EXISTING TELSTRA
- EXISTING WATER
- EXISTING RECYCLED WATER
- EXISTING STORMWATER DRAIN, PIT & PROPERTY INLET
- EXISTING SWALE DRAIN
- EXISTING SEWER & MAINTENANCE STRUCTURES
- EXISTING HOUSE DRAIN
- EXISTING SERVICE CONDUITS
- TACTILE PAVERS
- EXISTING WATER
- EXISTING RECYCLED WATER
- EXISTING STORMWATER DRAIN
- EXISTING SEWER
- EXISTING HOUSE DRAIN
- EXISTING SWALE DRAIN
- ZERO LOT LINES
- PAVEMENT TREATMENT
- DIRECTION OF FALL
- OVERLAND FLOW
- ALLOTMENT TO BE GRADED EVENLY IN DIRECTION OF FALL TO LEVELS INDICATED
- CONCRETE EDGE STRIP WITH SUBSOIL DRAIN, "NO ROAD" SIGN & BARRIER
- LIMIT OF WORKS
- EXISTING TREE TO BE REMOVED
- EXISTING SEWER RISING MAIN
- TREE PROTECTION ZONE
- STRUCTURAL ROOT ZONE

ROAD LAYOUT TABLE									
ROAD NAME	ROAD CLASSIFICATION	RESERVE WIDTH (m)	ROAD WIDTH (m)			KERB TYPE		VERGE WIDTH (m)	
			LIP to LIP	INV to INV	BACK to BACK	NTH/WEST	STH/EAST	NTH/WEST	STH/EAST
WATTLETREE ROAD	LOCAL COLLECTOR	20.00	6.40	7.00	7.60	-	SM2	VARIES	VARIES
PETTY ROAD	LOCAL ACCESS	15.20	4.90	5.50	6.10	SM2	-	VARIES	VARIES
ROAD A (LOT 208)	LOCAL ACCESS	16.00	6.90	7.50	7.95	SM2	B2	4.95	3.00
ROAD A (LOT 207 & 201-206 & 214-218)	LOCAL ACCESS	16.00	6.90	7.50	8.10	SM2	SM2	3.95	3.95
ROAD A (LOT 303-310)	LOCAL ACCESS	16.00	6.90	7.50	8.10	SM2	SM2	3.95	3.95

ROAD NAME	SIDE	GAS		WATER		ELECTRICITY		TELSTRA	
		OFFSET (m)	DEPTH (m)	OFFSET (m)	DEPTH (m)	OFFSET (m)	DEPTH (m)	OFFSET (m)	DEPTH (m)
WATTLETREE ROAD	SOUTH	4.00	0.75	3.50	0.75	2.70	0.75	1.85	0.75

WARNING
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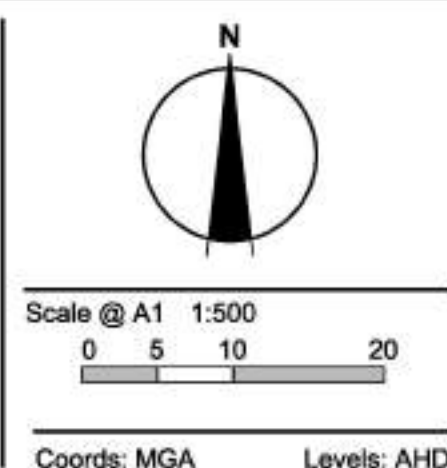
'##' - TREE ID NUMBER
'W' - WEED SPECIES
'S' - PLANTED SHRUB SPECIES

I:\work\22032-1 - B Wattletree road\22032-1.dwg (22032-1)

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REVISION		DATE	DESIGN	APPRO

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Pakenham, VIC, 3810

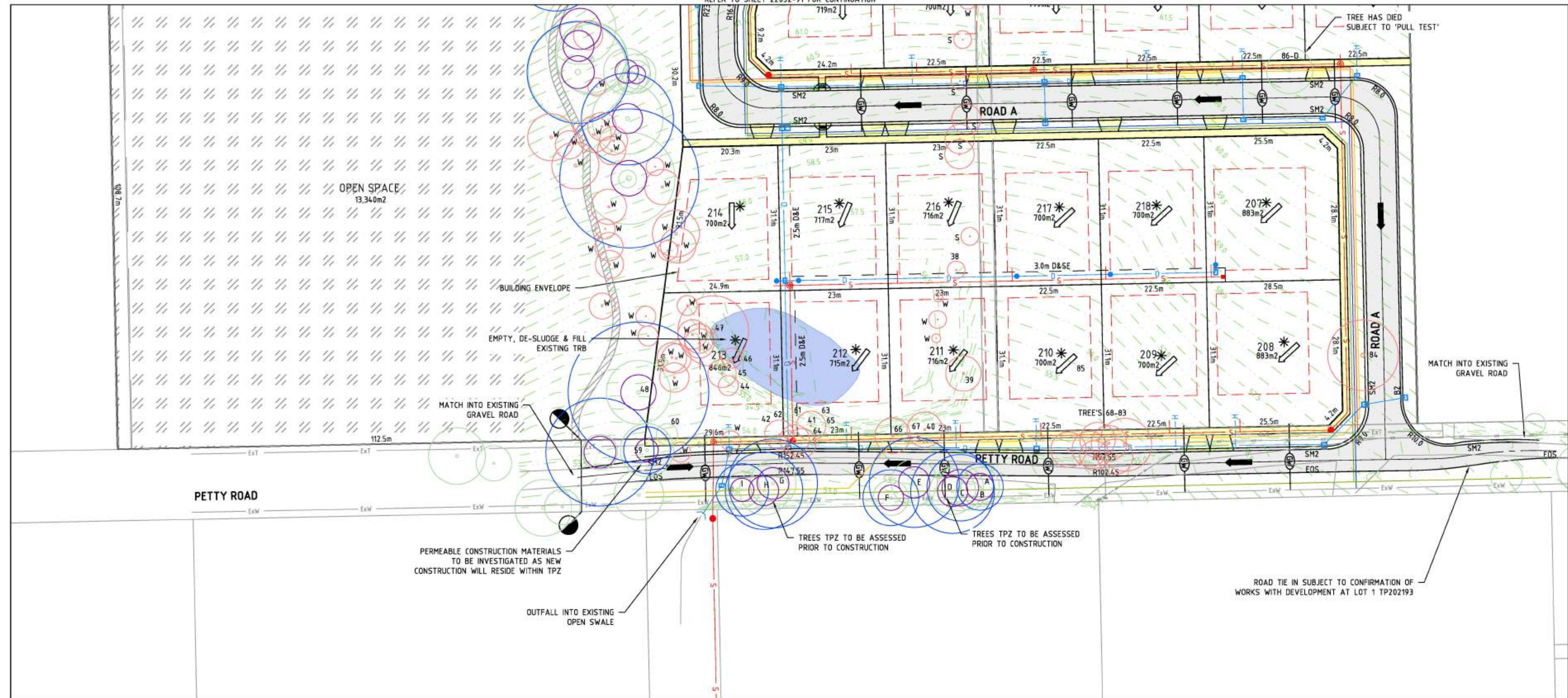
Designed
A.Cantwell
Drawn
A.Cantwell
Checked
N.Green
Authorised
K.Taylor
Date
February 2023



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REFER ADJACENT FOR CONTINUATION

