Traffic Impact Assessment

147 WOLLASTON ROAD,
WARNAMBOOL

Issued
4/11/2022

WARRNAMBOOL PLANNING SCHEME
Plans approved for
Permit: DP2022-0008
On the: 5/12/2022
Delegate Signature: rwandell

Melbourne Office
1 Glenferrie Road
PO Box 61
Malvern VIC 3144
Tel: (03) 9524 8888

beveridgewilliams.com.au

Beveridge Williams

Client:	Gull Group
Issued:	4/11/2022
Version:	2.0
Prepared by:	Max Small
Checked by:	Jimmy Liakos
Project Manager:	Antonia Erceg
Project Number:	2000243

Surveying
Asset Recording
Civil Engineering
Infrastructure Engineering
Traffic & Transport Engineering
Environmental Consulting
Water Resource Engineering
Strata Certification (NSW)
Town Planning
Urban Design
Landscape Architecture
Project Management

Revision Table

REV	DESCRIPTION	DATE	AUTHORISED
1.0	Submission	20/04/2020	
2.0	Updated Subdivision Layout	04/11/2022	Antonia Erceg

Contents

Figures

Appendix

1 PREAMBLE

INTRODUCTION

Beveridge Williams has been engaged by Gull Group to prepare a Traffic Impact Assessment for a proposed subdivision at 147 Wollaston Road, Warrnambool. The following report sets out the findings of this assessment based on the investigations undertaken by Beveridge Williams.

1.2 OBJECTIVES

Based on the scope of Beveridge Williams engagement, the information contained within this assessment has been prepared to respond to the following objectives:

- Review of the surrounding road network;
- Review of the Warrnambool Planning Scheme;
- Traffic impact considerations;
- Access considerations;
- Design considerations; and
- Other considerations.

1.3 FACTS AND MATTERS RELIED UPON

In preparing this assessment, Beveridge Williams have relied upon the following facts, matters and information:

- Warrnambool Planning Scheme;
- North of the Merri River Structure Plan;
- AS/NZS 2890.1:2004 Parking facilities Part 1: Off-street car parking;
- AS/NZS 2890.6:2009 Parking facilities Part 6: Off-street parking for people with disabilities;
- RMS Guide to Traffic Generating Developments (October 2002); and
- Traffic movement survey data collected.

2 EXISTING CONDITIONS

2.1 SUBJECT SITE

The subject site is located at 147 Wollaston Road, Warrnambool, and occupies a total area of 28.8ha. The site is bordered by Wollaston Road to the north and Merri River to the south of the site. There is residential development to the site's east.

The site is predominantly cleared and undeveloped with sparse vegetation. There is an existing vehicle crossover on Wollaston Road, and a street connection to Ponting Drive along the eastern boundary.

The existing site conditions are shown in Figure 1.

Figure 1: Subject Site – Existing Conditions

2.2 SUBJECT SITE CONTEXT

Located within the Warrnambool City Council municipality, the subject site is within a General Residential Zone (GRZ). The lower third of the site is also located within the Urban Floodway Zone (UGZ) due to Merri River along the site's southern border. The site is located within Schedule 10 to the Development Plan Overlay, which cross references the North of Merri River Development Plan discussed in section 2.4 of this report.

The site is located approximately 2.5km north of the Warrnambool Town Centre. The subject site locality and surrounding area are provided in Figure 2.

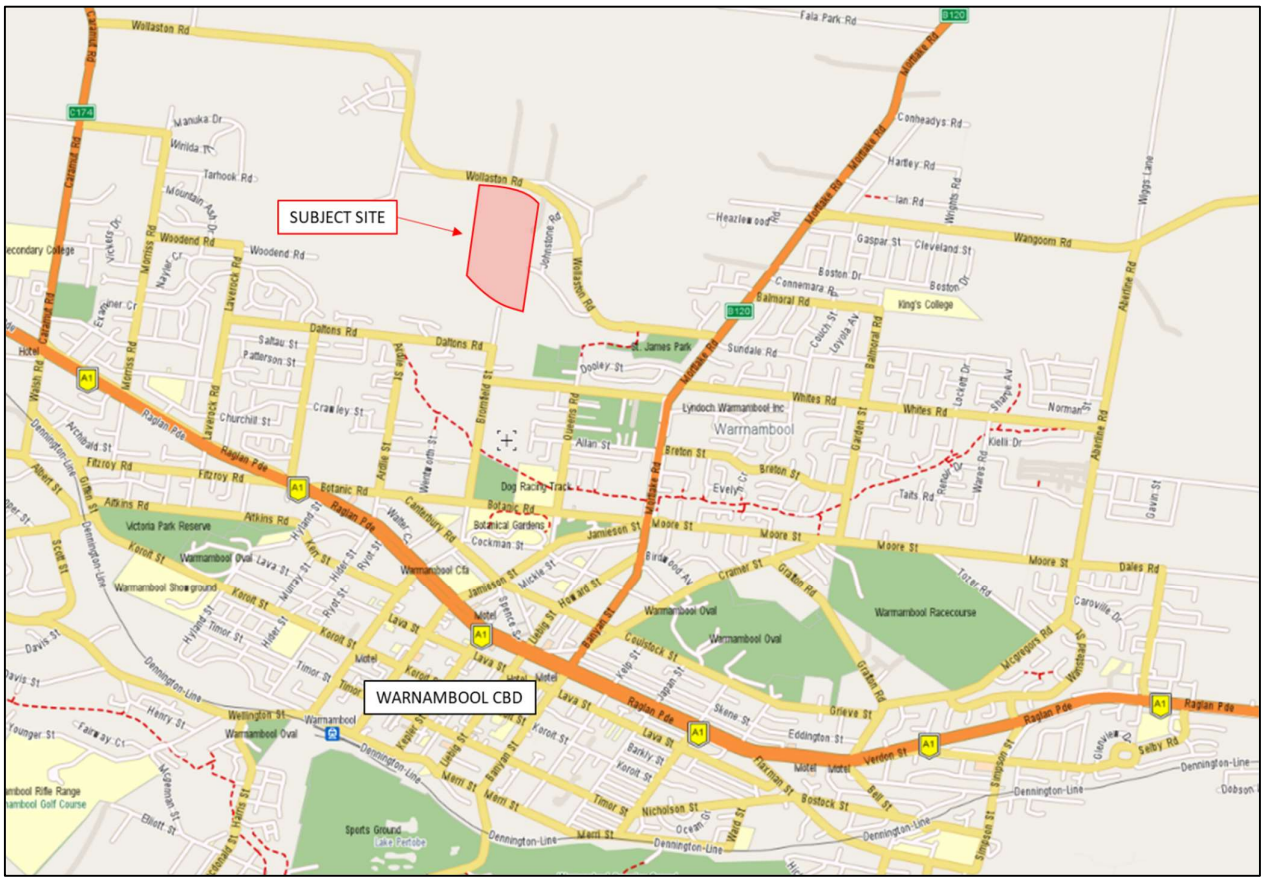


Figure 2 :Subject Site Locality

2.3 ROAD NETWORK

2.3.1 Wollaston Road

Wollaston Road is a rural collector road under the authority of the Warrnambool City Council. Wollaston Road runs between Hopkins Highway and Caramut Road, which are the main north/south roads that cross Merri River. Wollaston Road generally runs east/west with four large-radius, 90-degree bends.

At the frontage of the site, Wollaston Road is a two-lane, two-way road with 7m-wide carriageway and a posted speed limit of 80km/h. The roadside has grassed verges with no road shoulder. East of Walls Road the posted speed limit is 60km/h and the road is kerbed with no footpath on both sides of the road.

Figure 3: Wollaston Road facing west

2.3.2 Ponting Drive

Ponting Drive is a local road under the authority of Warrnambool City Council. Ponting Drive intersects with Wollaston Road and runs parallel with Merri River for approximately 450m and terminates at the eastern boundary of the subject site.

At the eastern boundary of the site Ponting Drive is a two-lane, two-way road with pavement of approximately 8m between kerbs. There are no footpaths and wide nature strips on both sides of the street. The speed limit is a default 50km/h.

Figure 4: Ponting Drive at the site boundary

2.4 NORTH OF MERRI RIVER STRUCTURE PLAN 2011

The North of Merri River Structure Plan 2011 has been prepared for Warrnambool City Council to provide planning and development framework for the land within the 250ha precinct area. The figure below shows the precinct area, with the site location and movement plan superimposed.

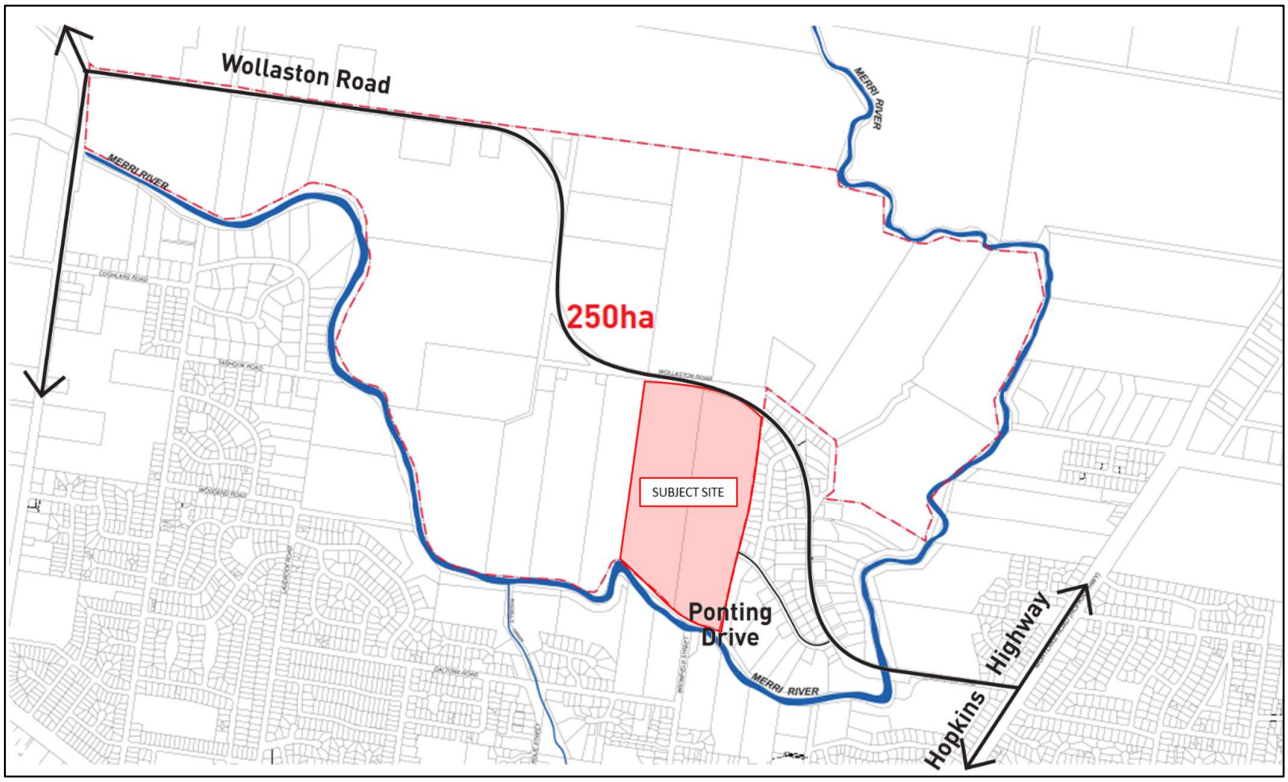


Figure 5: North of Merri River Precinct Area and Movement Plan

The movement plan as described in the North of Merri River Structure Plan indicates that Wollaston Road will continue its function to carry traffic between Hopkins Highway and Caramut Road. The through volumes are estimated to increase from approximately 3,000 vehicles per day (vpd) to 14,580vpd upon full development of the area. It is noted that the lot access objectives in Clause 56.06 in the Warrnambool Planning Scheme associates daily traffic volumes of more than 7,000vpd to an arterial road function albeit with the nominal geometry of a connector street.

It is also noted that the intersection of Hopkins Highway and Wollaston Road was signalised in 2015, after the structure plan was published 2011. The movement network also mentions a potential bridge connection to Bromfield Street, which terminates on the south side of Merri River.

2.5 EXISTING TRAFFIC MOVEMENTS

Turning movement surveys were undertaken on Wednesday 10 March 2021 to determine the existing peak hour traffic movements along Ponting Drive at Wollaston Road and Johnstone Street. Refer to Appendix A for the full survey data.

The survey at Wollaston Road indicated that the morning peak occurred between 8am-9am and the afternoon peak occurred between 3.30pm-4.30pm. The survey at Johnson Street had significantly less traffic and indicated no single peak as the hours commencing at 9.15am, 9.30am and 10am all had the same volume. The afternoon peak occurred between 4.15pm-5.15pm. In addition to the typical peak periods, there was a peak in traffic between 12.30pm-1.30pm.

The combined peak hour movements are shown in Figure 6.

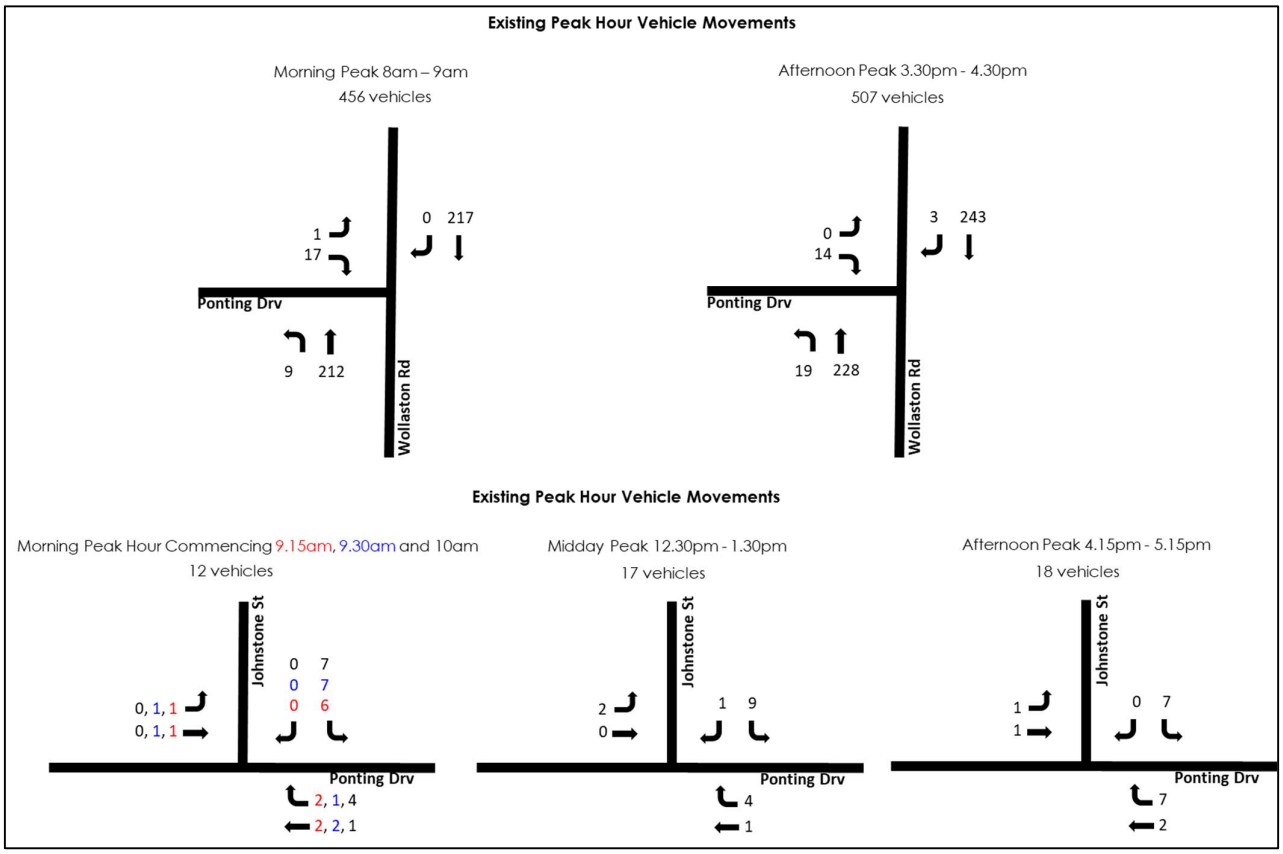


Figure 6: Existing Peak Hour Vehicle Movements

The traffic volumes of the signals at Hopkins Highway/Wollaston Road was obtained from the DoT data website. The date of the data obtained was also for Wednesday 10 March 2021 to coincide with the turning movement survey that was commissioned.

As all the approach lanes at this intersection has an individual turning direction and detector loop, the loop volume data was able to be used to ascertain a turning movement survey. Collating the data, the morning peak was found to occur between 8am-9am with 1,281 vehicles and the afternoon peak between 4.30pm-5.30pm with 1,319 vehicles.

A copy of the detector map and peak hour turning movements are shown below.

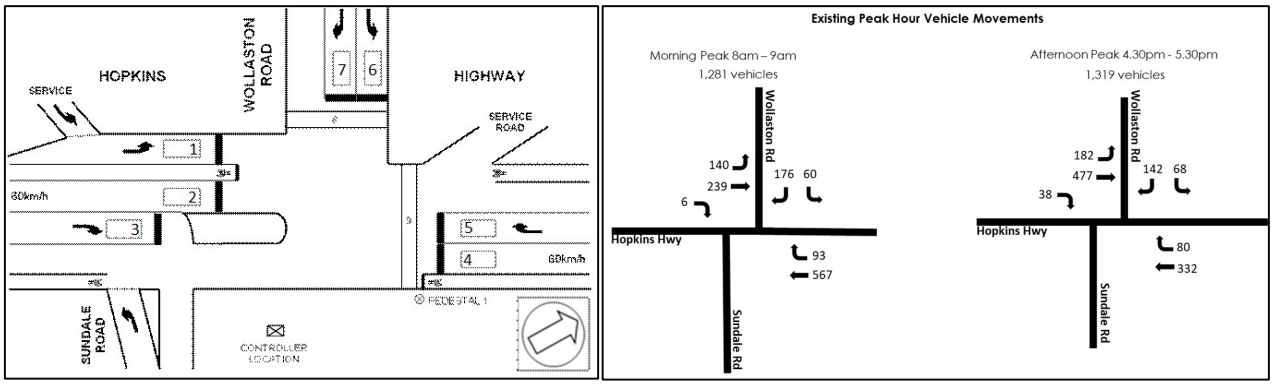


Figure 7: Detector Map and Peak Hour Turning Movements

3 PROPOSAL

3.1 GENERAL

It is proposed to develop a 52-lot residential subdivision, with an 18.46ha designation for a retirement village and associated facilities. Access will be obtained approximately from the existing vehicle crossing location on Wollaston Road.