REFER TO SHEET 22032-91 FOR CONTINUATION



PETTY ROAD

ROAD A

ROAD A

54 PETTY ROAD

45 PETTY ROAD

REFER ADJACENT FOR CONTINUATION

LEGEND - FUNCTIONAL LAYOUT PLAN									
—E—	ELECTRICITY (UNDERGROUND)	—E—	EXISTING ELECTRICITY (UNDERGROUND)	—P—	PAVEMENT TREATMENT	—	DIRECTION OF FALL	—	OVERLAND FLOW
—G—	GAS	—O/H E—	EXISTING ELECTRICITY (OVERHEAD)	—*	ALLOTMENT TO BE GRADED EVENLY IN	—	DIRECTION OF FALL TO LEVELS INDICATED	—	CONCRETE EDGE STRIP WITH SUBSOIL DRAIN
—T—	TELSTRA	—Ex G—	EXISTING GAS	—	"NO ROAD" SIGN & BARRIER	—	LIMIT OF WORKS	—	EXISTING TREE TO BE REMOVED
—W—	WATER	—Ex T—	EXISTING TELSTRA	—	EXISTING SEWER	—	EXISTING SEWER RISING MAIN	—	TREE PROTECTION ZONE
—RW—	RECYCLED WATER	—Ex W—	EXISTING WATER	—	EXISTING SWALE DRAIN	—	STRUCTURAL ROOT ZONE	—	
—D—	STORMWATER DRAIN, PIT & PROPERTY INLET	—Ex RW—	EXISTING RECYCLED WATER	—	EXISTING SWALE DRAIN	—		—	
—S—	SEWER & MAINTENANCE STRUCTURES	—Ex D—	EXISTING STORMWATER DRAIN	—	EXISTING SWALE DRAIN	—		—	
—H—	HOUSE DRAIN	—Ex S—	EXISTING SEWER	—	EXISTING SWALE DRAIN	—		—	
—GW—	SERVICE CONDUITS	—Ex H—	EXISTING HOUSE DRAIN	—	EXISTING SWALE DRAIN	—		—	
—P—	TACTILE PAVERS	—Ex GW—	EXISTING SERVICE CONDUITS	—	EXISTING SWALE DRAIN	—		—	
—		—	EXISTING TACTILE PAVERS	—	EXISTING SWALE DRAIN	—		—	
—		—	EXISTING TACTILE PAVERS	—	EXISTING SWALE DRAIN	—		—	

ROAD NAME	ROAD CLASSIFICATION	RESERVE WIDTH (m)	ROAD WIDTH (m)				KERB TYPE		VERGE WIDTH (m)	
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ROAD A (LOT 303-310)	LOCAL ACCESS	16.00	6.90	7.50	8.10		SM2	SM2	3.95	3.95

ROAD NAME	GAS		WATER		ELECTRICITY		TELSTRA	
	SIDE	OFFSET (m)	SIDE	OFFSET (m)	SIDE	OFFSET (m)	SIDE	OFFSET (m)
WATTLETREE ROAD	SOUTH	4.00	SOUTH	3.50	SOUTH	2.70	SOUTH	1.85
PETTY ROAD	SOUTH	3.00	SOUTH	1.50	NORTH/SOUTH	2.10	NORTH	1.50

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INTERIM TO ULTIMATE ARRANGEMENT
1. EMPTY, DE-SLUDGE AND BACKFILL EXISTING TRB
2. CONNECT DRAINAGE FROM SIDE EASEMENT INTO PETTY ROAD

'##' - TREE ID NUMBER
'W' - WEED SPECIES
'S' - PLANTED SHRUB SPECIES

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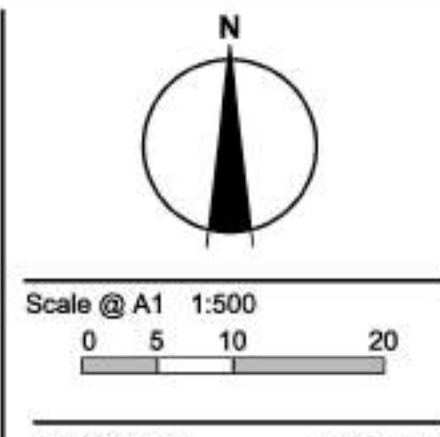
Designed
A.Cantwell