There is land set aside for a potential future road reserve along the southeast boundary to provide a bridge crossing over Merri River.

The proposed development is shown in Figure 8 and attached in Appendix B.

Figure 8: Proposed Development

3.2 SITE ACCESSES

In accordance with the structure plan, the site will continue pedestrian and cycling access to Ponting Drive on the eastern border. It will not, however, provide a vehicle connection. There is one intersection access proposed along Wollaston Road approximately 145m from the eastern boundary, which is the location of the current vehicle crossing to the site. The lots fronting the northern site boundary will also gain direct vehicle access to Wollaston Road.

There is also land set aside along southeast corner of the site to facilitate a road reserve that would provide access to the potential bridge connection to Bromfield Street, south of Merri River.

The site access locations including the potential bridge connection are demonstrated in the figure below.

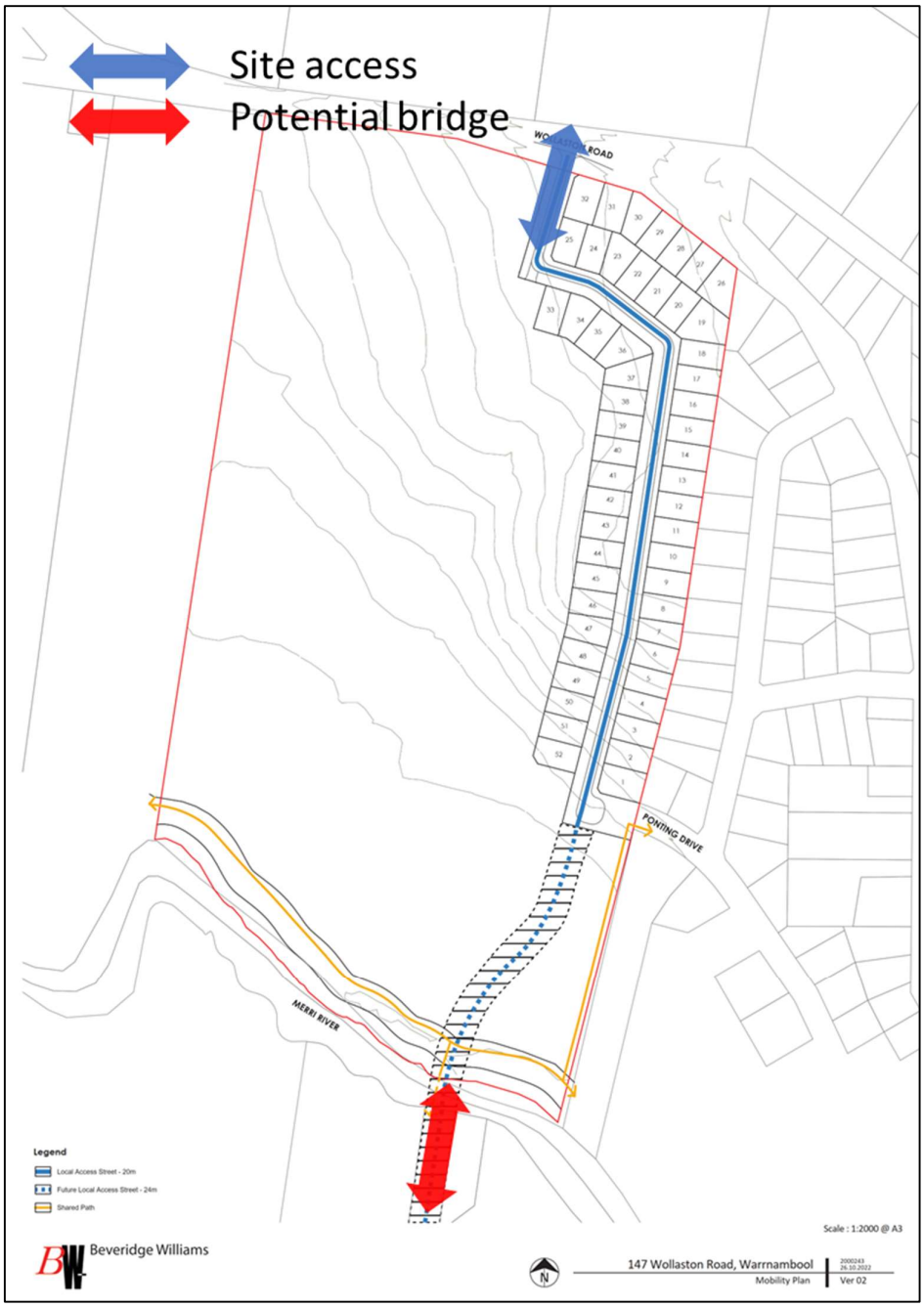


Figure 9: Site Access Plan

3.3 NORTH OF MERRI CREEK STRUCTURE PLAN

3.3.1 Existing Structure Plan

The North of Merri River Structure Plan outlines indicative amenity locations and road network. The indicative placement of the intersection access to the subject site is located immediately after the first left-hand bend from Hopkins Highway. Wollaston Road is proposed to be upgraded to a boulevard to the west of the site access with a wide median.

A north/south connector road is indicated through the subject site to connect Wollaston Road to the extension of Bromfield Street south of Merri River. Within the flood 1 in 100-year flood plain, there will be a proposed public open space.

The developable are of the subject site located north of the 1 in 100-year flood line is indicated to comprise standard density residential lots. The structure plan also indicates a pedestrian path to run along the north side of Merri River.

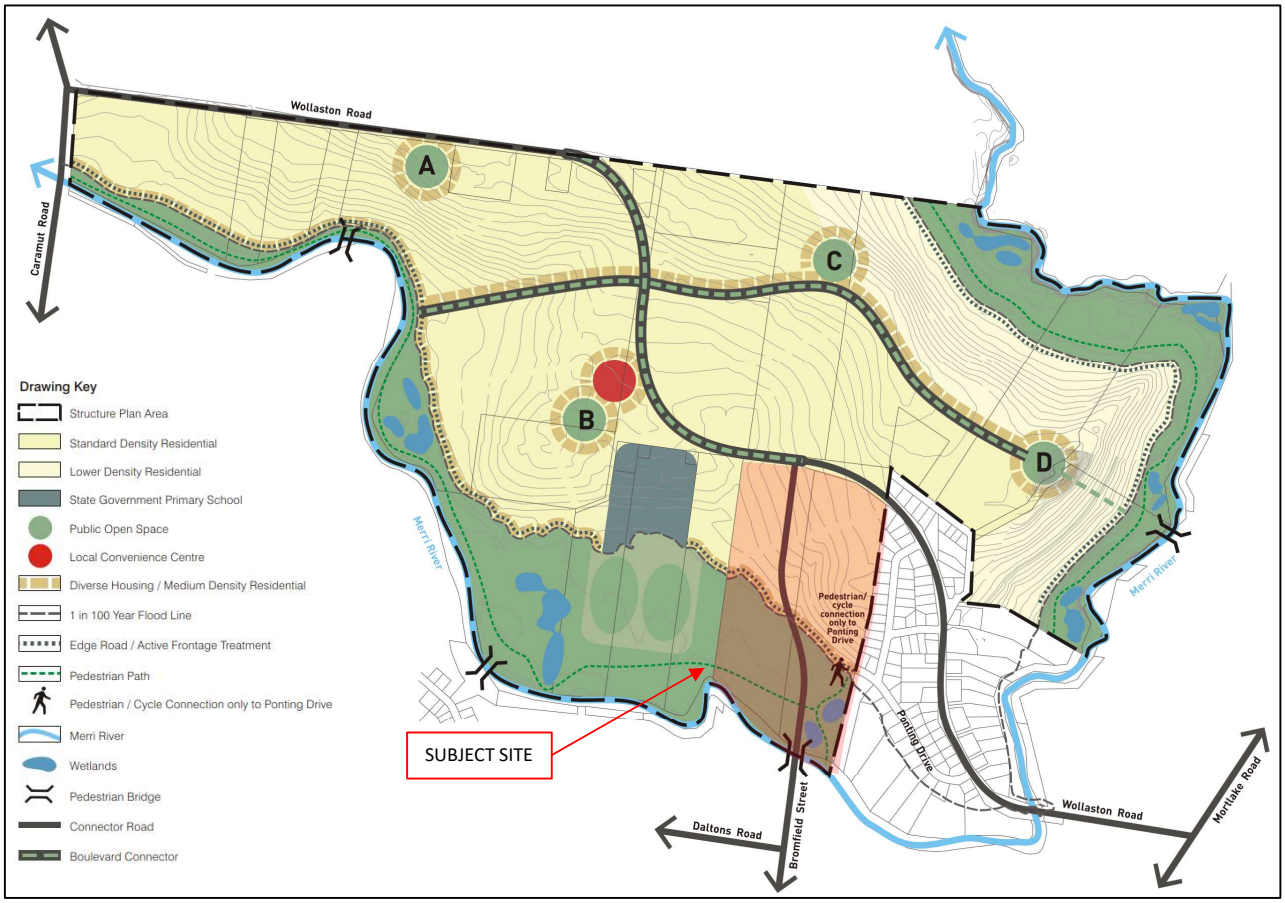


Figure 10: North of Merri River Structure Plan

3.3.2 Proposed Structure Plan Departures

As a departure to the structure plan, the proposed intersection is approximately 150m east of the location indicated in the structure plan. Additionally, the connector road instead doglegs toward the east and predominantly runs 50m offset from the eastern boundary. The Bromfield Street continuation is proposed to follow the south and eastern corner boundary to link the connector road with the proposed river crossing.

It is also proposed to amend the shared path route to connect to Ponting Drive via the vacant land east of the of the subject site. The shared path, much like the Bromfield Street continuation, will straddle the south and east corner boundary and continue following the general alignment of the Merri River.

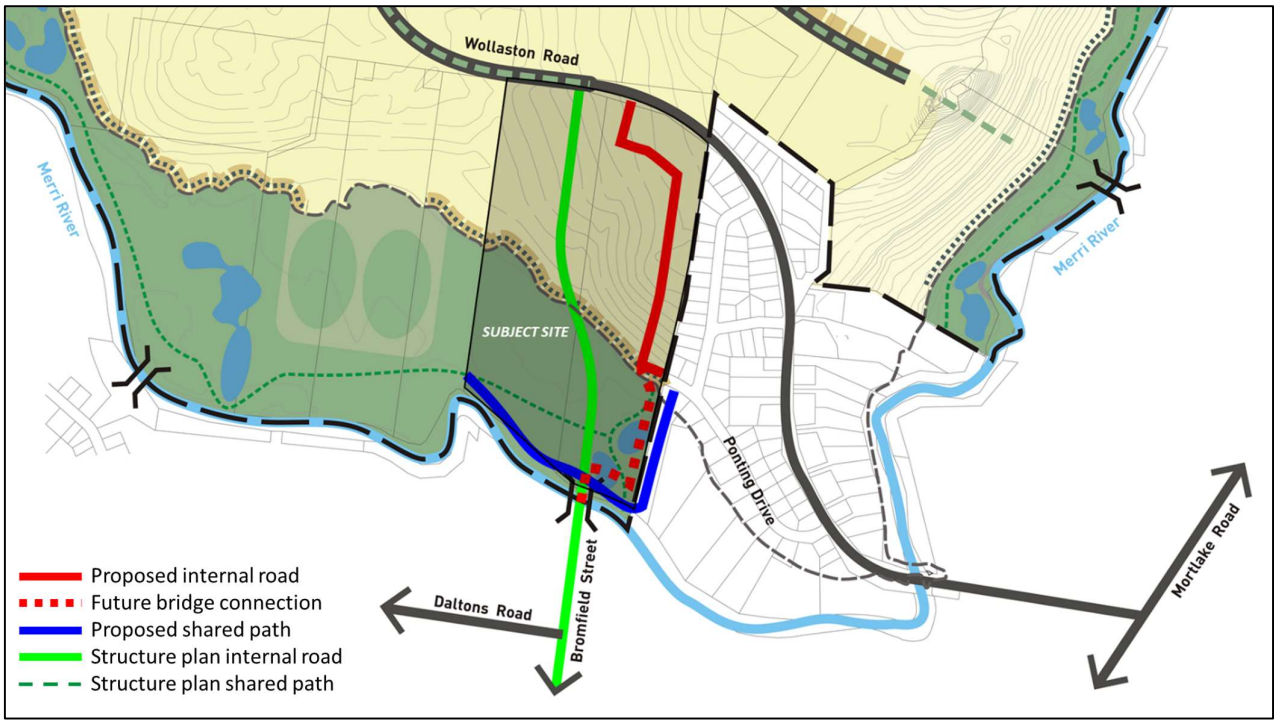


Figure 11: Proposed Development Structure Plan Amendments

3.4 PROPOSED INTERNAL ROAD NETWORK HEIRARCHY

The proposed network hierarchy generally follows the structure plan by providing a connector road link between Wollaston Road and Bromfield Street. The street network of the retirement village will remain private roads. The general carriageway width of these roads will be 6m.

The connector road is proposed to comprise two different cross sections: one for residential frontage and one for the retirement village frontage. The cross sections generally conform to the lot access objectives outlined in the Planning Scheme in Clause 56.06. The only departure of note is the minimum verge requirement of 4.5m each side. The retirement village cross section proposed an eastern verge of 4.35m.

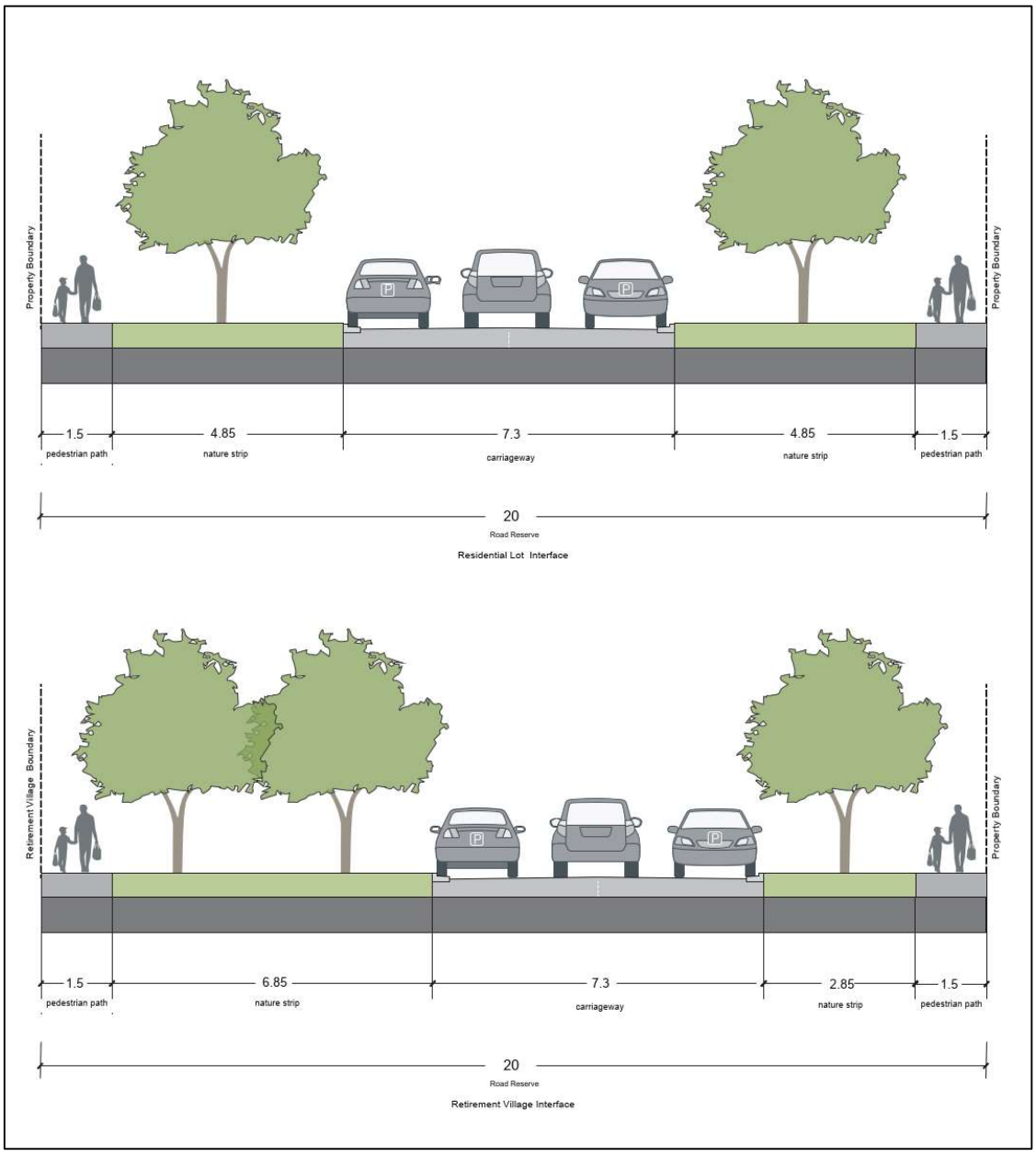


Figure 12: Connector Road Cross Sections

4 TRAFFIC IMPACT CONSIDERATIONS

4.1 TRAFFIC GENERATION

It is generally accepted that a single dwelling on a standard lot will generate vehicular traffic at a rate of 8-10 trips per day, with 10% of daily volume occurring in each peak hour. Based on case study data for similar projects, the following daily and peak hour rate for the subject site has been adopted.

- Daily volume: 10 vehicle movements / dwelling
- Peak volume: 1 vehicle movement / dwelling

The RMS Guide to Traffic Generating Developments outlines surveyed traffic generation and parking rates for specific land uses. The nominal traffic generation rate for housing for aged and disabled persons is as follows:

- Daily volume: 1-2 / dwelling
- Evening peak hour trips: 0.1-0.2 / dwelling

Applying the upper limit traffic generation rates for the 52 residential and 216 retirement village lots, the estimated traffic volume is below:

- 952 daily vehicle movements: 520 residential and 432 retirement village
- 95 peak hour movements: 52 residential and 43 retirement village

4.2 TRAFFIC DISTRIBUTION

Wollaston Road is expected to carry an additional 952 daily vehicle movements upon full occupation of the proposed development. Based off the turning movement survey at the intersection of Ponting Drive and Wollaston Road, the overwhelming demand is east toward Hopkins Highway. The subject site context also indicates that Warrnambool and Melbourne/Geelong-bound traffic will likely head east. As such, a distribution split of 95% east/5% west is applied.

During peak periods, traffic is generally split 90% outbound and 10% inbound during the morning and 40% outbound and 60% inbound during the afternoon peak.

Applying the above traffic generation rates to the internally accessed lots, the traffic generation is calculated below.

	East out	East in	West out	West in
AM Peak	75	8	4	1
PM Peak	33	50	2	3

All internally and externally accessed lots will travel via Wollaston Road.

4.3 POST-DEVELOPMENT TRAFFIC VOLUME

The total post-development daily traffic volume is shown below applying the distribution split estimations. The traffic generation source consists of 216 retirement village lots and the 52 residential lots that comprise the internal lots.

Of the 52 residential lots, it is proposed that 7 of them will directly access Wollaston Road.

The internal road will likely carry 882 daily movements with a total of approximately 904 movements to/from the east and approximately 48 to/from the west.

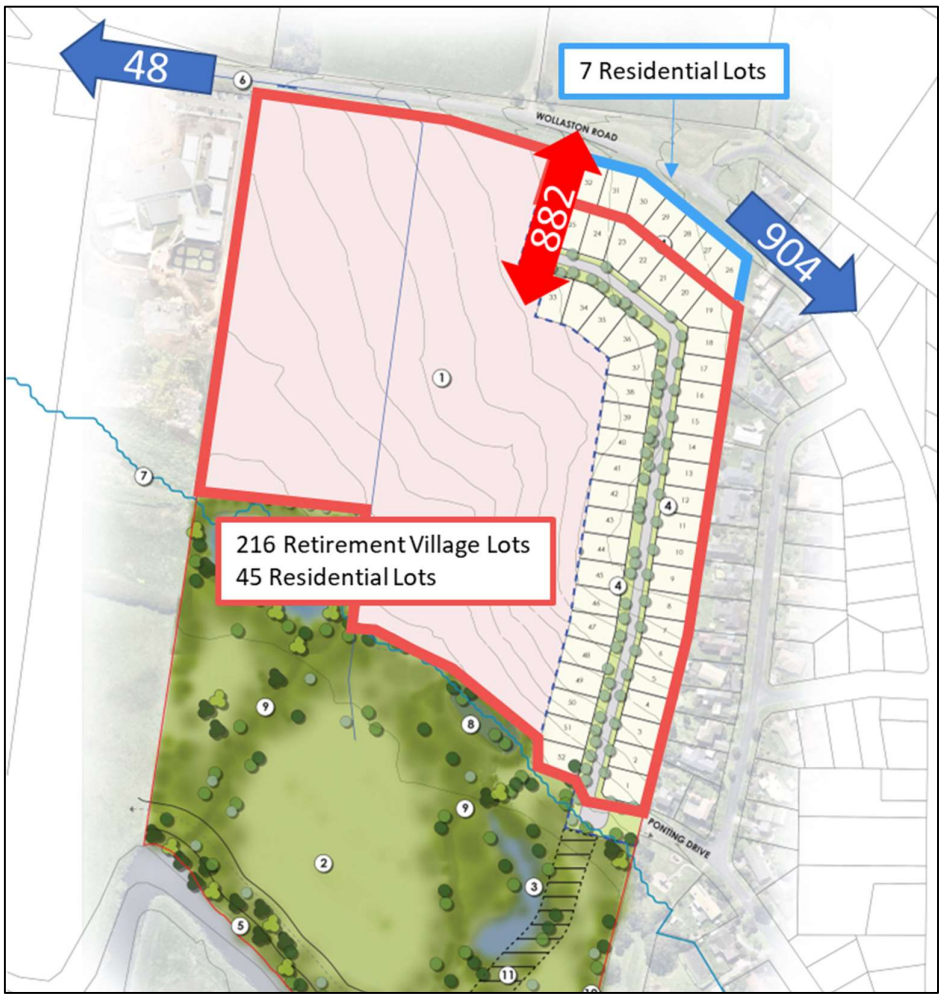


Figure 13: Additional Daily Post-Development Traffic Volumes

4.4 POST-DEVELOPMENT TRAFFIC IMPACTS

Based on the lot objectives in Clause 56.06 of the Warrnambool Planning Scheme, the estimated daily traffic volume does not exceed the nominal volumes. The connector road has a daily volume cap of 3,000vpd. Considering that the only external connectivity to the surrounding road network will be via the northern intersection of the connector road with Wollaston Road, it is anticipated that the post-development volumes along the connector road will be similar to the volumes generated by the subject site.

It is expected that the intersection of the connector street and Wollaston Road will continue to operate at an acceptable level of service and well below capacity post-development.

Based on the intended zoning objectives of the structure plan, the entire retirement village area replaces what would otherwise be standard density residential lots. This results in a significant reduction of traffic generation across more than half of the developable area of the subject site.

It is noted that the set of signals at the intersection of Wollaston Road and Hopkins Highway was constructed in 2015 – four years after the North of Merri River Structure Plan was published. It is assumed that the signals and lane geometry of this intersection would have taken into account the proposed traffic volumes of a fully developed study area. Considering the subject site proposes a lower traffic generating land-use the traffic impact of the proposed development along Wollaston Road and its intersection with Hopkins Highway is expected to be less than the structure plan outlines. Additionally, the realignment of the connector road makes the travel route along Wollaston Road more equitable.

The proposed development is considered appropriate and is expected to operate with less of an impact than initially provisioned within the North of Merri River Structure Plan.

5 SUMMARY AND CONCLUSIONS

Based on the preceding analysis, it is summarised that:

- It is proposed to develop a subdivision on subject site to comprise 52 residential lots and a retirement village including 216 lots.
- The site will be accessed by a proposed intersection along Wollaston Road.
- There is land set aside for a potential future road reserve along the southeast boundary to provide a bridge crossing over Merri River.
- A turning movement survey was commissioned on Wednesday 10 March 2010 along Ponting Drive at its intersections with Wollaston Road and Ponting Drive.
- The site layout proposes a realigned connector street from the structure plan that travels closer to the eastern boundary of the site.
- The proposed shared path is also realigned to track along the vacant land east of the subject site and north of the Merri River.
- The proposed development is expected to generate 952 daily vehicle movements or 95 peak hour movements.
- The traffic distribution is expected to predominantly travel east towards Hopkins Highway.
- All ingress and egress traffic movements from the subject site will use the intersection of the connector road and Wollaston Road.
- The post development traffic generated from the site is expected to not exceed the operational objectives of the road hierarchies of the internal collector road or Wollaston Road.
- The proposed development is considered to not have significant impact on the operation of Wollaston Road or the signalised intersection at Hopkins Highway.

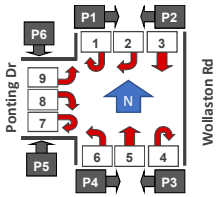
In conclusion, the proposed development is considered to have minimal impact on the operation of the existing road network. Should you have any queries or require any clarification, please do not hesitate to call or contact the Beveridge Williams traffic department.

Jimmy Liakos
Manager – Traffic Engineering and Transport Planning
BEVERIDGE WILLIAMS

APPENDIX A: TURNING MOVEMENT SURVEY

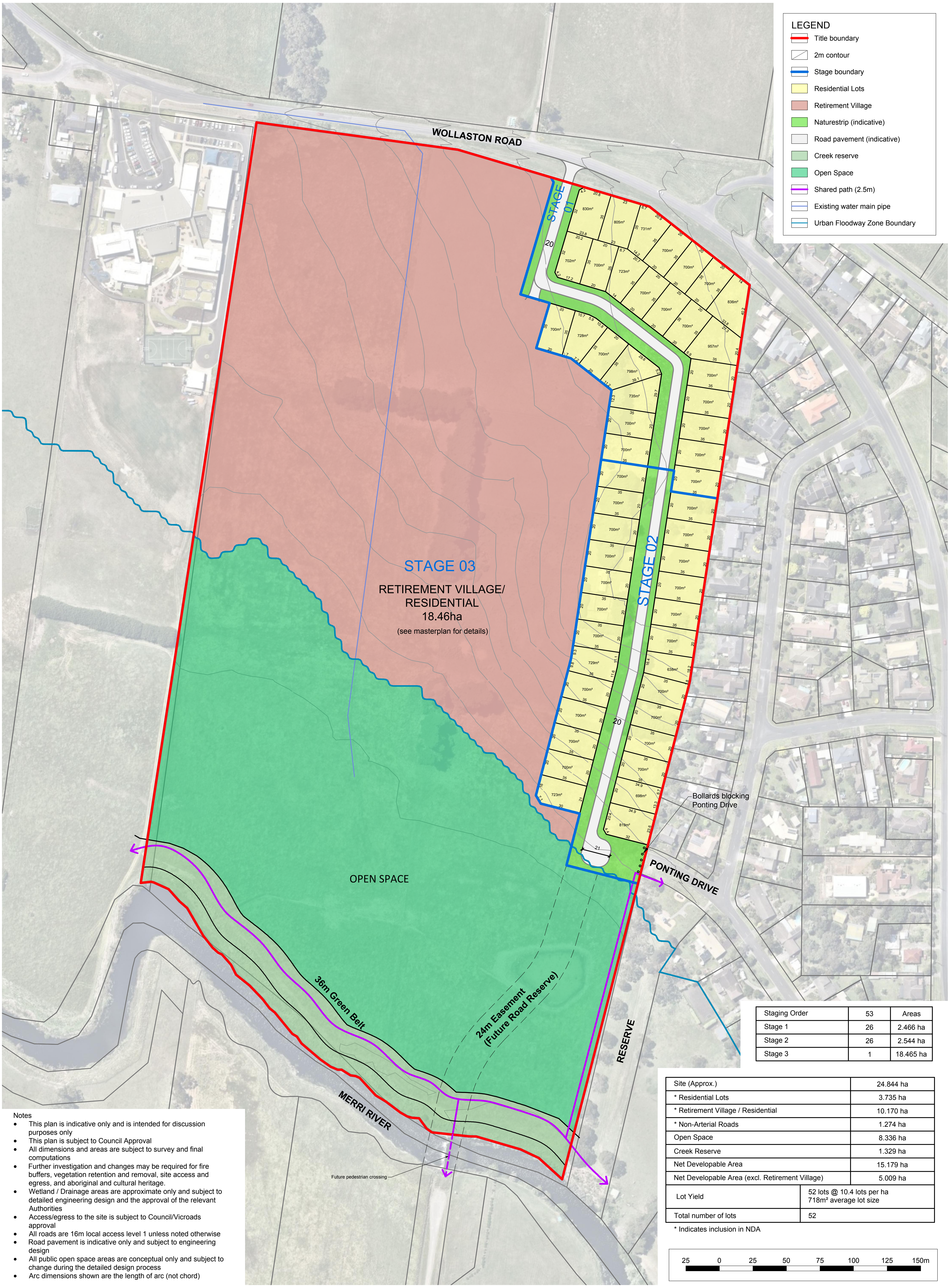
nationwide TRAFFIC SURVEYS

Client: Beverage Williams
Name: Warrnambool Traffic Count
Job No.: 6072
Location: Wollaston Rd and Ponting Dr
Date: Wed 10/03/2021 **Time:** 7am to 7pm
Weather: Sunny



Absolute Value		VEHICLE MOVEMENTS																		PEDESTRIAN MOVEMENTS												
		1		2		3		4		5		6		7		8		9		P1		P2		P3		P4		P5		P6		
TIME		Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Ped	Bike	Ped	Bike	Ped	Bike	Ped	Bike	Ped	Bike	Ped	Bike	
7:00	7:15	0	0	0	0	20	2	0	0	29	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
7:15	7:30	0	0	0	0	12	0	1	0	33	1	2	0	0	0	6	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
7:30	7:45	0	0	0	0	24	1	0	0	24	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
7:45	8:00	0	0	0	0	33	0	0	0	42	3	0	0	0	0	2	0	1	0	0	0	1	0	0	0	0	0	2	0	0	0	243
8:00	8:15	0	0	0	0	40	3	0	0	35	2	3	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	277
8:15	8:30	0	0	0	0	41	3	0	0	47	3	3	0	0	0	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	324
8:30	8:45	0	0	0	0	71	2	0	0	64	3	2	0	0	0	4	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	417
8:45	9:00	0	0	0	0	57	0	0	0	53	5	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	456
9:00	9:15	0	0	0	0	39	0	0	0	34	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	443
9:15	9:30	0	0	0	0	28	2	0	0	27	0	2	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	402
9:30	9:45	0	0	0	0	31	1	0	0	23	3	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	316
9:45	10:00	0	0	0	0	24	1	0	0	25	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	247
10:00	10:15	0	0	0	0	26	1	0	0	30	3	3	0	0	0	6	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	242
10:15	10:30	0	0	0	0	26	3	0	0	34	1	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	247
10:30	10:45	0	0	0	0	31	1	0	0	24	1	2	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	250
10:45	11:00	0	0	0	0	33	0	0	0	27	1	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	268
11:00	11:15	0	0	0	0	26	3	0	0	30	3	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	266
11:15	11:30	0	0	1	0	20	1	0	0	20	2	4	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	251
11:30	11:45	0	0	0	0	25	0	0	0	25	3	2	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	247
11:45	12:00	0	0	0	0	31	1	0	0	25	3	3	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	245
12:00	12:15	1	0	0	0	29	3	0	0	40	0	4	0	0	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	258
12:15	12:30	0	0	0	0	31	0	0	0	37	1	4	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	280
12:30	12:45	0	0	0	0	36	1	0	0	37	0	2	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	302
12:45	13:00	0	0	0	0	32	0	0	0	38	0	0	0	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	310
13:00	13:15	0	0	0	0	35	1	0	0	33	0	4	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	306
13:15	13:30	0	0	0	0	42	0	0	0	44	4	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	324
13:30	13:45	0	0	0	0	39	5	0	0	33	1	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	325
13:45	14:00	0	0	0	0	39	0	0	0	27	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	318
14:00	14:15	0	0	0	0	19	1	0	0	23	4	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	291
14:15	14:30	0	0	0	0	33	2	0	0	39	2	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	280
14:30	14:45	0	0	0	0	31	1	1	0	26	0	3	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	262
14:45	15:00	0	0	1	0	37	2	0	0	36	1	2	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	275
15:00	15:15	0	0	0	0	58	1	1	0	56	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	347
15:15	15:30	0	0	0	0	59	4	0	0	39	1	2	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	374
15:30	15:45	0	0	1	0	76	1	0	0	50	2	4	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	447
15:45	16:00	0	0	1	0	43	1	0	0	55	1	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	473
16:00	16:15	0	0	0	0	63	1	0	0	57	3	8	0	0	0	6	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	490
16:15	16:30	0	0	1	0	57	1	0	0	58	2	4	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	507
16:30	16:45	0	0	0	0	43	1	0	0	51	3	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	471
16:45	17:00	0	0	0	0	52	0	1	0	53	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	1	0	1	0	475
17:00	17:15	0	0	1	0	58	1	0	0	53	1	4	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	459
17:15	17:30	0	0	0	0	45	1	0	0	59	0	6	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	448
17:30	17:45	0	0	0	0	43	0	0	0	65	1	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	460
17:45	18:00	0	0	0	0	42	0	0	0	44	1	4	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	443
18:00	18:15	0	0	0	0	44	1	0	0	50	1	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	423
18:15	18:30	0	0	0	0	39	0	0	0	40	0	0	0	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	393
18:30	18:45	0	0	1	0	37	0	0	0	37	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	359
18:45	19:00	0	0	0	0	32	0	0	0	36	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	337

APPENDIX B: SITE LAYOUT PLAN



LEGEND

🟥	Title boundary
▨	2m contour
🟦	Stage boundary
🟨	Residential Lots
🟫	Retirement Village
🟩	Naturestrip (indicative)
⬜	Road pavement (indicative)
🟩	Creek reserve
🟩	Open Space
🟪	Shared path (2.5m)
🟦	Existing water main pipe
🟦	Urban Floodway Zone Boundary

Staging Order	53	Areas
Stage 1	26	2.466 ha
Stage 2	26	2.544 ha
Stage 3	1	18.465 ha

Site (Approx.)	24.844 ha
* Residential Lots	3.735 ha
* Retirement Village / Residential	10.170 ha
* Non-Arterial Roads	1.274 ha
Open Space	8.336 ha
Creek Reserve	1.329 ha
Net Developable Area	15.179 ha
Net Developable Area (excl. Retirement Village)	5.009 ha
Lot Yield	52 lots @ 10.4 lots per ha 718m² average lot size
Total number of lots	52

* Indicates inclusion in NDA

25 0 25 50 75 100 125 150m

Notes
- This plan is indicative only and is intended for discussion purposes only
- This plan is subject to Council Approval
- All dimensions and areas are subject to survey and final computations
- Further investigation and changes may be required for fire buffers, vegetation retention and removal, site access and egress, and aboriginal and cultural heritage.
- Wetland / Drainage areas are approximate only and subject to detailed engineering design and the approval of the relevant Authorities
- Access/egress to the site is subject to Council/Vicroads approval
- All roads are 16m local access level 1 unless noted otherwise
- Road pavement is indicative only and subject to engineering design
- All public open space areas are conceptual only and subject to change during the detailed design process
- Arc dimensions shown are the length of arc (not chord)

Beveridge Williams

ph : 03 9524 8888 - www.beveridgewilliams.com.au

Indicative Subdivision Plan

147 Wollaston Road, Warnambool

Gull Group

Version	Date	Description	Drafted	Approved
08	20.05.2021	Amended layout	MJ	WEB
09	08.06.2021	Amended layout	MJ	WEB
10	25.08.2021	Amended layout	MJ	WEB
11	08.08.2022	Amended layout	VA	WEB
12	26.10.2022	Golf course removed	VA	WEB