Drawn
A.Cantwell

Checked
N.Green

Authorised
K.Taylor

Date
February 2023



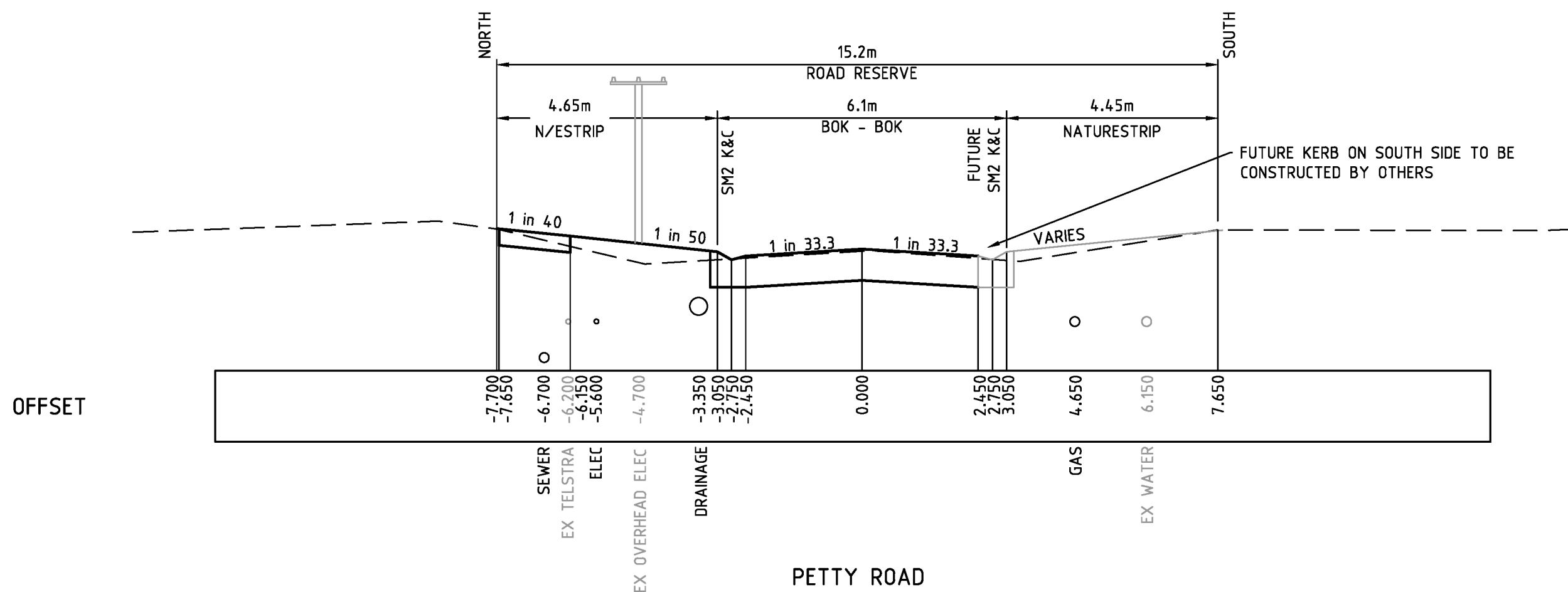
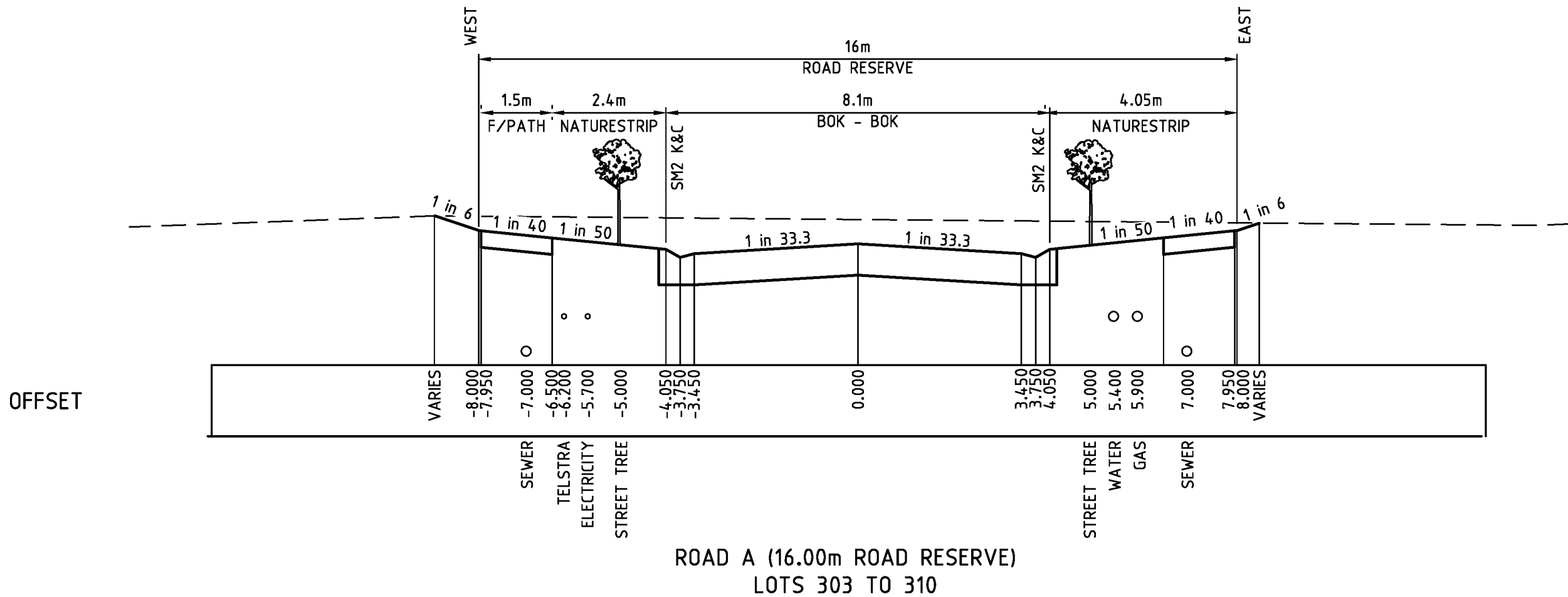
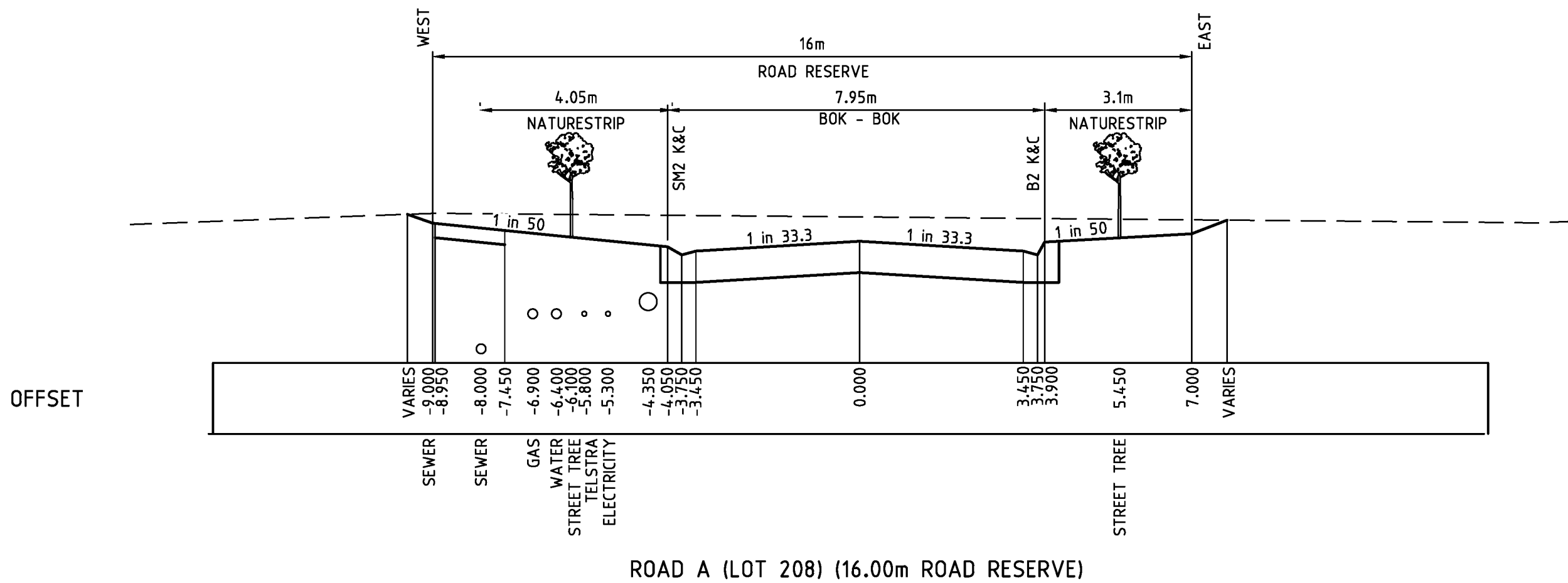