Date: 26.10.2022
Version No: 12
Job No: 2000243
Scale (A1): 1:1250
(A3): 1:2500

N

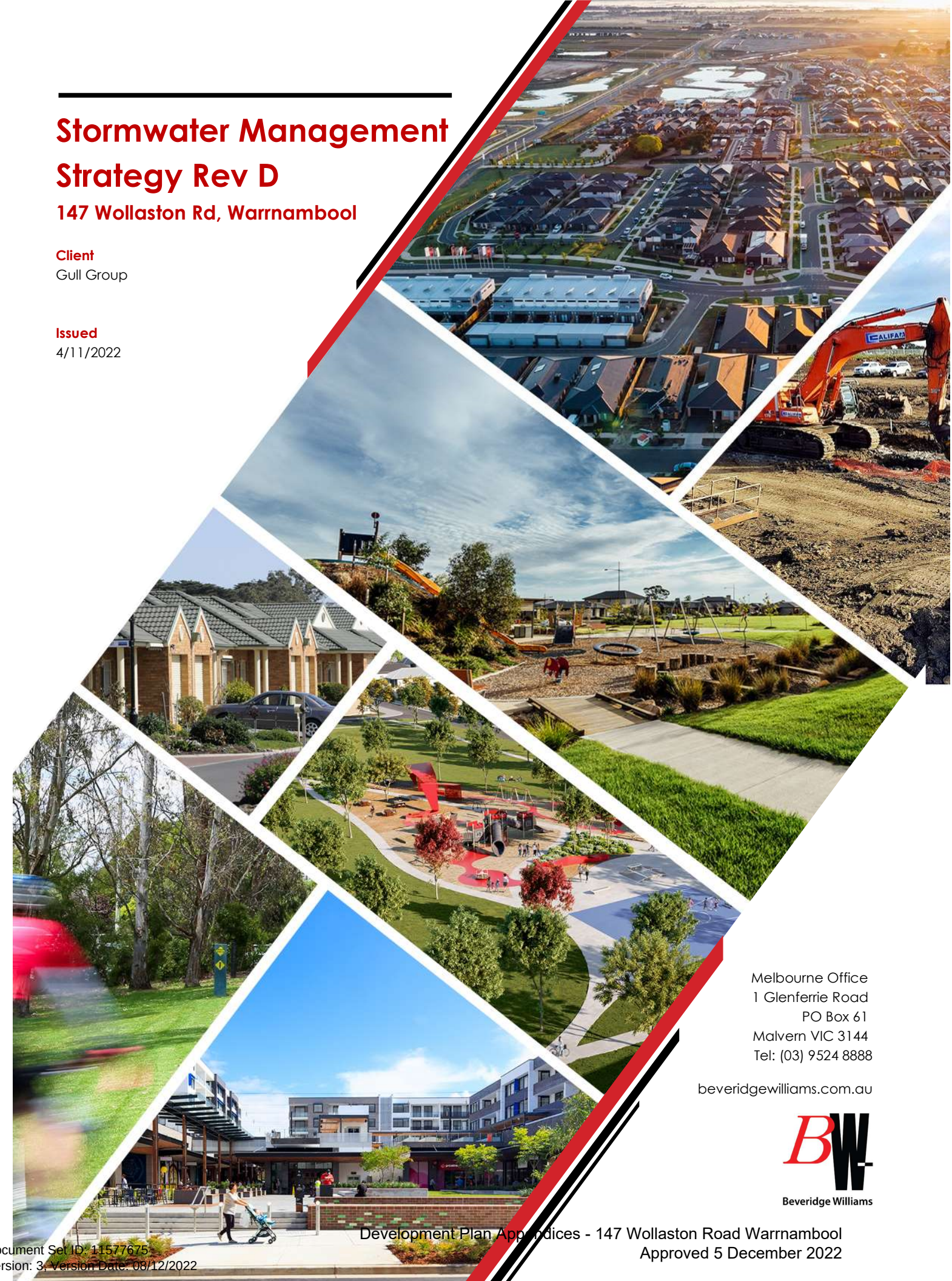
K:\JOBS DATA\2000243 - 147 WOLLASTON ROAD WARRNAMBOOL_UD\CAD\2000243_UD_BASE01.DWG

Stormwater Management Strategy Rev D

147 Wollaston Rd, Warrnambool

Client
Gull Group

Issued
4/11/2022



Melbourne Office
1 Glenferrie Road
PO Box 61
Malvern VIC 3144
Tel: (03) 9524 8888

beveridgewilliams.com.au

Beveridge Williams

Client:	Gull Group
Issued:	4/11/2022
Version:	D
Prepared by:	Lola Nurhalim
Checked by:	Aram Manjikian
Project Manager:	Antonia Erceg
Project Number:	2000243

Surveying
Asset Recording
Civil Engineering
Infrastructure Engineering
Traffic & Transport Engineering
Environmental Consulting
Water Resource Engineering
Strata Certification (NSW)
Town Planning
Urban Design
Landscape Architecture
Project Management

Revision Table

REV	DESCRIPTION	DATE	AUTHORISED
A	Drainage Strategy – 147 Wollaston Road, Warrnambool	**24/03/2020**	**RS**
B	Updated Master Plan Rev 07	**27/08/2021**	**RS**
C	Updated Master Plan Rev 08	**07/09/2021**	**RS**
D	Updated Master Plan Rev 09 – No technical change to drainage strategy	**04/11/2022**	**AE**

Contents

Tables

Figures

Appendix

Glossary of terms

Alphabetical list of terms and abbreviations used in report

AHD	Australian Height Datum A common national surface level datum approximately corresponding to mean sea level.
AEP	Annual Exceedance Probability. Probability of a flood event occurring in any year
AR&R	Australian Rainfall and Runoff
Authorities	Organisations responsible for supply and management of sewer, water, gas, electricity and telecommunications, roads and transport
BPEMG	Best Practice Environmental Management Guidelines
BWCo	Beveridge Williams & Co Pty Ltd
CMA	Glenelg Hopkins Catchment Management Authority
Client	Gull Group
Council	Warrnambool City Council
IDM	Infrastructure Design Manual
LSIO	Land Subject to Inundation Overlay
NTWL	Normal Top Water Level
Q_5	Storm water flow generated from 20% AEP storm event.
Q_{100}	Storm water flow generated from 1% AEP storm event.
Q_{gap}	Flow difference between Q_5 and Q_{100} storm event.
RB	Retardation Basin
WLRB	Wetland Retardation Basin
WSUD	Water Sensitive Urban Design

1 INTRODUCTION

Beveridge Williams has been commissioned by Gull Group to prepare a Stormwater Management Strategy (SWMS) for the proposed residential development site located at 147 Wollaston Road, Warrnambool. The total site area is 24.84 ha and is proposed to develop the land into a retirement village and 52 residential lots.

This SWMS report is intended to provide sufficient evidence that drainage strategy from the proposed development site can meet Stormwater Best Practice Environmental Management Guidelines (BPEMG) and to the satisfaction of Glenelg Hopkins CMA, Warrnambool City Council and other relevant authorities.

1.1. Site Overview

The subject site is located approximately 285 km west of Melbourne. It is located within the Warrnambool City Council municipality. The site is currently vacant land and is bounded by Wollaston Road to the north, existing residential area to the east, Merri River to the south and Merri River School to the west. There are a few existing rows of trees scattered around the site (Refer to Figure 1 below).

Figure 1: Site Aerial Map (Source: Near Map, Mar 2020)

2 EXISTING CONDITIONS

2.1. Topography

The Feature and Level plan shows the slopes generally descends from north east and north to south direction (Refer to Figure 2 below and Appendix A). The high points are located on the north east corner of the site, which is approximately RL 25 on the north east. The low points are located along the southern boundary (the bank of Merri River), which ranges from RL 3 to 4 (see Figure 2 below).

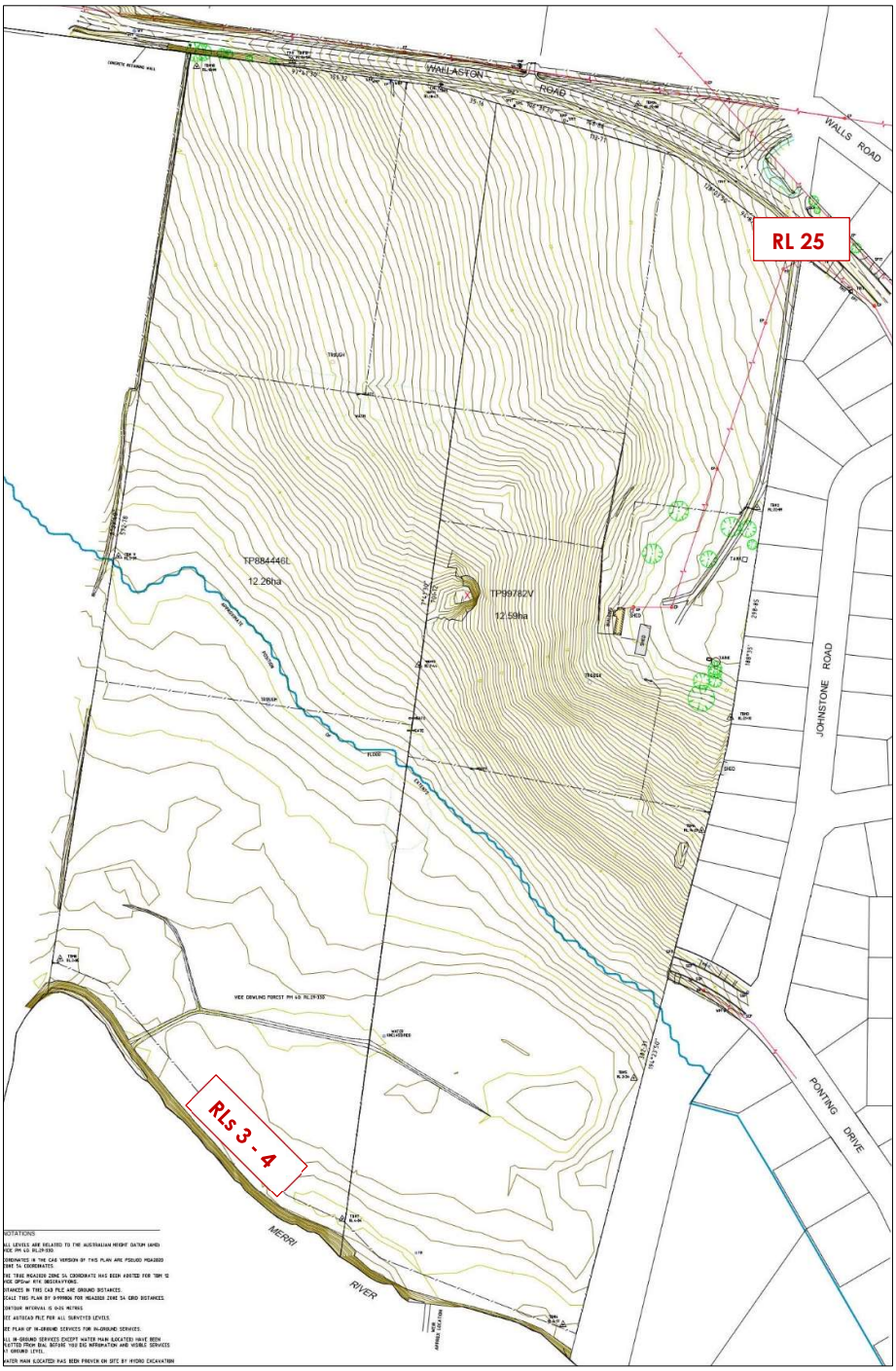


Figure 2: Feature & Level Survey (Not to scale)

2.2. Surface Water and Drainage

As previously mentioned in Section 2.1, the site generally slopes from north east and north towards to the south. The surface water flows are mainly directed to the Merri River on the south, as shown in Figure 3 below.

Figure 3: Site Drainage Analysis Plan (Not to scale)

3 DESIGN INTENT

3.1. Proposed Development

It is proposed to subdivide the land for residential development to 52 lots (total of 5 ha) with 700 m^2 average lot size and a retirement village site. The development also includes a wetland (with a sedimentation basin) and two retarding basins. The total net developable area is 23.48 ha (Refer to Figure 4 below and Appendix B for Indicative Master Plan).

The overall development area is limited by the floodway zone boundary, as shown on Figure 4. Both residential lots and retirement village sited will be located on the northern part, outside from the floodway zone.

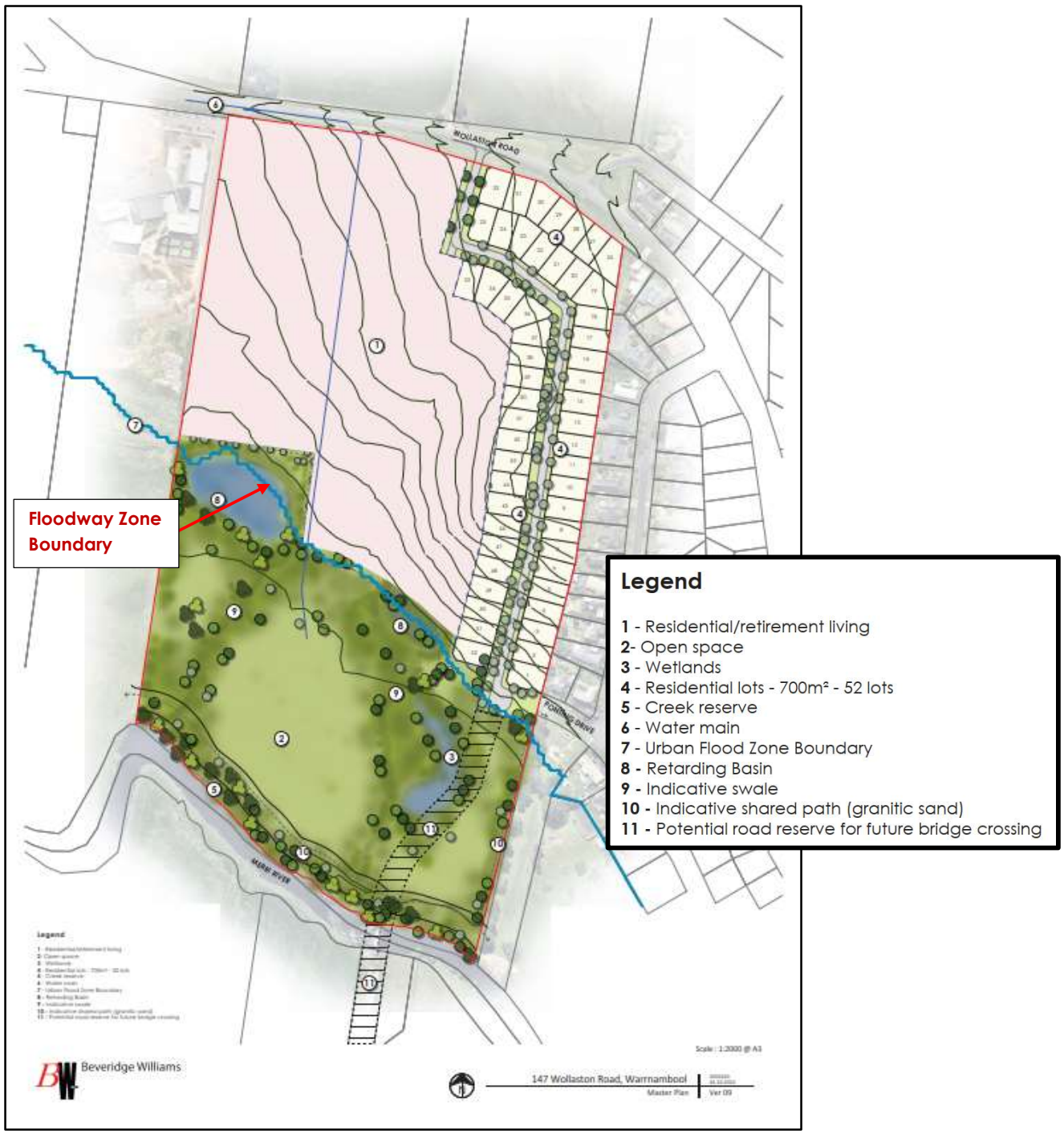


Figure 4: Indicative Master Plan Layout (Not to scale)

3.2. Proposed Stormwater Management Strategy

The proposed site's Stormwater Management Strategy is to follow the existing natural features of the pre-developed site.

For stormwater quantity management, it is proposed to provide two stormwater retardation basins (RBs) to the south of the retirement village residential area to detain the 1% AEP post development site flow to pre-development level.

For stormwater quality management, it is proposed to provide a sedimentation basin (SB) and a wetland system. Both stormwater treatment assets will be located within the available area located on the southern part of the site. The system will provide stormwater treatment for the proposed development site.

Details of both stormwater quantity and quality management are discussed in Sections 4 and 5 and Drainage Assets Location Plan is provided in Figure 5 below.

Figure 5: Drainage Assets Location Plan

4 STORMWATER QUANTITY MANAGEMENT

Details of stormwater quantity management are discussed in the following sections.

4.1. Pre- and Post- Development Catchment Plans

The pre-development and post-development catchment plans were developed to include the subject site and associated external catchment sites, as shown in Figures 6 and 7 (also in Appendix C). Each catchment plan shows with a series of sub-areas that indicate where stormwater discharges are channelled towards to southern direction (Merri River).

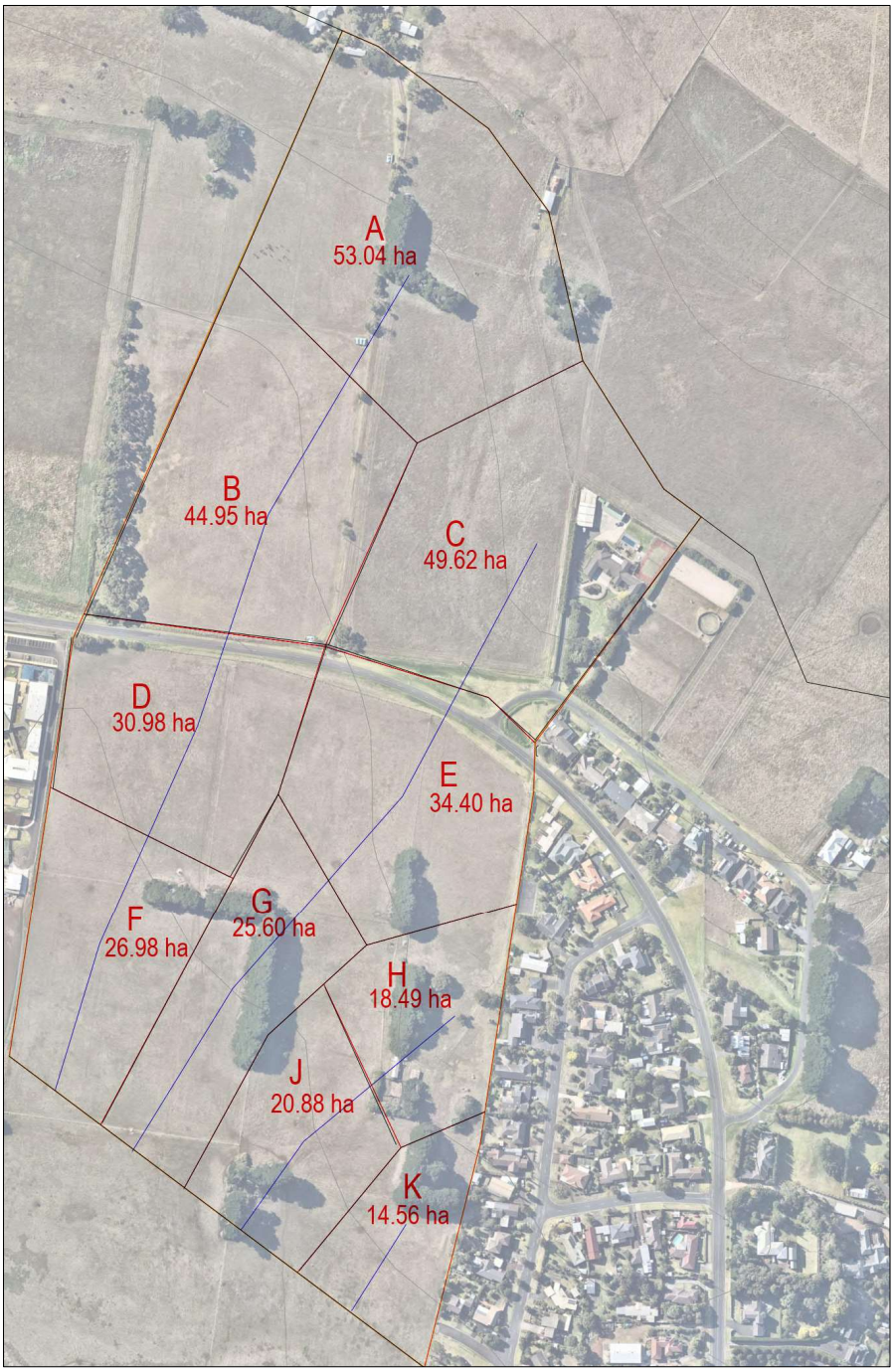


Figure 6: Pre-Development Catchment Plan

The post-development catchment plan shows that the flows are to be diverted towards the proposed retarding basins on the south prior to being discharged into Merri River. This plan was developed based on an Indicative Retirement Village Area Layout.