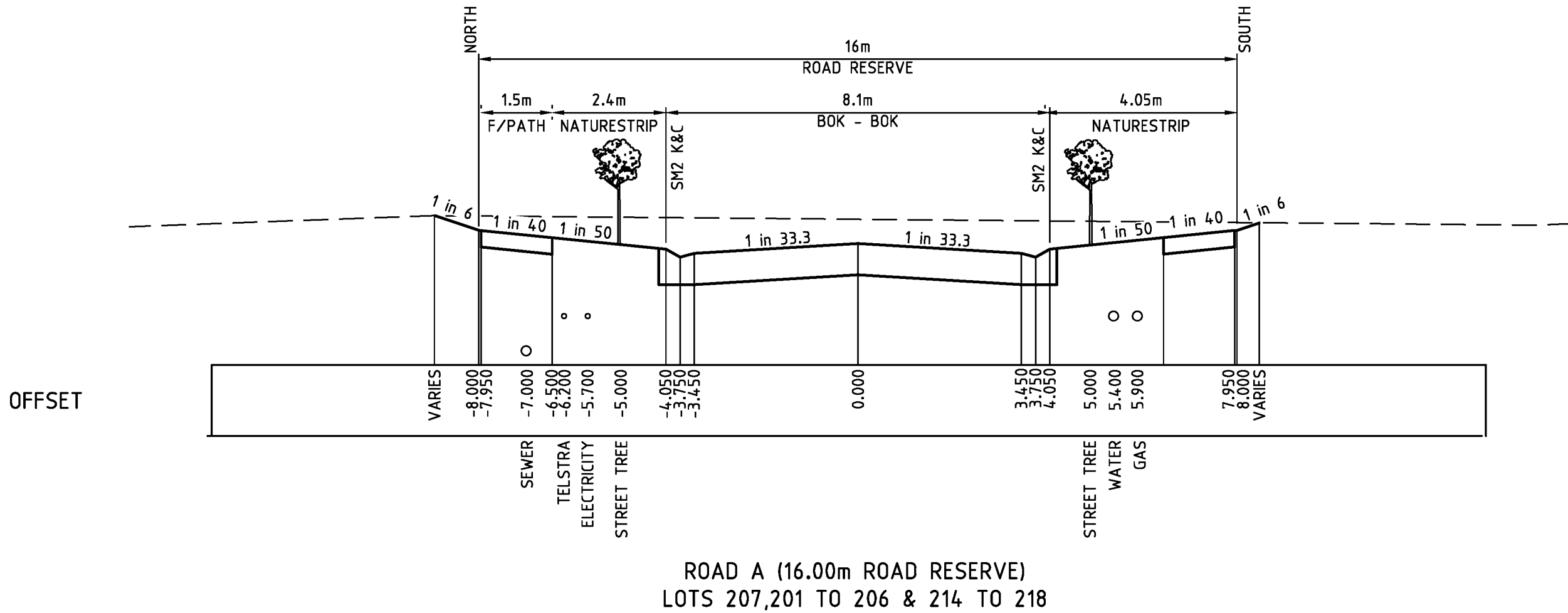
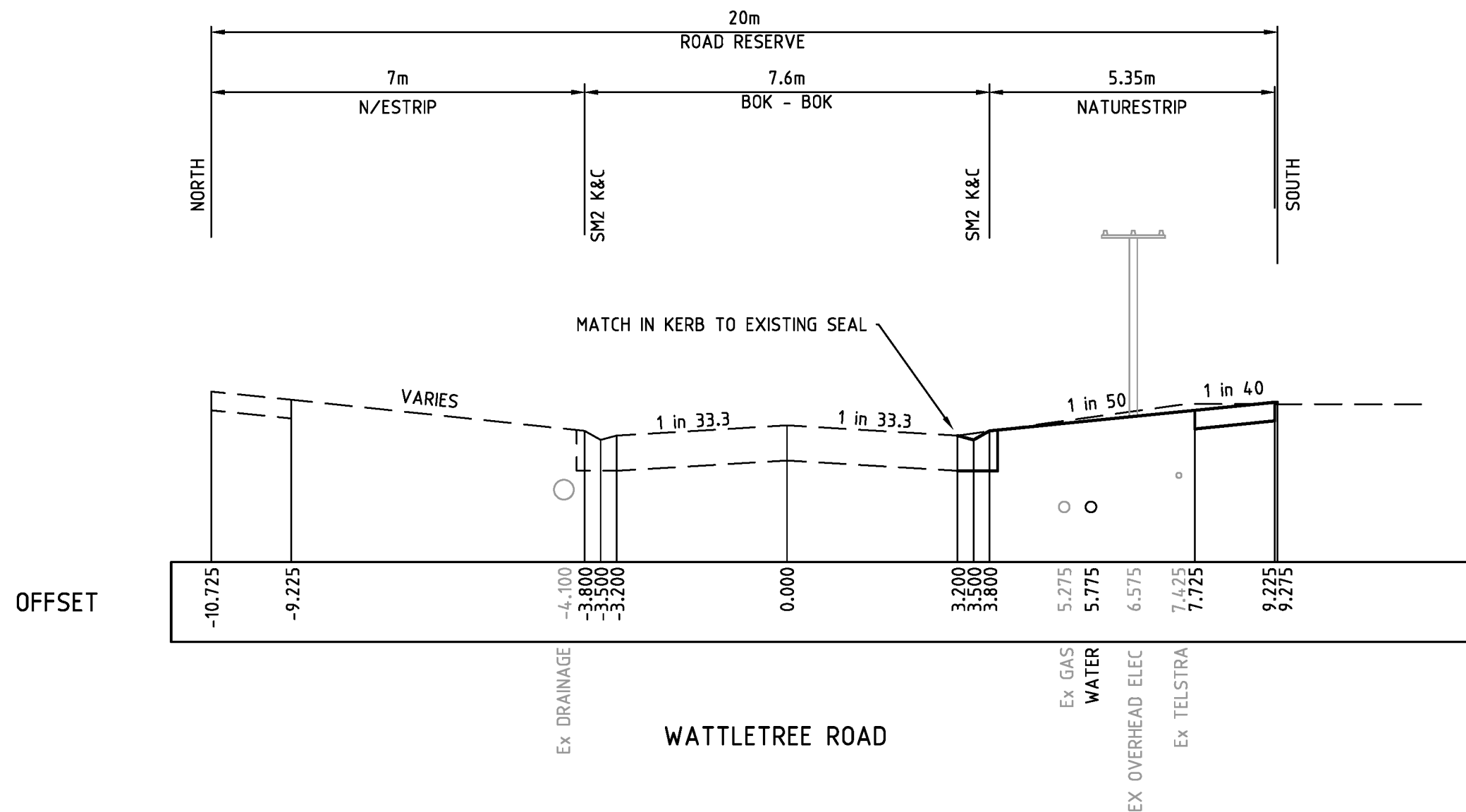
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STRUCTURAL FILL REQUIRED UNDER
PAVEMENT AND FOOTPATHS WHERE
CONSTRUCTED ABOVE EXISTING SURFACE