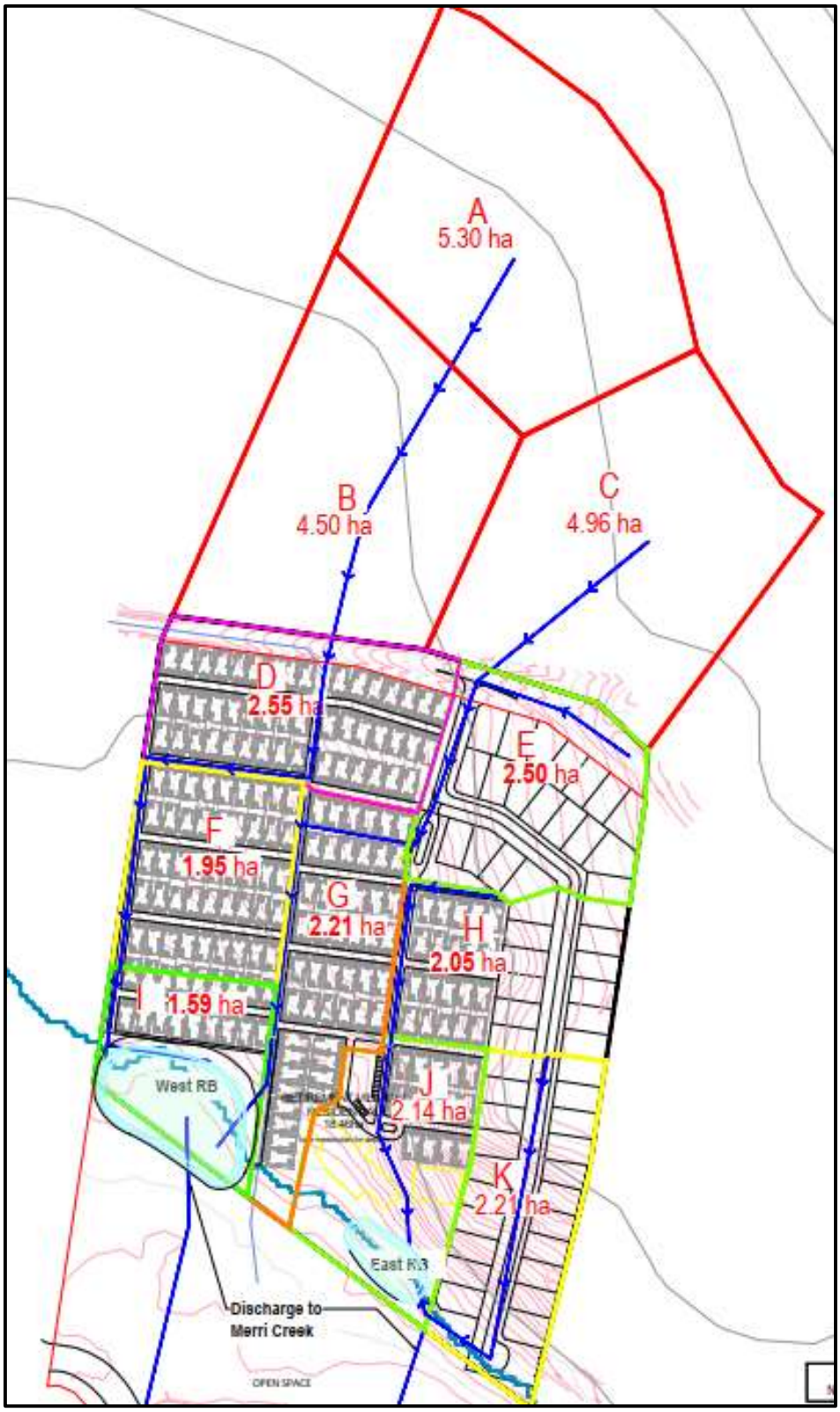


Figure 7: Post-development Catchment Plan (based on an Indicative Retirement Village Area Layout)

4.2. RORB Modelling

The hydrological analysis for the proposed development site was undertaken using RORB Runoff Routing Program modelling (in accordance with AR&R 2019) to determine the design flows for the pre-developed and post-developed scenarios. The RORB input parameters and results are provided as follows.

4.2.1. Losses

For this assessment, the losses adopted were derived from AR&R19 provided losses in the Datahub for rural catchments, as shown in Table 1.

Table 1: Model Losses

Type	Losses Type	Value
AR&R19 Provided Losses	Initial Losses (mm)	24
	Continuing Losses (mm/hr)	4.6

4.2.2. Kc Parameter

The k_c parameter for pre-development scenario was determined using the RORB default equation method. The k_c parameter for post-development scenario was calibrated by using a k_c to d_{av} ratio from the pre-development parameter. Details of these parameters are provided in Table 2.

Table 2: RORB Input Parameters

Parameter	Adopted Parameters for the Pre Development Scenario	Adopted Parameters for the Post-development Scenario
k_c	1.24	1.78
d_{av} (km)	0.39	0.56
m	0.80	0.80

4.2.3. Model Comparisons

To ensure RORB practicality, the Regional Flood Frequency Equation Method (RFFE) has been used to check the suitability of the hydrology assessment (pre-develop flow) as suggested by AR&R19 guidelines. The comparison in Table 3 shows a difference of approximately 68% between the RFFE and RORB Model (using the RORB default method generated Kc). This is considered not a suitable discrepancy between the two methods. The RFFE method is commonly more conservative to RORB modelling since the datasets RFFE extrapolates from have catchment areas ranging from 0.5-1000 km^2, which is far greater than our overall catchment area that is less than 0.5 km^2 (Refer to Appendix D for RFFE calculation results).

Therefore, another comparison has been made with ARR 16 Book 7, Chapter 6.2.1.3 (MAR>800mm) and as shown on Table 3 the difference is approximately 17%, which considered a more suitable discrepancy. Additionally, a comparison with Rational Method has also been made with difference of approximately 36%, which is considered another slightly suitable discrepancy.

Table 3: Calibration Check

Methodology	Peak Pre-Development Flow (m^3/s)
RORB Model	0.92
Rational Method	1.25
RFFE Method	0.29
ARR16 Book 7, Chapter 6.2.1.3 (MAR > 800mm, 21 catchments, 20 sq.km < A < 1924 sq.km	0.76

4.2.4. Sub-Catchment Area and Fraction Impervious

The RORB model sub-areas and fraction impervious used for this catchment modelling are provided in Table 4. The modelling includes associated external sub catchment areas to the north of the site (Refer to Figure 6).

Table 4: RORB Sub-Catchment Areas and Fraction Impervious

RORB Sub-Catchments and Fraction Impervious	
RORB Total Catchment Area:	31.96 ha
• *West RB Catchment*	*25.56 ha*
• *East RB Catchment*	*6.40 ha*
Total Catchment Area for the proposed development site (up to retarding basins)	17.20 ha
Total External Catchment Area	14.76 ha
Fraction Impervious for retirement village residential area (lot area < 300m^2)	0.75
Fraction Impervious for residential area (lot area 601 - 1,000m^2)	0.60
Fraction Impervious for reserve and external areas	0.10

4.3. 1% AEP Peak Flows Results and Detention Storage Volume

The results of 1% AEP pre-development and post-development peak flows and the required detention storage volume from the RORB modelling are shown in Table 5. Additionally, the results of pre-development flows from the external catchments are also shown in Table 5. The RORB models were run using the Ensemble method. Details of the RORB modelling results are shown in Appendix D.

Table 5: 1% AEP Post-development Flows and Detention Storage Volumes Required

	Peak Pre-Development Flow (m^3/s)	Peak Post-Development Flow (Total Inflow to RB) (m^3/s)	Peak Post-Development Flow (m^3/s) (Detention - Outflow from RBs)	Total Storage Volume Required for Detention (m^3)
External Catchment (West)	0.38 (2hr)	-	-	-
External Catchment (East)	0.28 (2 hr)	-	-	-
Total Catchment	0.92 (3 hr)	4.42 (20 min)	0.91 (4.5 hr)	6,140

The above peak flows and detention storage volumes results indicate that the 1% AEP post-development peak flows for the overall site can be detained to the pre-development level by providing a total detention storage of 6,140 m³. This will be provided through the two retarding basins (RBs), the West RB with volume of 4,980 m³ and the East RB with volume of 1,160 m³.

4.4. Flow Hydrographs Comparison with Merri River

Peak-flow hydrographs for the development site (outlet from the RBs) and Merri River at the upstream boundary (taken from Design of North Warrnambool Floodplain Management Plan, prepared by Cardno for Glenelg Hopkins CMA & Warrnambool City Council, October 2010) are compared to analyse the peak-flow events for the 1% AEP flow. Both hydrographs (shown in Figures 8 and 9) clearly indicate that the peak flows occur at different rainfall events and times.

Peak flow from subject site (RB outlets) (0.91 m^3/s @4.5 hr-median flow result) occur before peak flow of the Merri River (approximately 430 m^3/s @25 hr). The location of Merri River adjacent to the subject site is further downstream from the flood study shown on Figure 9. That means that the peak flow further downstream occurs later than 25 hr and therefore, the peak flow from the subject site will not increase the peak flow discharge at Merri River.

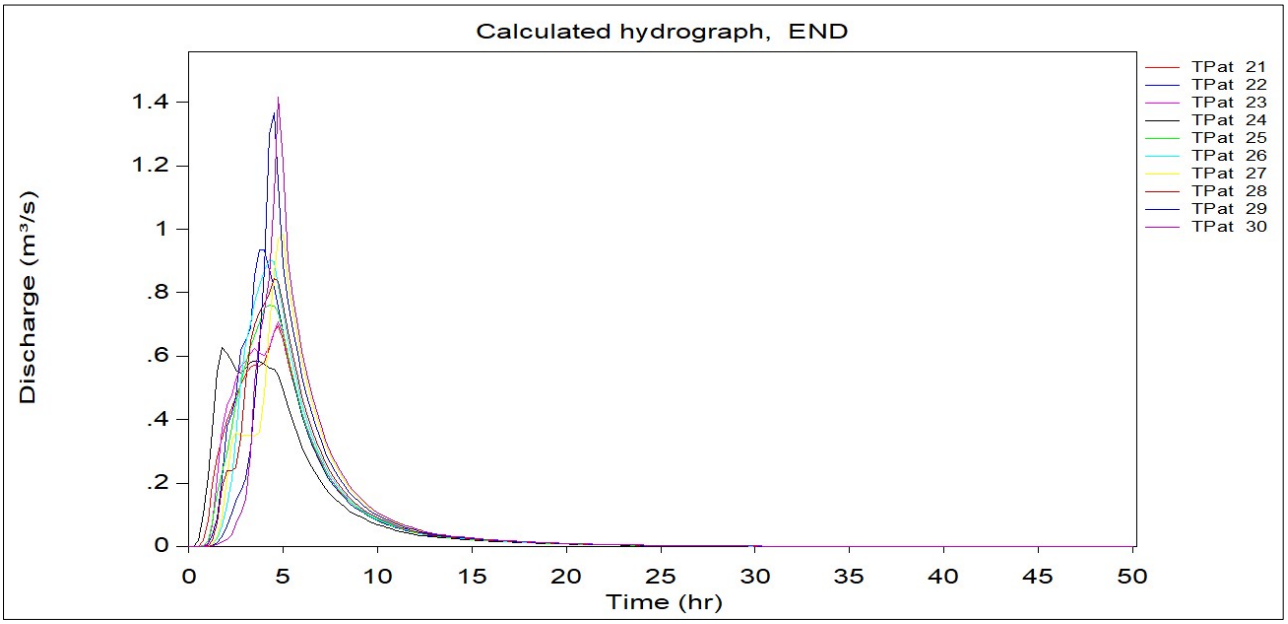


Figure 8: Hydrograph for the Development Site – Outlet from the RBs

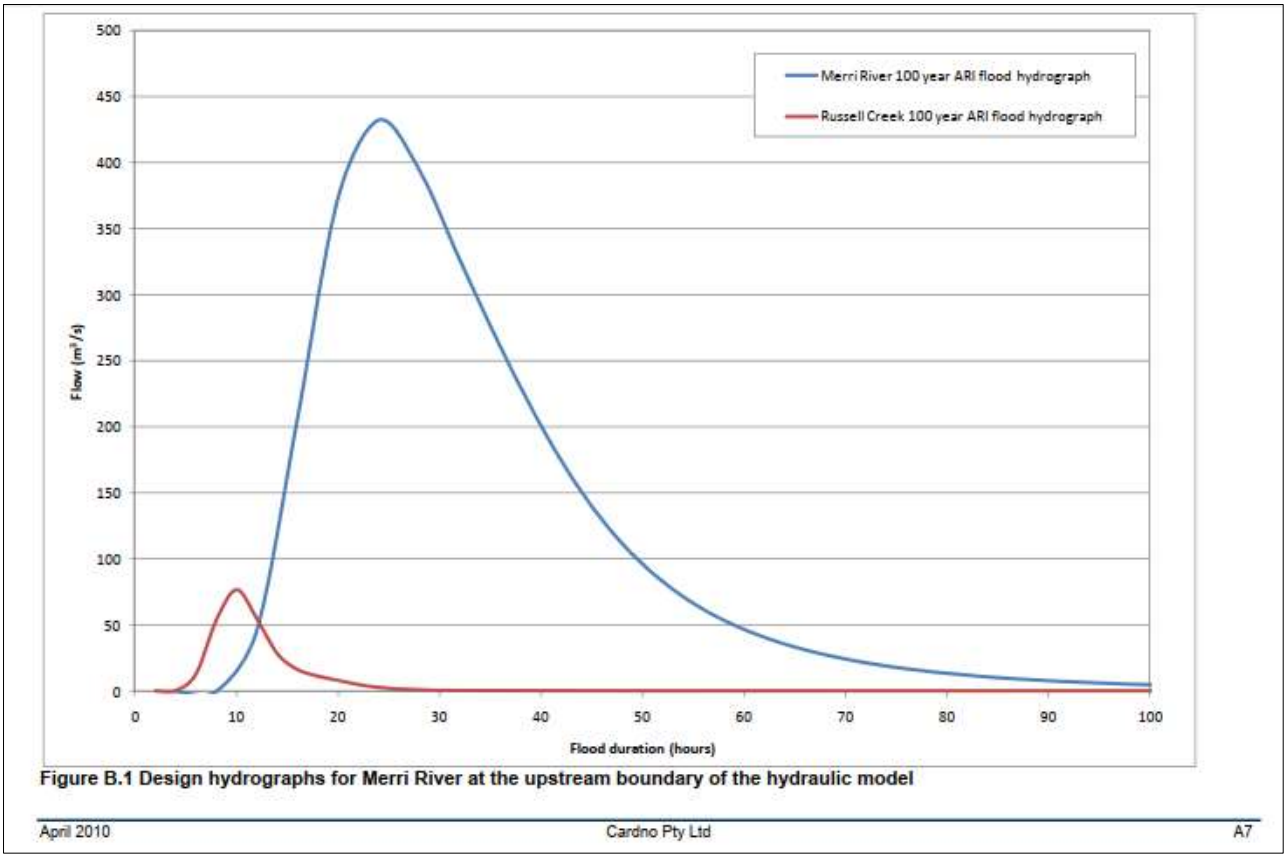


Figure 9: Hydrograph for Merri River at the Upstream Boundary (Source: Design of North Warrnambool Floodplain Management Plan, Cardno, October 2010)

4.5. Gap Flow

Gap flow, which is the difference between 1% AEP and 20% AEP post-development flows, was calculated for the biggest sub-catchments area contributing to the West RB, which contributes to West RB Inflow 1 (Refer to Figure 10 in Section 4.7). These sub-catchments have a total area of 15.89 Ha, including associated external catchment area. The calculations are included in Appendix C and the results are shown in Table 6 below. These flows are the basis for the road reserve capacity assessment, which is further discussed in Section 4.7.

Table 6: Gap Flows

	1% AEP Flow (m^3/s)	20% AEP Flow (m^3/s)	Gap Flow (m^3/s)
Sub-catchments to the West RB Inflow 1	1.66	0.76	0.90

4.6. Subsurface Drainage

The legal drainage point for the overall catchment will be to Merri River to the south. The subsurface drainage network for the development will convey all pipe flows to the outlet location, via the proposed stormwater quality treatment facilities (a sedimentation basin and a wetland) on the southern part of the available drainage area (Refer to Figure 4 in Section 3.2). The pipe network will be adequately sized to convey the 20% AEP flows throughout the proposed development's drainage network.

In addition, there are external catchment areas to the external north that will be directed to the proposed sub-surface drainage network.

4.7. Subject Site Overland Flow

Overland flows from the subject site will be directed via the proposed subdivisional roads to the proposed two retarding basins on the south (Refer to Figure 10). The overland flow path plan (Figure 10) was developed based on an Indicative Retirement Village Area Layout.

The internal roads for the development, and associated lot finished surface levels, will be designed to ensure that the 1% AEP overland flows through the site are within the safe hydraulic capacity of road floodway.

Figure 10: Indicative Overland Flow Path Plan (based on an Indicative Retirement Village Area Layout) (Not to Scale)

PC Convey Assessment

The internal roads or overland flow path within the proposed site development and associated lot finished surface levels will be designed to ensure that the 1% AEP overland flows through the site are within the safe hydraulic capacity of road floodway. A PC Convey assessment for the overland flow path adjacent to the West RB Inflow 1 location (Refer to Figure 10) has been undertaken to demonstrate that gap flow of 0.90 m^3/s for the designated sub-catchments can be contained within the overland flow path.

A typical cross section of the overland flow path is shown in Figure 11 and the calculation result is included in Appendix E. The section location was chosen based on where the largest peak flow would be expected to provide the most conservative result.