LEGEND
— EXISTING SURFACE
— DESIGN LINE
--- FUTURE DESIGN LINE

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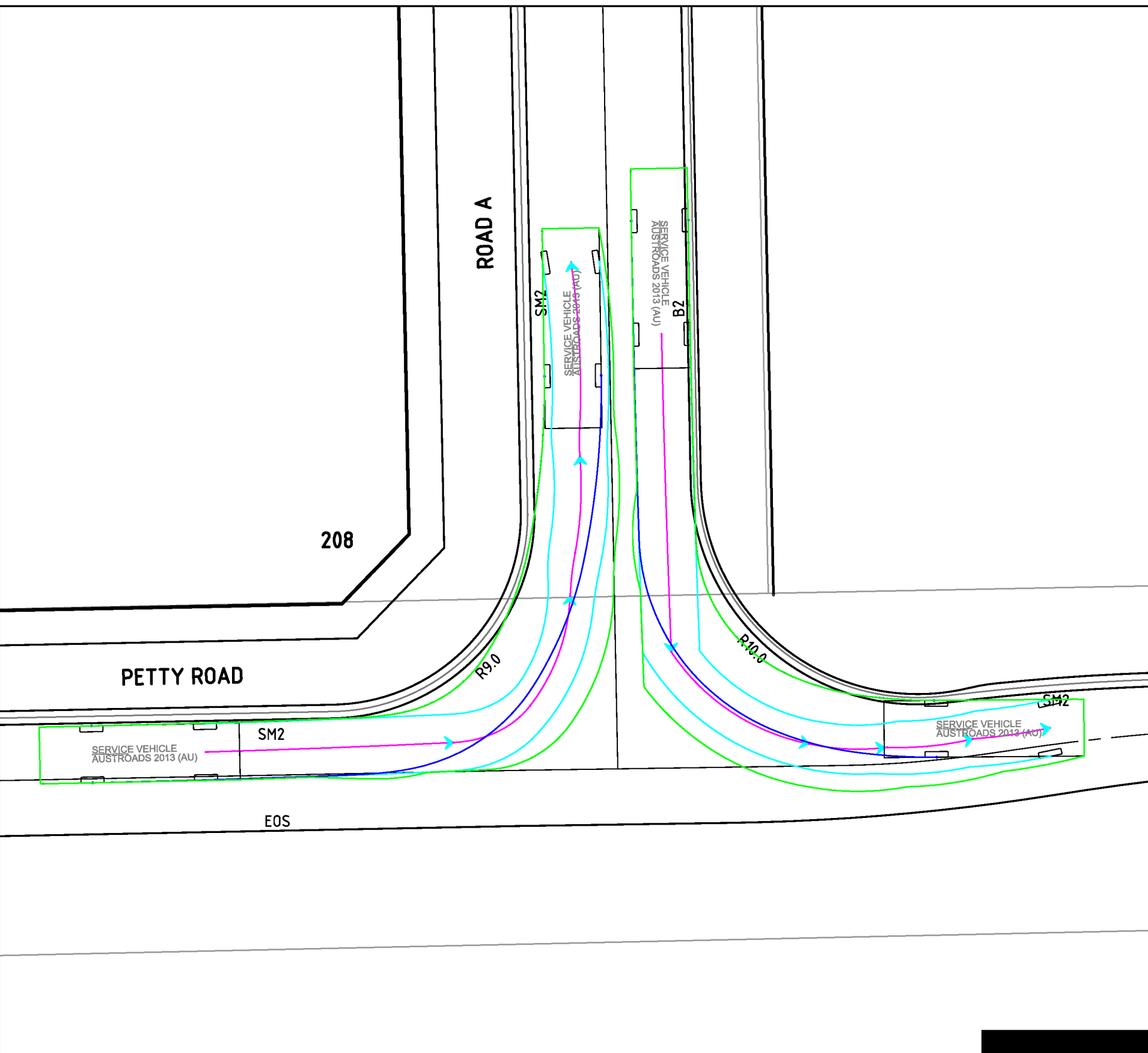
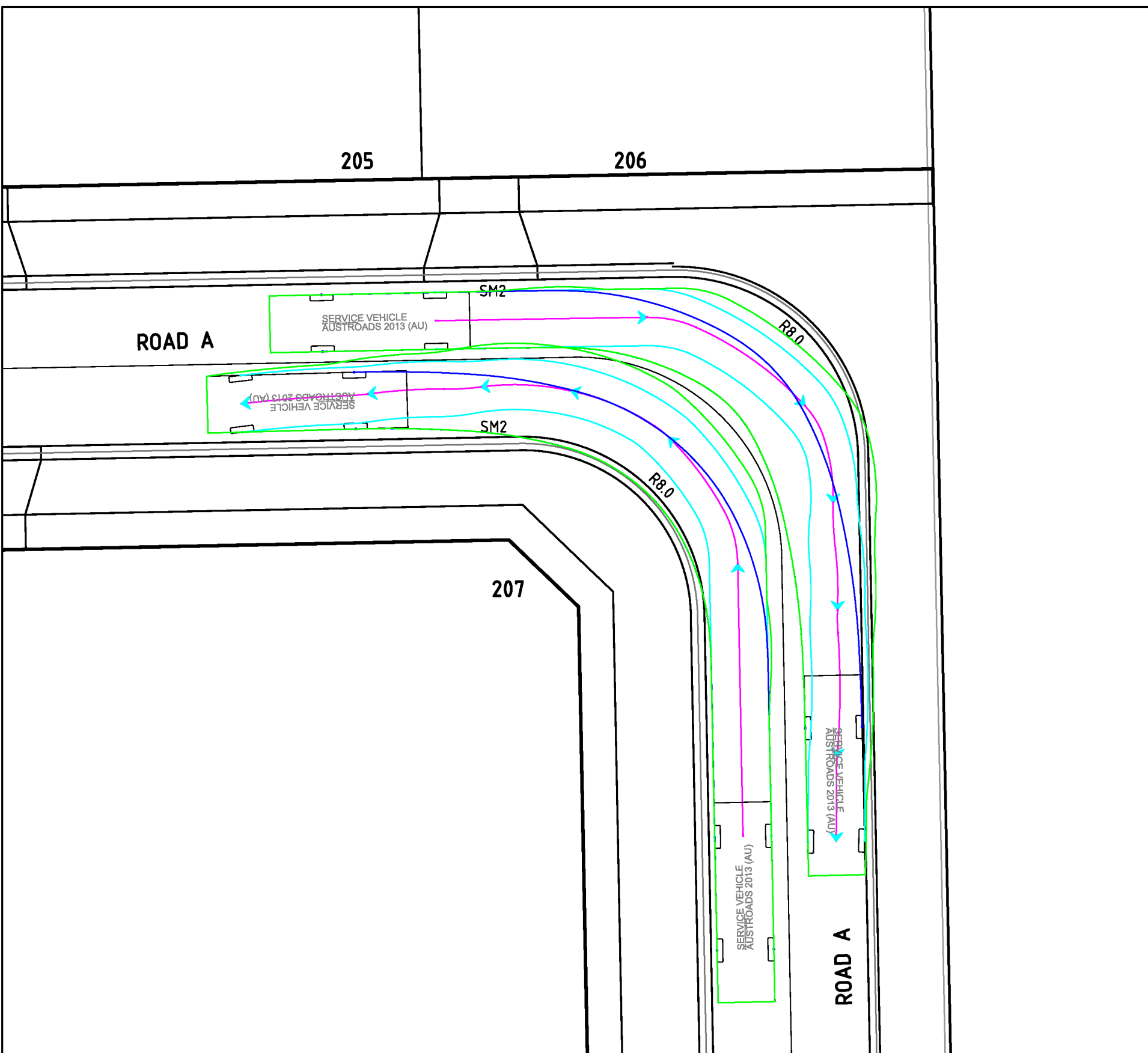
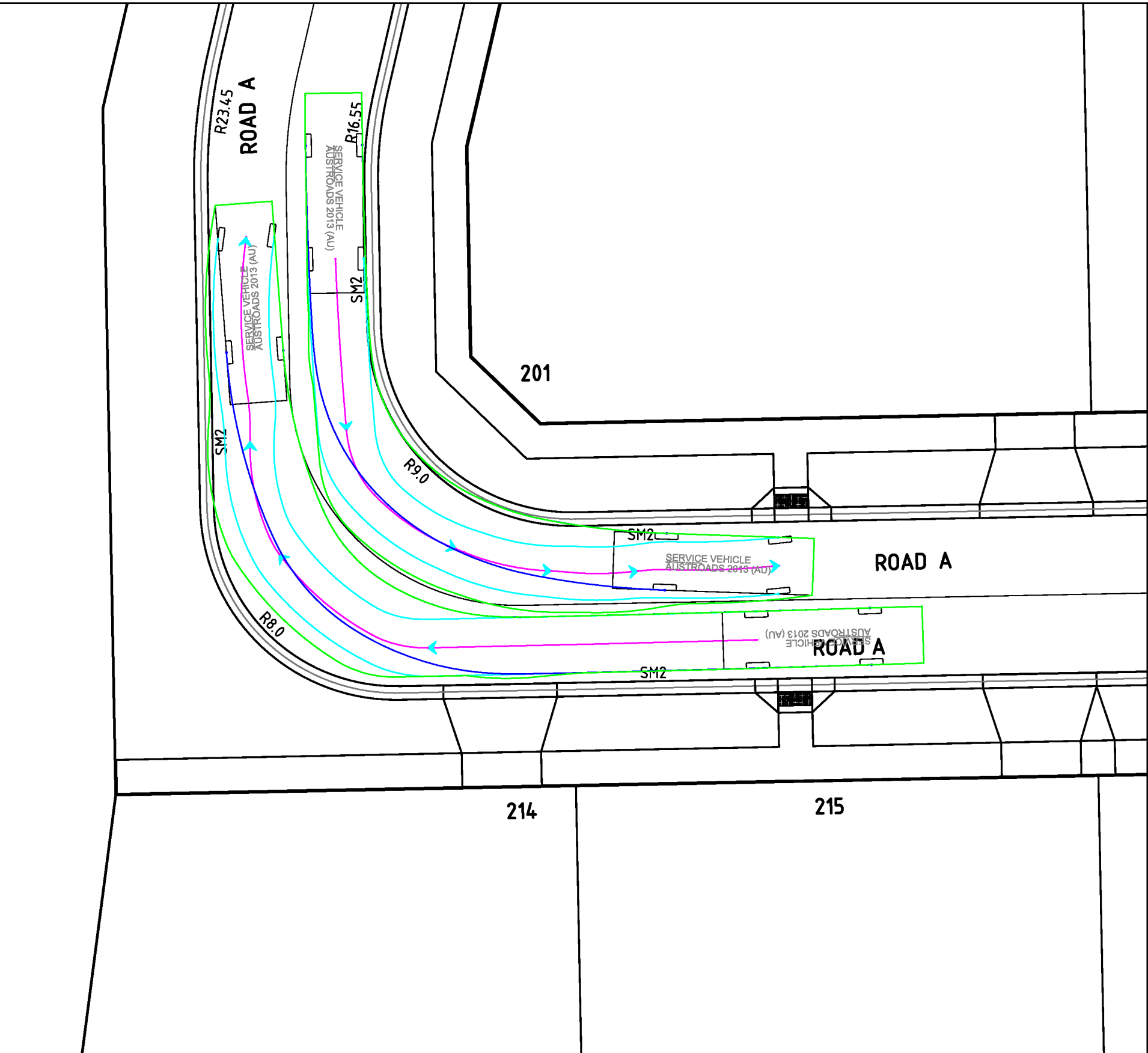
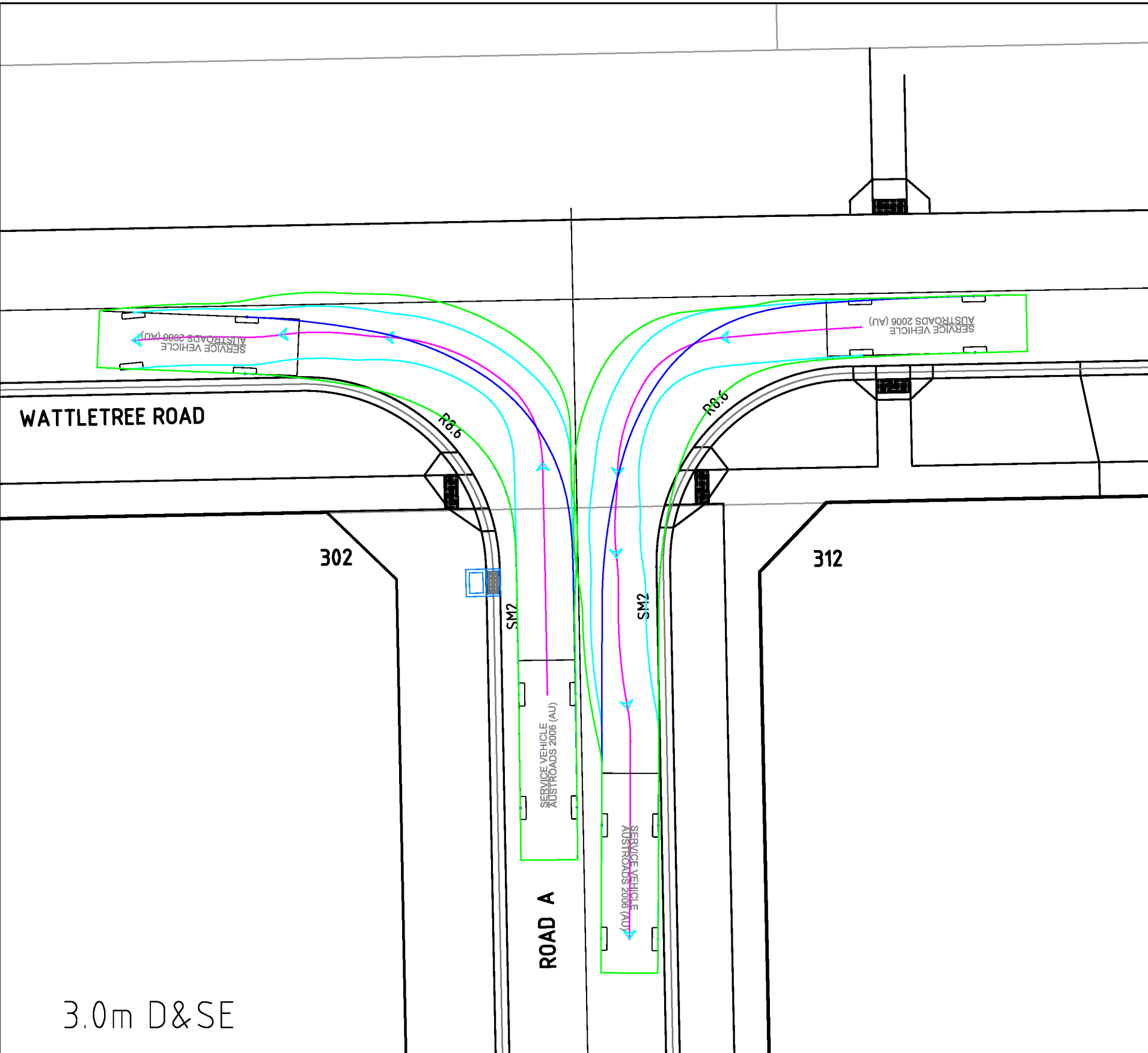
Designed
A.CANTWELL
Drawn
A.Cantwell
Checked
N.Green
Authorised
K.Taylor
Date
February 2023