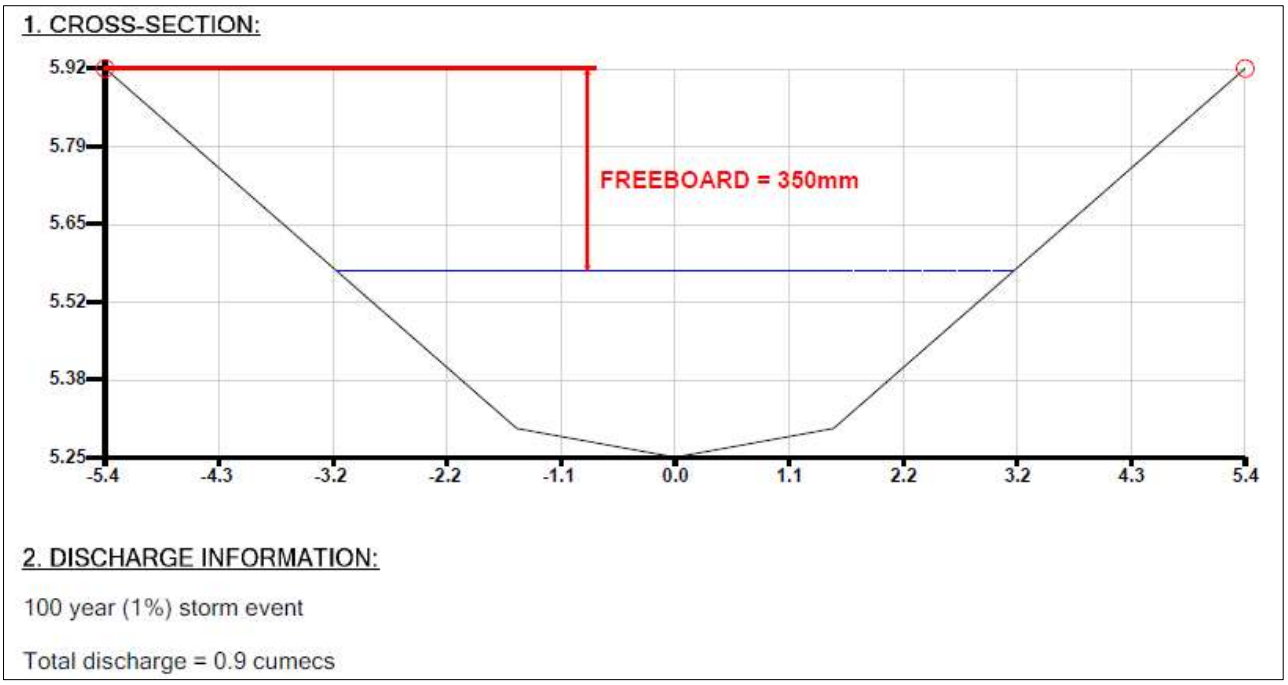


Figure 11: PC Convey Result for Proposed Development Site

As shown on above, the gap flow of 0.90 m^3/s can be contained within the typical 10 m overland flow path reserve with 350 mm freeboard. In addition, the average velocity (Vav) m/s x average depth (dav) is 0.15 m^2/s, which is less than 0.35 m^2/s and an average depth (dav) of 0.21 m, which is less than 0.30 m. The Vav is 0.71 m/s which is less than 1.5 m/s. Therefore, the gap flow is within recommended safety limits.

4.8. Sizing of the Retarding Basins and Outlets

Details of the proposed retarding basins for are provided in Table 7 below and a plan of indicative locations of the RBs is provided in the previous Figure 10 in section 4.7. Concept plans of the RBs are shown on Figure 12 and Figure 13. The overall concept layout plan is shown in Appendix F.

Table 7: Details of Retarding Basin

Retarding Basin	Outlet Control	Storage	Batter Slope
West RB	• Spillway 1 – 0.7 m length at the base level (RL 3.2m AHD) • Spillway 2 –10 m length at RL 3.9 m AHD	4,980 m^3	1 in 5
East RB	• Spillway 1 – 0.3 m length at the base level (RL 3.6m AHD) • Spillway 2 –10 m length at RL 4.4 m AHD	1,160 m^3	1 in 5

Outlets from both retarding basins will be conveyed to Merri Creek via swales or proposed outlet weirs throughout the available drainage area.

The retarding basins will be designed in accordance with Melbourne Water's Retarding Basin Guidelines and IDM (Infrastructure Design Manual), where applicable. The design of the retarding basins, including the outlets configuration will be undertaken during the functional and detailed design phases of the project.

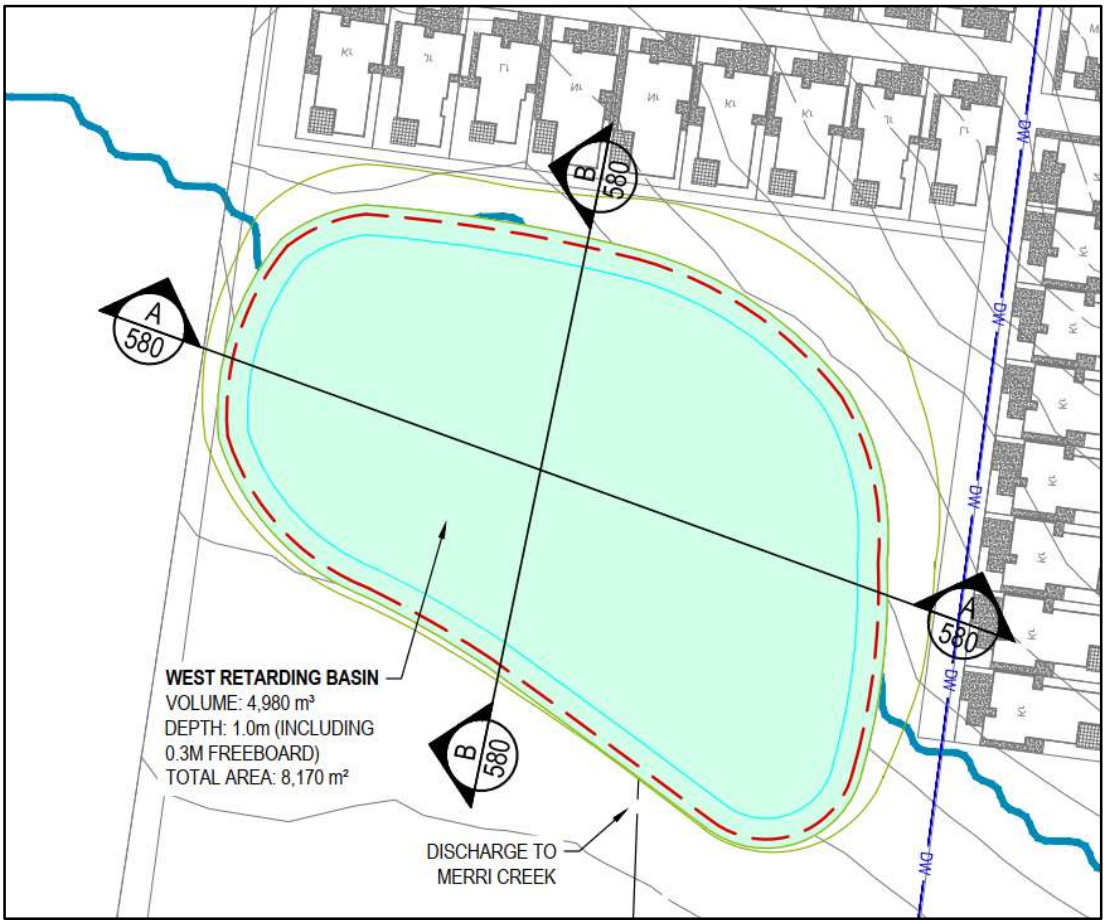


Figure 12: West RB Concept Layout Plan

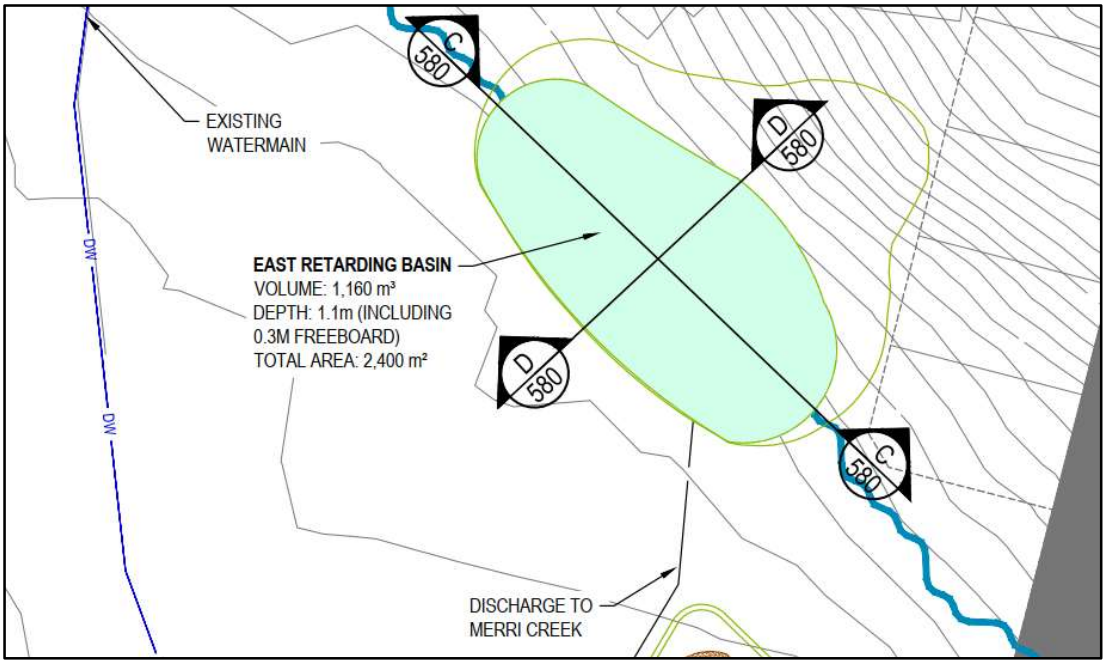


Figure 13: East RB Concept Layout Plan

5 STORMWATER QUALITY MANAGEMENT

It is a Victorian Government requirement that Quality of stormwater runoff from the proposed development meets the Urban Stormwater Best Practice Environmental Management Guidelines (BPEMG), which are required under Clause 56 of the Victorian Planning Provisions (VPP). The targets are:

- 70% removal of the Total Gross Pollutant Load (Litter)
- 80% removal of Total Suspended Solids (TSS)
- 45% removal of Total Phosphorus (TP)
- 45% removal of Total Nitrogen (TN)

Stormwater quality modelling was conducted using MUSIC (Model for Urban Stormwater Improvement Conceptualisation) for the development site. The weather station used was obtained from the BOM (Bureau of Meteorology) website (www.bom.gov.au) and located at Warrnambool Racecourse, which is approximately 4 km away from the subject site. The rainfall data ranges from 1950-2010.

The layout of the MUSIC Model is shown in Figure 14 and results of the MUSIC model are shown in Table 8. The stormwater treatment assets include a sedimentation basin and a wetland located on the south of the East RB, within the available draiange area. Low flows from the two RB's will be directed to the sediment basin, and high flows will bypass the treatment assets to protect them from high velocities.

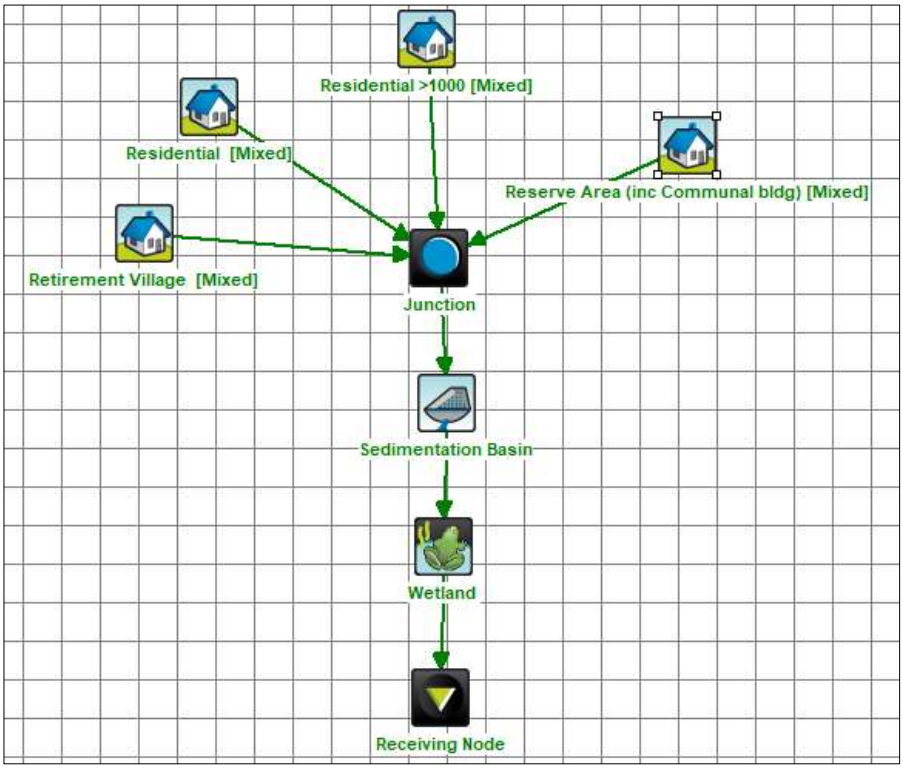


Figure 14: MUSIC Model Layout

Table 8: MUSIC Model Result

Site Treatment	BPEMG Target % Removal	% Removal
Total Suspended Solids (Kg/yr)	80	92.9
Total Phosphorus (Kg/yr)	45	75.9
Total Nitrogen (Kg/yr)	45	45.0
Gross Pollutants (Kg/yr)	100	100.0

As shown above, the proposed sedimentation basin and wetland meet the best practice BPEMG standard for the site development area.

Details of stormwater treatments assets are shown in Table 9 and the concept layout plan of both assets is shown on previous Figure 15 (also in Appendix F). Both sedimentation basin and wetland will be designed in accordance with Melbourne Water's Retarding Basin Guidelines and IDM (Infrastructure Design Manual), where applicable.

Table 9: Details of Sedimentation Basin and Wetland

Location	Catchment Area	Asset	Surface Area
Development site	17.20 ha	Wetland	2,000 m²
		Sedimentation Basin	500 m²
		Sediment Dry Out Area	640 m²

Outlet from the wetland will be conveyed to Merri Creek via swales/pipes throughout the available drainage area.

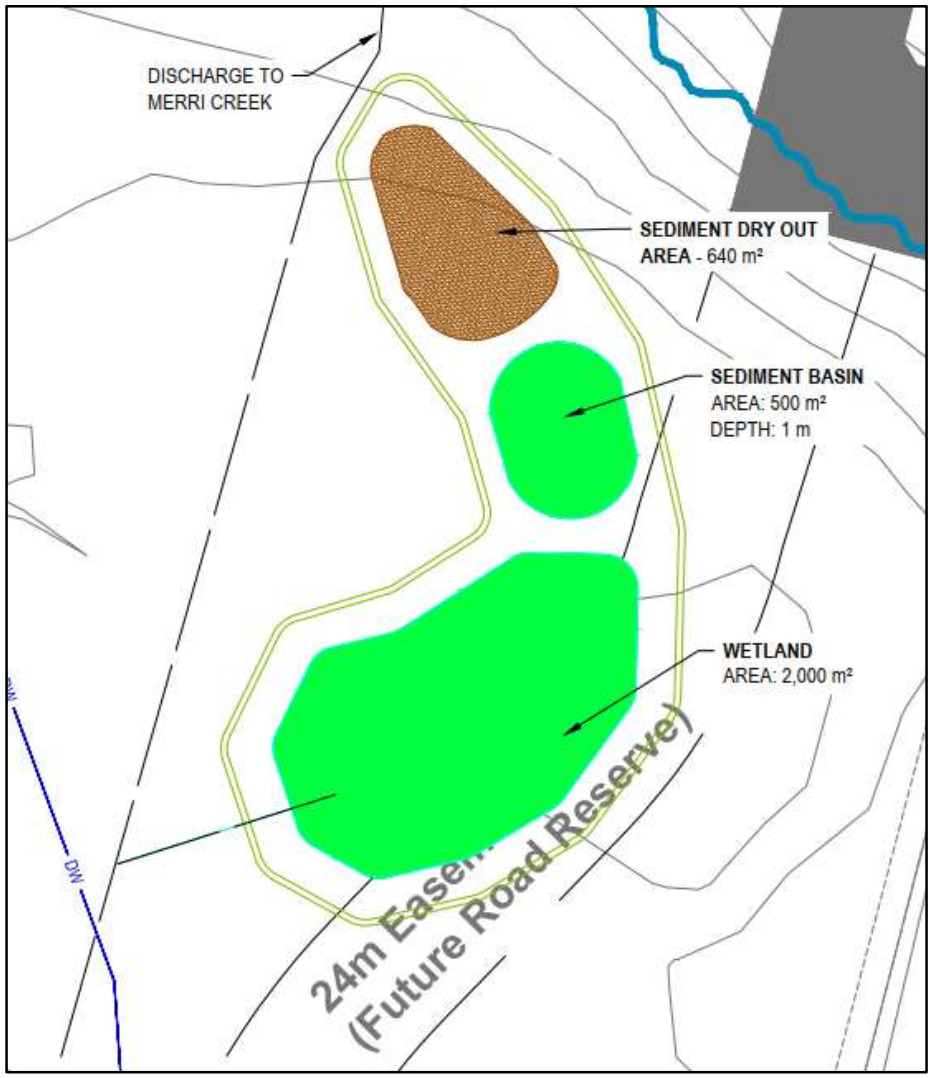


Figure 15: Sedimentation Basin and Wetland Concept Layout Plan

6 CONCLUSION

This report has identified an overall drainage management strategy for the proposed residential development at 147 Wollaston Road, Warrnambool. The strategy provides a methodology for the management of stormwater on the subject site, which would result in:

- Conveyance of catchment flows through the site in accordance with the Glenelg Hopkins Catchment Management Authority Floodway Criteria.
- Construction of drainage to meet the requirements of CMA and Council, including 1% AEP capacity road reserves and underground drainage for the 20% AEP storm event as required.
- Stormwater detention for the development site to detain 1% AEP post-development flow to pre-development level is provided through the proposed two retarding basins with volumes of 4,980 m^3 and 1,1600 m^3 for each.
- Stormwater quality treatment system required to meet BPMEG standard will be provided through the proposed a 500 m^2 sedimentation basin and a 2,000 m^2 wetland system located on the southern part of the site.

The above strategy can be implemented, and all the CMA's and Council's development requirements can be achieved, with no net effect on the downstream properties.