Scale @ A1 H1:100 V1:50
0 1 2 4
0 0.5 1 2
Coords: MGA Levels: AHD

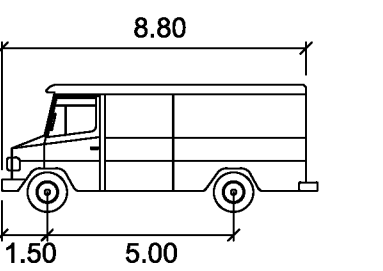
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www.1100.com.au



VEHICLE BODY
FRONT WHEELS
REAR WHEELS
TRAVEL PATH



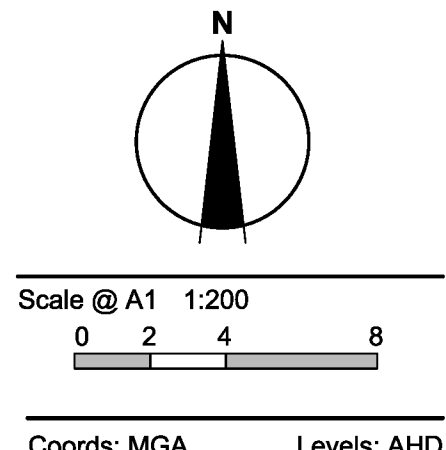
SERVICE VEHICLE
Width : 2.50
Track : 2.50
Lock to Lock Time : 6.0 s
Steering Angle : 38.7 deg

LEGEND - INTERSECTION PLAN	
	STORMWATER DRAIN, PIT & PROPERTY INLET
	SWALE DRAIN
	SEWER & MAINTENANCE STRUCTURES
	HOUSE DRAIN
	TACTILE PAVERS
	EXISTING HOUSE DRAIN
	RETAINING WALL
	PAVEMENT TREATMENT
	CONCRETE EDGE STRIP WITH SUBSOIL DRAIN
	"NO ROAD" SIGN & BARRIER
	LIMIT OF WORKS
	EXISTING TREE TO BE REMOVED
	PERMANENT SURVEY MARK
	TEMPORARY BENCH MARK
	PROPOSED DRIVEWAY

REVISION	DATE	DES/DT	APPD
I AMENDED AS PER CONCEPT PLAN VER 14	15.08.25	AC/AC	NG
H AMENDED TO SHOW TREE IDS AS PER CONCEPT PLAN VER 10	14.05.25	AC/AC	NG
G AMENDED IN LINE WITH CONCEPT PLAN VER 10	12.05.25	AC/AC	NG
F AMENDED IN LINE WITH CONCEPT PLAN VER 9	04.03.25	AC/AC	NG
E AMENDED IN LINE WITH CONCEPT PLAN VER 6	09.09.24	AC/AC	NG
D AMENDED DRIVEWAY AS PER COUNCIL RFI DATED 25/07/2023	16.08.23	AC/AC	KT
C AMENDED ROAD A ALIGNMENT	19.06.23	AC/AC	KT
B AMENDED AS PER CLIENT COMMENTS	27.04.23	AC/AC	KT
A INITIAL ISSUE	10.02.23	AC/AC	KT

Principal
Neil Pascoe C/- Nobellus Land Surveyors Pty Ltd
PO Box 461
Pakenham, VIC, 3810

Designed
A.Cantwell
Drawn
A.Cantwell
Checked
N.Green
Authorised
K.Taylor
Date
February 2023



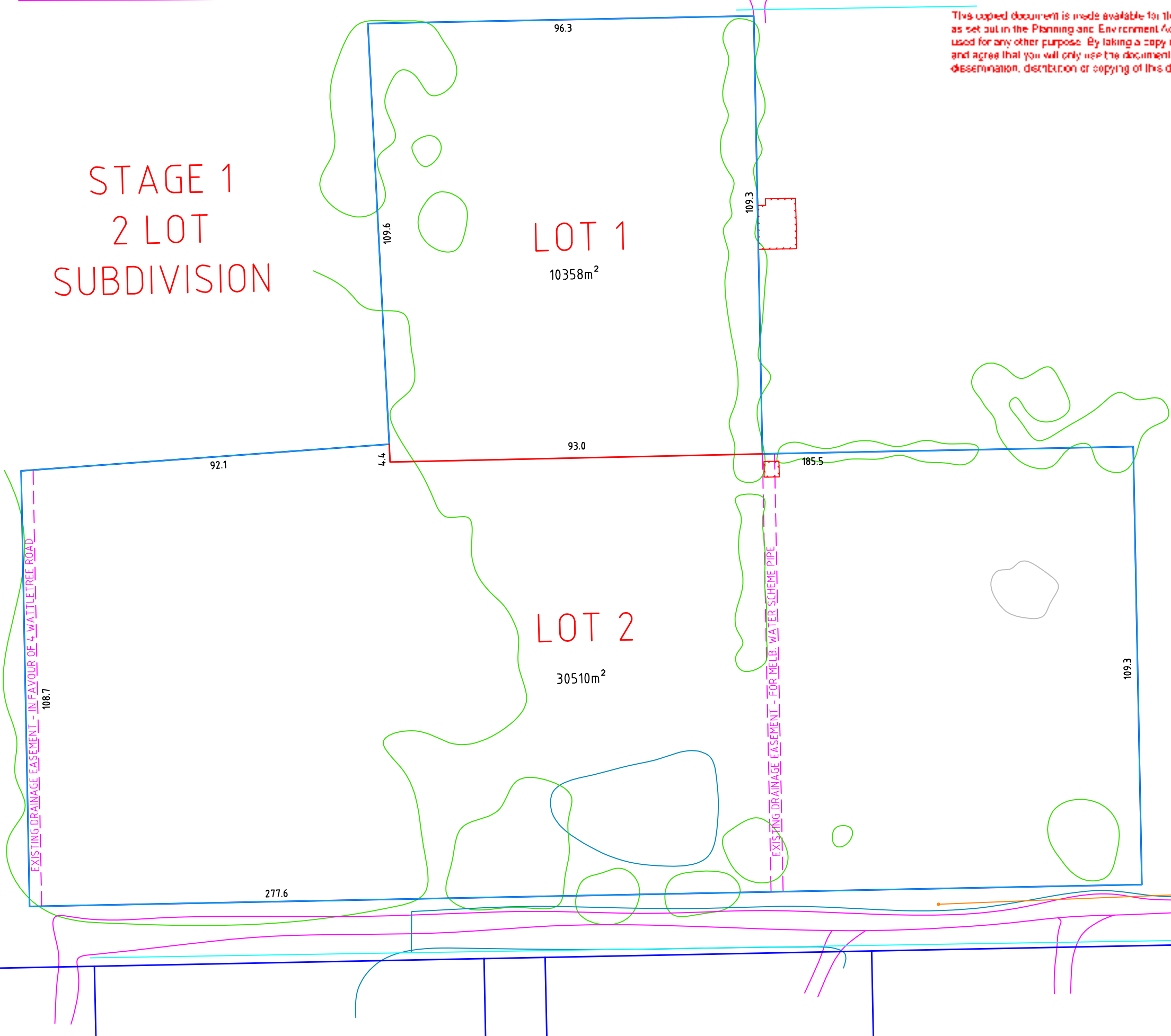
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STAGE 1
2 LOT
SUBDIVISION

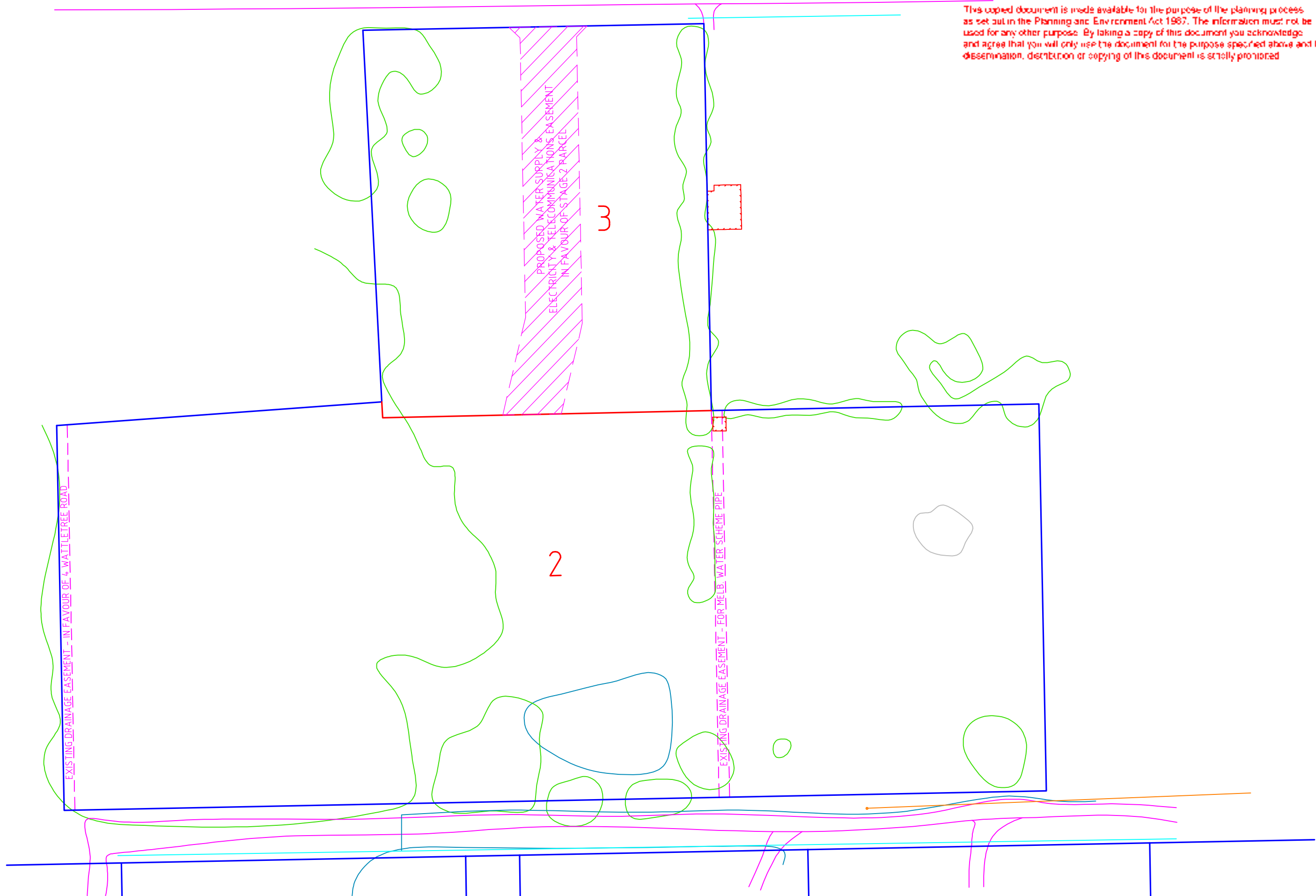
LOT 1
10358m²

LOT 2
30510m²

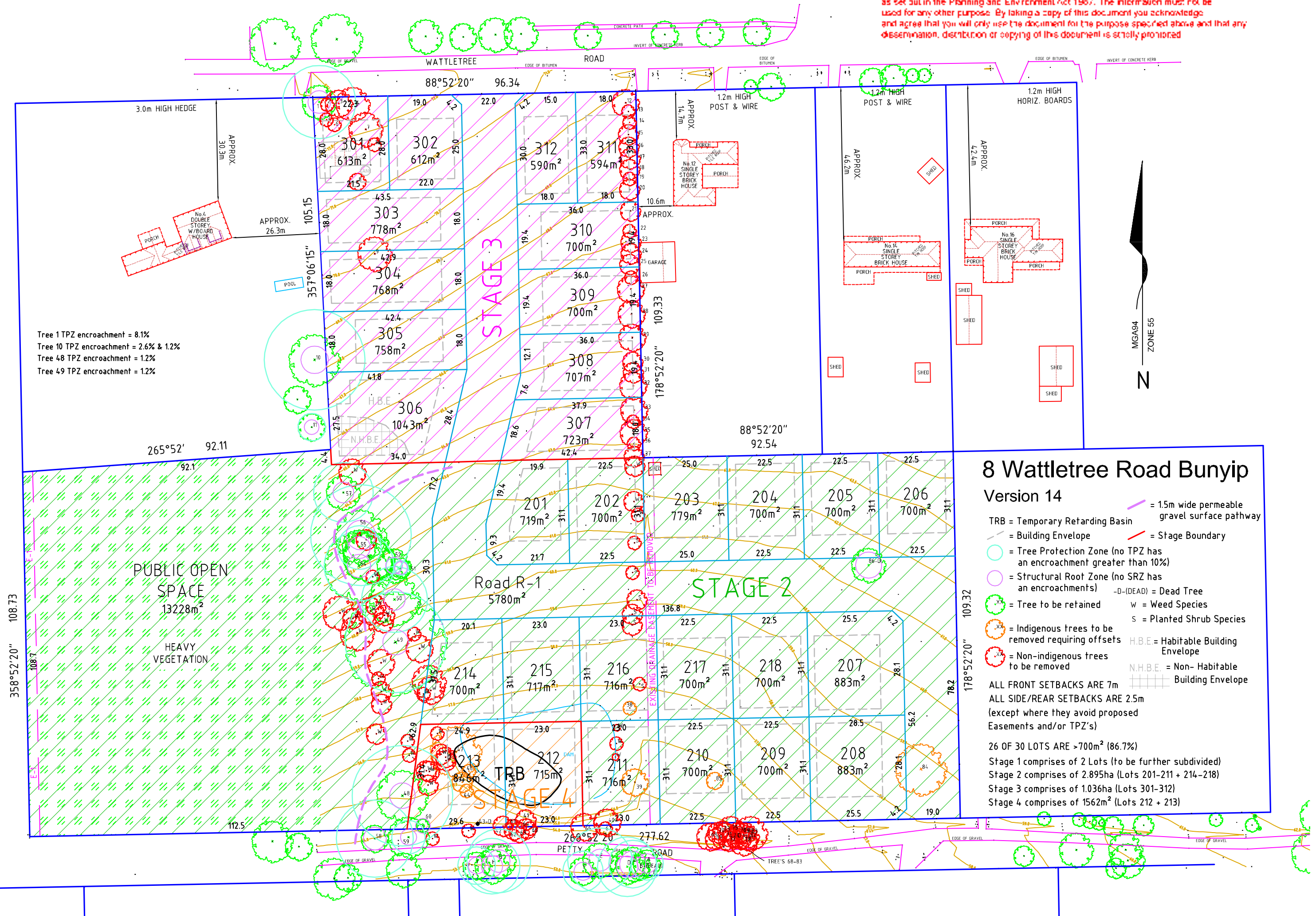
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307

723m²

42.4

19.9

10.85

19.4

17.7

201

719m²

21.6

31.1

15.2

21.7

9.3

12.4

7

Road R-1