BEVERIDGE WILLIAMS & CO PTY LTD

Prepared by	Reviewed by
Lola Nurhalim *Senior Water Resources Engineer*	*Aram Manjikian* *Water Resources Engineering Manager*

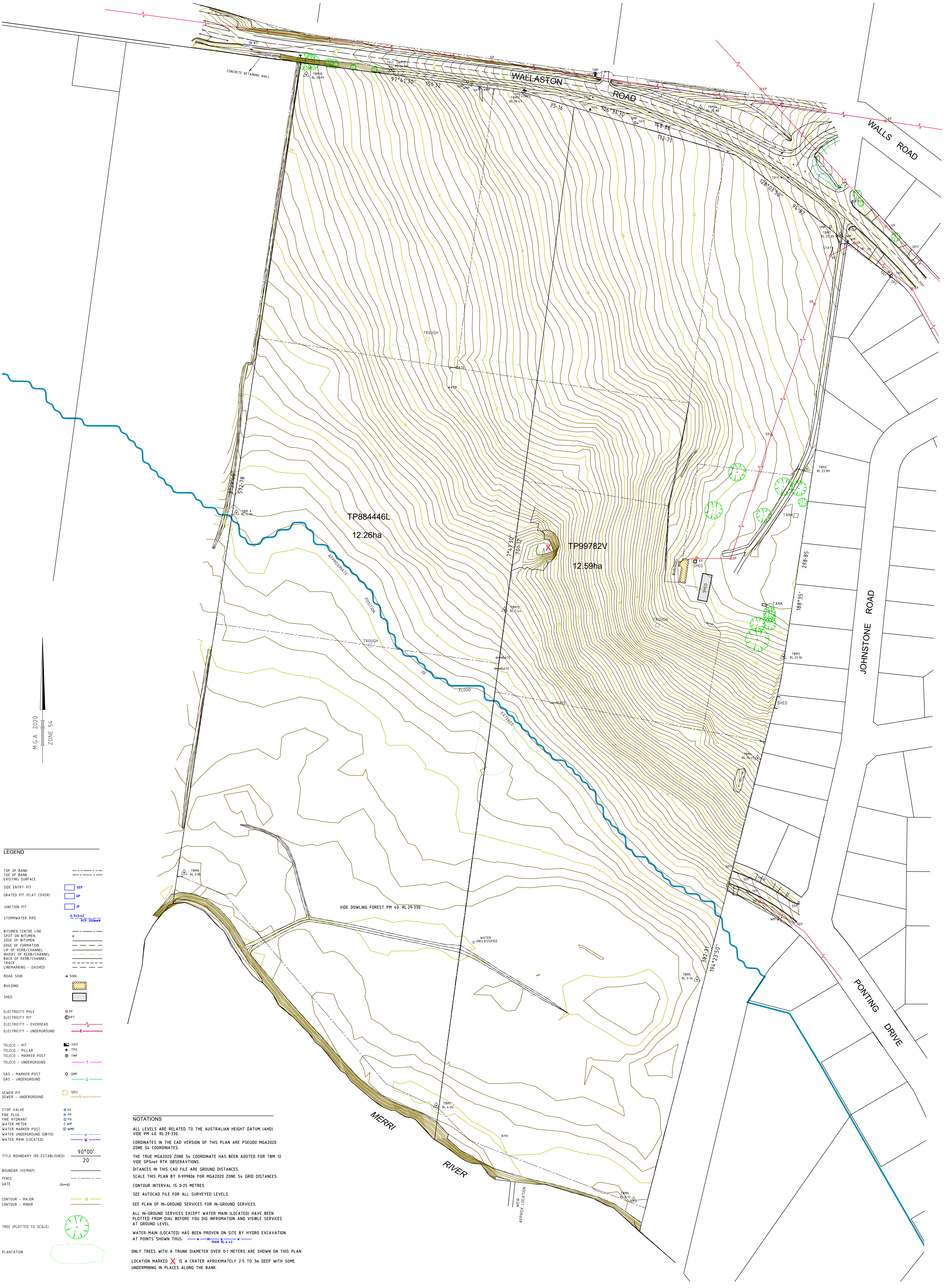
Approved for issue by

Antonia Erceg
Project Manager

7 REFERENCE

Design of North Warrnambool Floodplain Management Plan – Implementation Works, RM3309 v1.0 Final, Prepared for City of Warrnambool, Cardno (October 2010)

APPENDIX A: FEATURE AND LEVEL SURVEY PLAN



LEGEND

TOP OF BANK	
TOE OF BANK	
EXISTING SURFACE	
SIDE ENTRY PIT	SEP
GRATED PIT (FLAT COVER)	GP
JUNCTION PIT	JP
STORMWATER PIPE	IL:540·42 RCP 300mmΦ
BITUMEN CENTRE LINE	
SPOT ON BITUMEN	+
EDGE OF BITUMEN	
EDGE OF FORMATION	
LIP OF KERB/CHANNEL	
INVERT OF KERB/CHANNEL	
BACK OF KERB/CHANNEL	
TRACK	
LINEMARKING - DASHED	
ROAD SIGN	SIGN
BUILDING	▨
SHED	▢
ELECTRICITY POLE	EP
ELECTRICITY PIT	EPT
ELECTRICITY - OVERHEAD	
ELECTRICITY - UNDERGROUND	E
TELECO - PIT	TPIT
TELECO - PILLAR	TPIL
TELECO - MARKER POST	TMP
TELECO - UNDERGROUND	T
GAS - MARKER POST	GMP
GAS - UNDERGROUND	G
SEWER PIT	SPIT
SEWER - UNDERGROUND	S
STOP VALVE	SV
FIRE PLUG	FP
FIRE HYDRANT	FH
WATER METER	WM
WATER MARKER POST	WMP
WATER UNDERGROUND (DBYD)	W
WATER MAIN (LOCATED)	W
TITLE BOUNDARY (RE-ESTABLISHED)	90°00' 20
BOUNDAR (VICMAP)	
FENCE	
GATE	
CONTOUR - MAJOR	10
CONTOUR - MINOR	
TREE (PLOTTED TO SCALE)	
PLANTATION	

NOTATIONS

ALL LEVELS ARE RELATED TO THE AUSTRALIAN HEIGHT DATUM (AHD) VIDE PM 40: RL:29·330.

CORDINATES IN THE CAD VERSION OF THIS PLAN ARE PSEUDO MGA2020 ZONE 54 COORDINATES.

THE TRUE MGA2020 ZONE 54 COORDINATE HAS BEEN ADOTED FOR TBM 12 VIDE GPSnet RTK OBSERAVTIONS.

DITANCES IN THIS CAD FILE ARE GROUND DISTANCES.

SCALE THIS PLAN BY 0·999806 FOR MGA2020 ZONE 54 GRID DISTANCES.

CONTOUR INTERVAL IS 0·25 METRES

SEE AUTOCAD FILE FOR ALL SURVEYED LEVELS.

SEE PLAN OF IN-GROUND SERVICES FOR IN-GROUND SERVICES.

ALL IN-GROUND SERVICES EXCEPT WATER MAIN (LOCATED) HAVE BEEN PLOTTED FROM DIAL BEFORE YOU DIG INFROMATION AND VISIBLE SERVICES AT GROUND LEVEL.

WATER MAIN (LOCATED) HAS BEEN PROVEN ON SITE BY HYDRO EXCAVATION AT POINTS SHOWN THUS: MAIN RL:4·43

ONLY TREES WITH A TRUNK DIAMETER OVER 0·1 METERS ARE SHOWN ON THIS PLAN.

LOCATION MARKED X IS A CRATER APROXIMATELY 2·5 TO 3m DEEP WITH SOME UNDERMINING IN PLACES ALONG THE BANK.

CAD REFERENCE: 2000243fs.dwg

VER	BY	AMENDMENTS	DATE

SURVEYOR: SW, PJ, SG, SM

DRAWN: SM

CHECKED: SM

SURVEYORS REF. 2000243

VERSION 01

DATE

SHEET 1 OF 2

ORIGINAL SCALE 1:800 SHEET SIZE A0

0 8 16 24 32

LENGTHS ARE IN METRES

Beveridge Williams
development & environment consultants
96 Main Road Ballarat
PO Box 1465 Bakery Hill 3354
Ph:53272000 Fax:53272099
www.beveridgewilliams.com.au

NOTATIONS

PROJECT: 147 WOLLASTON ROAD WARRNAMBOOL LOT 1 TP884446L LOT 1 TP99782V

DETAILS: PLAN OF FEATURE & RE-ESTABLISHMENT SURVEY

APPENDIX B: INDICATIVE MASTER PLAN

Legend

1 - Residential/retirement living
2- Open space
3 - Wetlands
4 - Residential lots - 700m² - 52 lots
5 - Creek reserve
6 - Water main
7 - Urban Flood Zone Boundary
8 - Retarding Basin
9 - Indicative swale
10 - Indicative shared path (granitic sand)
11 - Potential road reserve for future bridge crossing

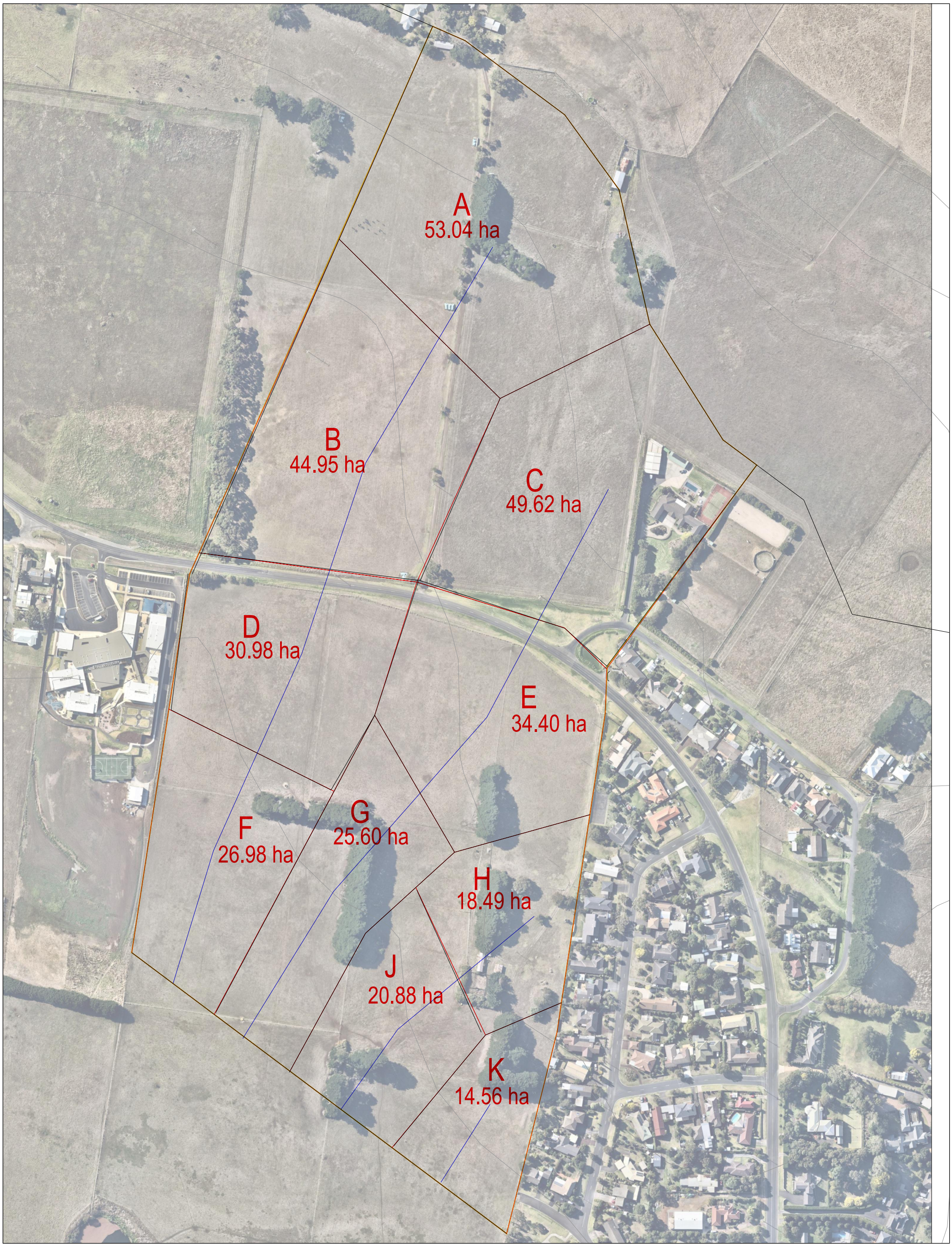
Scale : 1:2000 @ A3

Beveridge Williams

147 Wollaston Road, Warrnambool | 2000243 26.10.2022
Master Plan | Ver 09

Development Plan Appendices - 147 Wollaston Road Warrnambool
Approved 5 December 2022

APPENDIX C: CATCHMENT PLANS



PRELIMINARY PRINT
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRN.	APP.

Designed	ZOE O'HARA
Date	31.07.20
Drawn	ZOE O'HARA
Approved	A.MANJIKIAN
Date	31.08.20
PS Number	PS

Beveridge Williams
1 Glenferrie Road
Malvern VIC 3144
ph: 03 9524 8888
www.beveridgewilliams.com.au

Project Details	147 WOLLASTON ROAD, WARRNAMBOOL GULL GROUP WARRNAMBOOL CITY COUNCIL
Drawing Title	DRAINAGE STRATEGY PRE DEVELOPMENT CATCHMENT PLAN

Sheet 01 of 1
Scale NOT TO SCALE

Project Ref	Stage No	Drawing No	Rev
2000243	00	1	P0

N

Development Plan Appendices - 147 Wollaston Road Warrnambool

K:\Jobs\2000243 147 Wollaston Road Warrnambool\Design\Civil\Drawings\Catchment Plan\2000243-CP-PREDEV.dwg

A
5.30 ha

B
4.50 ha

C
4.96 ha

D
2.55 ha

E
2.50 ha

F
1.95 ha

G
2.21 ha

H
2.05 ha

I
1.59 ha

J
2.14 ha

K
2.21 ha

West RB

East RB

RETIREMENT VILLAGE/
RESIDENTIAL
18.46ha
(see masterplan for details)

Discharge to
Merri Creek

OPEN SPACE

PRELIMINARY PRINT
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRN.	APP.

Designed	L. NURHALIM
Date	04.03.21
Drawn	L. NURHALIM
Approved	A.MANJIKIAN
Date	11.03.21
PS Number	PS

Beveridge Williams
1 Glenferrie Road
Malvern VIC 3144
ph: 03 9524 8888
www.beveridgewilliams.com.au

Project Details: 147 WOLLASTON ROAD, WARRNAMBOOL
GULL GROUP
WARRNAMBOOL CITY COUNCIL

Drawing Title: DRAINAGE STRATEGY
POST DEVELOPMENT CATCHMENT PLAN

Sheet 01 of 1

Scale: NOT TO SCALE

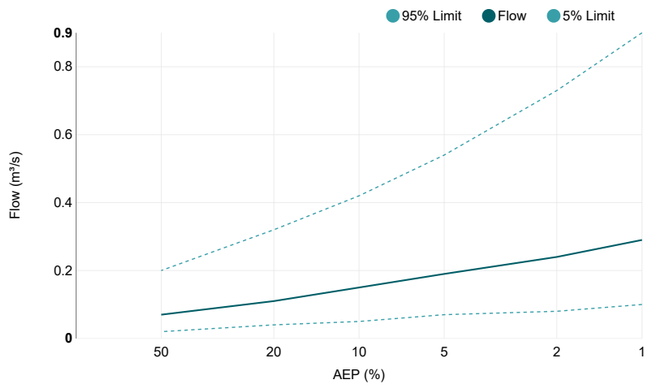
N

Project Ref	Stage No	Drawing No	Rev
2000243	00	1	P1

\\MelSto01\Projects\2000243 147 Wollaston Rd Warrnambool\Drawings\Development Plan\2000243-CP-POSTDEV V2.dwg

APPENDIX D: RORB AND RFFE RESULTS

Results | Regional Flood Frequency Estimation Model



*The catchment is outside the recommended catchment size of 0.5 to 1,000 km^2. Results have lower accuracy and may not be directly applicable in practice.

AEP (%)	Discharge (m^3/s)	Lower Confidence Limit (5%) (m^3/s)	Upper Confidence Limit (95%) (m^3/s)
50	0.0700	0.0200	0.200
20	0.110	0.0400	0.320
10	0.150	0.0500	0.420
5	0.190	0.0700	0.540
2	0.240	0.0800	0.730
1	0.290	0.100	0.900

Statistics

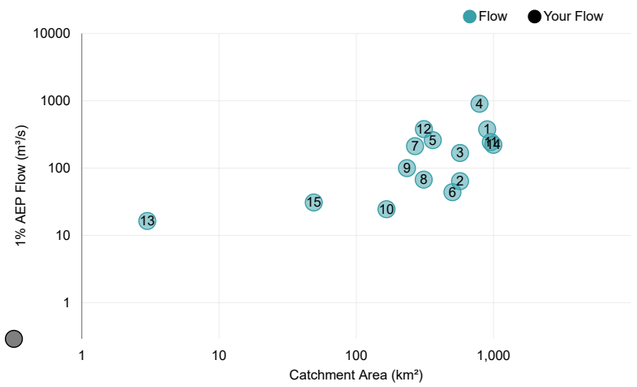
Variable	Value	Standard Dev
Mean	-2.909	0.678
Standard Dev	0.603	0.207
Skew	0.101	0.032

Note: These statistics come from the nearest gauged catchment. Details.

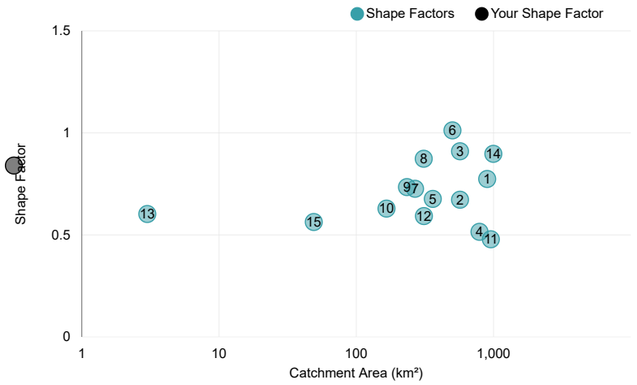
Correlation		
1.000		
-0.330	1.000	
0.170	-0.280	1.000

Note: These statistics are common to each region. Details.

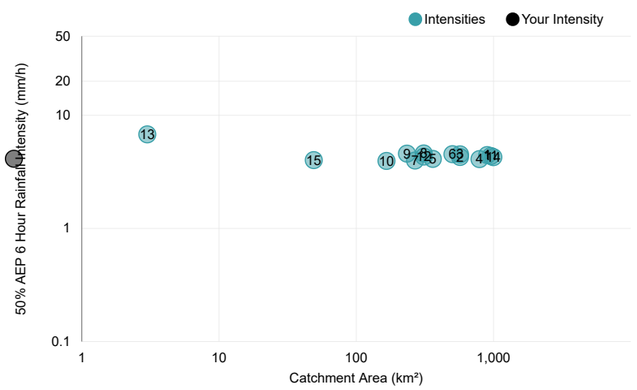
1% AEP Flow vs Catchment Area



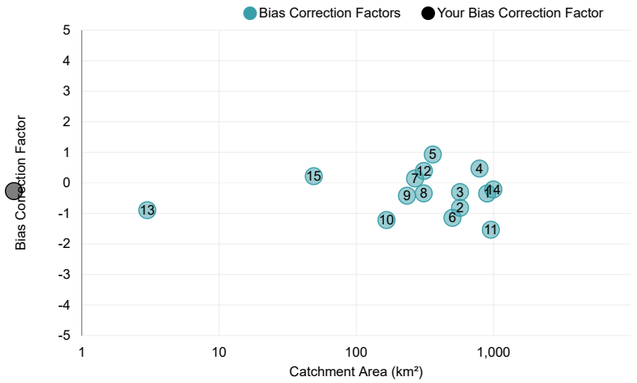
Shape Factor vs Catchment Area



Intensity vs Catchment Area



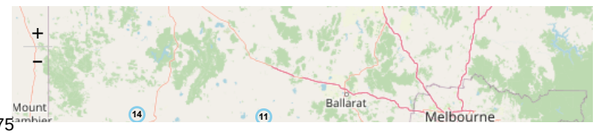
Bias Correction Factor vs Catchment Area



Download

TXT Nearby JSON

Input Data	
Date/Time	2021-03-18 14:50
Catchment Name	Catchment1
Latitude (Outlet)	-38.361
Longitude (Outlet)	142.483
Latitude (Centroid)	-38.357
Longitude (Centroid)	142.485
Catchment Area (km^2)	0.32*
Distance to Nearest Gauged Catchment (km)	4.57
50% AEP 6 Hour Rainfall Intensity (mm/h)	4.129825
2% AEP 6 Hour Rainfall Intensity (mm/h)	10.448288
Rainfall Intensity Source (User/Auto)	Auto
Region	East Coast
Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	0.84
Interpolation Method	Natural Neighbour
Bias Correction Value	-0.27



Method by Dr Ataur Rahman and Dr Khaled Haddad from Western Sydney University for the Australian Rainfall and Runoff Project. Full description of the project can be found at the project page (http://arr.ga.gov.au/revision-projects/project-list/projects/project-5) on the ARR website. Send any questions regarding the method or project here (mailto:admin@arr-software.org).

ENGINEERS AUSTRALIA (http://www.engineersaustralia.org.au)

WESTERN SYDNEY UNIVERSITY (http://www.uws.edu.au)

RORBWin Batch Run Summary
****

Program version 6.45 (last updated 20th March 2019)
Copyright Monash University and Hydrology and Risk Consulting

Date run: 04 Mar 2021 12:09

Catchment file   : K:\Jobs Data\2000243 - 147 Wollaston Road Warrnambool_Wat\Models\RORB\Pre Dev\2000243-PREDEV.catg
Rainfall location: User defined
Temporal pattern : ARR2016 point temporal patterns
Spatial pattern : Uniform
Areal Red. Fact. : Based on ARR 2016 (Book 2 Chapter 4)
Loss factors   : Constant with ARI

Parameters: kc =   1.24   m = 0.80

Loss parameters	Initial loss (mm)	Cont. loss (mm/h)
	24.00	4.60

Peak	Description
01	Calculated hydrograph, END

Run	Duration	AEP	TPat	Rain(mm)	ARF	Peak0001
1	10 min	1%	21	22.00	1.00	0.0543
1	10 min	1%	22	22.00	1.00	0.0543
1	10 min	1%	23	22.00	1.00	0.0543
1	10 min	1%	24	22.00	1.00	0.0543
1	10 min	1%	25	22.00	1.00	0.0543
1	10 min	1%	26	22.00	1.00	0.0543
1	10 min	1%	27	22.00	1.00	0.0543
1	10 min	1%	28	22.00	1.00	0.0543
1	10 min	1%	29	22.00	1.00	0.0543
1	10 min	1%	30	22.00	1.00	0.0543
2	15 min	1%	21	26.80	1.00	0.1759
2	15 min	1%	22	26.80	1.00	0.1758
2	15 min	1%	23	26.80	1.00	0.1759
2	15 min	1%	24	26.80	1.00	0.1759
2	15 min	1%	25	26.80	1.00	0.1759
2	15 min	1%	26	26.80	1.00	0.1759
2	15 min	1%	27	26.80	1.00	0.1759
2	15 min	1%	28	26.80	1.00	0.1759
2	15 min	1%	29	26.80	1.00	0.1759
2	15 min	1%	30	26.80	1.00	0.1759
3	20 min	1%	21	30.10	1.00	0.3055
3	20 min	1%	22	30.10	1.00	0.3056
3	20 min	1%	23	30.10	1.00	0.3048
3	20 min	1%	24	30.10	1.00	0.3317
3	20 min	1%	25	30.10	1.00	0.3115
3	20 min	1%	26	30.10	1.00	0.3033
3	20 min	1%	27	30.10	1.00	0.3116
3	20 min	1%	28	30.10	1.00	0.3105
3	20 min	1%	29	30.10	1.00	0.3317

3	20 min	1%	30	30.10	1.00	0.3317
4	25 min	1%	21	32.60	1.00	0.4228
4	25 min	1%	22	32.60	1.00	0.3966
4	25 min	1%	23	32.60	1.00	0.4316
4	25 min	1%	24	32.60	1.00	0.4107
4	25 min	1%	25	32.60	1.00	0.4259
4	25 min	1%	26	32.60	1.00	0.4027
4	25 min	1%	27	32.60	1.00	0.3929
4	25 min	1%	28	32.60	1.00	0.4187
4	25 min	1%	29	32.60	1.00	0.4346
4	25 min	1%	30	32.60	1.00	0.4373
5	30 min	1%	21	34.60	1.00	0.4965
5	30 min	1%	22	34.60	1.00	0.4609
5	30 min	1%	23	34.60	1.00	0.4588
5	30 min	1%	24	34.60	1.00	0.4626
5	30 min	1%	25	34.60	1.00	0.4913
5	30 min	1%	26	34.60	1.00	0.5001
5	30 min	1%	27	34.60	1.00	0.4823
5	30 min	1%	28	34.60	1.00	0.4700
5	30 min	1%	29	34.60	1.00	0.5233
5	30 min	1%	30	34.60	1.00	0.5336
6	45 min	1%	21	38.90	1.00	0.6653
6	45 min	1%	22	38.90	1.00	0.6215
6	45 min	1%	23	38.90	1.00	0.6690
6	45 min	1%	24	38.90	1.00	0.6419
6	45 min	1%	25	38.90	1.00	0.6078
6	45 min	1%	26	38.90	1.00	0.6804
6	45 min	1%	27	38.90	1.00	0.6390
6	45 min	1%	28	38.90	1.00	0.6308
6	45 min	1%	29	38.90	1.00	0.6731
6	45 min	1%	30	38.90	1.00	0.7199
7	1 hour	1%	21	42.00	1.00	0.8263
7	1 hour	1%	22	42.00	1.00	0.6444
7	1 hour	1%	23	42.00	1.00	0.7044
7	1 hour	1%	24	42.00	1.00	0.7216
7	1 hour	1%	25	42.00	1.00	0.7476
7	1 hour	1%	26	42.00	1.00	0.7781
7	1 hour	1%	27	42.00	1.00	0.6924
7	1 hour	1%	28	42.00	1.00	0.7745
7	1 hour	1%	29	42.00	1.00	0.7647
7	1 hour	1%	30	42.00	1.00	0.8051
8	1.5 hour	1%	21	46.70	1.00	0.7696
8	1.5 hour	1%	22	46.70	1.00	0.9228
8	1.5 hour	1%	23	46.70	1.00	0.7391
8	1.5 hour	1%	24	46.70	1.00	0.8638
8	1.5 hour	1%	25	46.70	1.00	0.6648
8	1.5 hour	1%	26	46.70	1.00	0.8346
8	1.5 hour	1%	27	46.70	1.00	0.8714
8	1.5 hour	1%	28	46.70	1.00	0.8752
8	1.5 hour	1%	29	46.70	1.00	0.8238
8	1.5 hour	1%	30	46.70	1.00	1.0127
9	2 hour	1%	21	50.60	1.00	0.7706
9	2 hour	1%	22	50.60	1.00	0.7832
9	2 hour	1%	23	50.60	1.00	0.8673

9	2 hour	1%	24	50.60	1.00	0.8135
9	2 hour	1%	25	50.60	1.00	0.9503
9	2 hour	1%	26	50.60	1.00	0.8294
9	2 hour	1%	27	50.60	1.00	0.9620
9	2 hour	1%	28	50.60	1.00	0.8699
9	2 hour	1%	29	50.60	1.00	0.9652
9	2 hour	1%	30	50.60	1.00	1.0881
10	3 hour	1%	21	57.30	1.00	1.2167
10	3 hour	1%	22	57.30	1.00	0.6951
10	3 hour	1%	23	57.30	1.00	0.7712
10	3 hour	1%	24	57.30	1.00	0.6899
10	3 hour	1%	25	57.30	1.00	0.9420
10	3 hour	1%	26	57.30	1.00	0.9833
10	3 hour	1%	27	57.30	1.00	0.9341
10	3 hour	1%	28	57.30	1.00	0.9318
10	3 hour	1%	29	57.30	1.00	0.9192
10	3 hour	1%	30	57.30	1.00	1.1108
11	4.5 hour	1%	21	65.60	1.00	0.6589
11	4.5 hour	1%	22	65.60	1.00	0.9951
11	4.5 hour	1%	23	65.60	1.00	0.6592
11	4.5 hour	1%	24	65.60	1.00	0.5661
11	4.5 hour	1%	25	65.60	1.00	0.7394
11	4.5 hour	1%	26	65.60	1.00	0.8982
11	4.5 hour	1%	27	65.60	1.00	1.0289
11	4.5 hour	1%	28	65.60	1.00	0.8510
11	4.5 hour	1%	29	65.60	1.00	1.2549
11	4.5 hour	1%	30	65.60	1.00	1.2087
12	6 hour	1%	21	72.70	1.00	1.3732
12	6 hour	1%	22	72.70	1.00	0.7323
12	6 hour	1%	23	72.70	1.00	0.9846
12	6 hour	1%	24	72.70	1.00	0.6330
12	6 hour	1%	25	72.70	1.00	0.5997
12	6 hour	1%	26	72.70	1.00	0.9156
12	6 hour	1%	27	72.70	1.00	0.6968
12	6 hour	1%	28	72.70	1.00	0.7058
12	6 hour	1%	29	72.70	1.00	0.6326
12	6 hour	1%	30	72.70	1.00	0.9943
13	9 hour	1%	21	84.60	1.00	0.5385
13	9 hour	1%	22	84.60	1.00	0.4492
13	9 hour	1%	23	84.60	1.00	0.8724
13	9 hour	1%	24	84.60	1.00	0.6606
13	9 hour	1%	25	84.60	1.00	0.8978
13	9 hour	1%	26	84.60	1.00	0.5532
13	9 hour	1%	27	84.60	1.00	0.8184
13	9 hour	1%	28	84.60	1.00	0.8472
13	9 hour	1%	29	84.60	1.00	1.0245
13	9 hour	1%	30	84.60	1.00	1.2728
14	12 hour	1%	21	94.20	1.00	1.0044
14	12 hour	1%	22	94.20	1.00	0.7738
14	12 hour	1%	23	94.20	1.00	0.4007
14	12 hour	1%	24	94.20	1.00	0.5922
14	12 hour	1%	25	94.20	1.00	1.2441
14	12 hour	1%	26	94.20	1.00	0.5485
14	12 hour	1%	27	94.20	1.00	0.6119

14	12 hour	1%	28	94.20	1.00	1.0578
14	12 hour	1%	29	94.20	1.00	0.5817
14	12 hour	1%	30	94.20	1.00	0.6784
15	18 hour	1%	21	109.00	1.00	0.2246
15	18 hour	1%	22	109.00	1.00	0.3311
15	18 hour	1%	23	109.00	1.00	0.4149
15	18 hour	1%	24	109.00	1.00	0.6601
15	18 hour	1%	25	109.00	1.00	0.6275
15	18 hour	1%	26	109.00	1.00	0.2608
15	18 hour	1%	27	109.00	1.00	0.6554
15	18 hour	1%	28	109.00	1.00	0.5741
15	18 hour	1%	29	109.00	1.00	0.4022
15	18 hour	1%	30	109.00	1.00	0.4119
16	24 hour	1%	21	120.00	1.00	0.4562
16	24 hour	1%	22	120.00	1.00	0.2566
16	24 hour	1%	23	120.00	1.00	0.4808
16	24 hour	1%	24	120.00	1.00	0.4439
16	24 hour	1%	25	120.00	1.00	0.5466
16	24 hour	1%	26	120.00	1.00	0.4710
16	24 hour	1%	27	120.00	1.00	0.5027
16	24 hour	1%	28	120.00	1.00	0.1914
16	24 hour	1%	29	120.00	1.00	0.4945
16	24 hour	1%	30	120.00	1.00	0.4939
17	30 hour	1%	21	128.00	1.00	0.2413
17	30 hour	1%	22	128.00	1.00	0.5393
17	30 hour	1%	23	128.00	1.00	0.3120
17	30 hour	1%	24	128.00	1.00	0.3110
17	30 hour	1%	25	128.00	1.00	0.4585
17	30 hour	1%	26	128.00	1.00	0.1832
17	30 hour	1%	27	128.00	1.00	0.1422
17	30 hour	1%	28	128.00	1.00	0.1435
17	30 hour	1%	29	128.00	1.00	0.3567
17	30 hour	1%	30	128.00	1.00	0.1610
18	36 hour	1%	21	134.00	1.00	0.1419
18	36 hour	1%	22	134.00	1.00	0.2034
18	36 hour	1%	23	134.00	1.00	0.3401
18	36 hour	1%	24	134.00	1.00	0.6048
18	36 hour	1%	25	134.00	1.00	0.2883
18	36 hour	1%	26	134.00	1.00	0.1797
18	36 hour	1%	27	134.00	1.00	0.1042
18	36 hour	1%	28	134.00	1.00	0.1160
18	36 hour	1%	29	134.00	1.00	0.7742
18	36 hour	1%	30	134.00	1.00	0.3267
19	48 hour	1%	21	143.00	1.00	0.1029
19	48 hour	1%	22	143.00	1.00	0.3141
19	48 hour	1%	23	143.00	1.00	0.5489
19	48 hour	1%	24	143.00	1.00	0.2571
19	48 hour	1%	25	143.00	1.00	0.7027
19	48 hour	1%	26	143.00	1.00	0.1862
19	48 hour	1%	27	143.00	1.00	0.1410
19	48 hour	1%	28	143.00	1.00	0.1499
19	48 hour	1%	29	143.00	1.00	0.1423
19	48 hour	1%	30	143.00	1.00	0.3368
20	72 hour	1%	21	152.00	1.00	0.0302

```
20         72 hour              1%     22    152.00    1.00    0.2171
20         72 hour              1%     23    152.00    1.00    0.2311
20         72 hour              1%     24    152.00    1.00    0.0987
20         72 hour              1%     25    152.00    1.00    0.0388
20         72 hour              1%     26    152.00    1.00    0.0337
20         72 hour              1%     27    152.00    1.00    0.0851
20         72 hour              1%     28    152.00    1.00    0.3465
20         72 hour              1%     29    152.00    1.00    0.2083
20         72 hour              1%     30    152.00    1.00    0.1339
21         96 hour              1%     21    156.00    1.00    0.1457
21         96 hour              1%     22    156.00    1.00    0.4101
21         96 hour              1%     23    156.00    1.00    0.0276
21         96 hour              1%     24    156.00    1.00    0.1995
21         96 hour              1%     25    156.00    1.00    0.1513
21         96 hour              1%     26    156.00    1.00    0.0177
21         96 hour              1%     27    156.00    1.00    0.1088
21         96 hour              1%     28    156.00    1.00    0.0942
21         96 hour              1%     29    156.00    1.00    0.0550
21         96 hour              1%     30    156.00    1.00    0.5555
22        120 hour              1%     21    158.00    1.00    0.0176
22        120 hour              1%     22    158.00    1.00    0.2711
22        120 hour              1%     23    158.00    1.00    0.3275
22        120 hour              1%     24    158.00    1.00    0.2902
22        120 hour              1%     25    158.00    1.00    0.0429
22        120 hour              1%     26    158.00    1.00    0.0739
22        120 hour              1%     27    158.00    1.00    0.2043
22        120 hour              1%     28    158.00    1.00    0.0713
22        120 hour              1%     29    158.00    1.00    0.0091
22        120 hour              1%     30    158.00    1.00    0.1606
23        144 hour              1%     21    159.00    1.00    0.0674
23        144 hour              1%     22    159.00    1.00    0.1190
23        144 hour              1%     23    159.00    1.00    0.2596
23        144 hour              1%     24    159.00    1.00    0.0432
23        144 hour              1%     25    159.00    1.00    0.0519
23        144 hour              1%     26    159.00    1.00    0.0166
23        144 hour              1%     27    159.00    1.00    0.1774
23        144 hour              1%     28    159.00    1.00    0.0006
23        144 hour              1%     29    159.00    1.00    0.1785
23        144 hour              1%     30    159.00    1.00    0.0000
24        168 hour              1%     21    160.00    1.00    0.3403
24        168 hour              1%     22    160.00    1.00    0.0305
24        168 hour              1%     23    160.00    1.00    0.3441
24        168 hour              1%     24    160.00    1.00    0.4486
24        168 hour              1%     25    160.00    1.00    0.1652
24        168 hour              1%     26    160.00    1.00    0.1067
24        168 hour              1%     27    160.00    1.00    0.2616
24        168 hour              1%     28    160.00    1.00    0.1269
24        168 hour              1%     29    160.00    1.00    0.0000
24        168 hour              1%     30    160.00    1.00    0.0243
Run,    Representative hydrograph
 1     dur10min_aep1tp26.out
Run,    Representative hydrograph
 2     dur15min_aep1tp25.out
Run,    Representative hydrograph
```

```
 3     dur20min_aep1tp25.out
Run,    Representative hydrograph
 4     dur25min_aep1tp21.out
Run,    Representative hydrograph
 5     dur30min_aep1tp25.out
Run,    Representative hydrograph
 6     dur45min_aep1tp21.out
Run,    Representative hydrograph
 7     dur1hour_aep1tp29.out
Run,    Representative hydrograph
 8     dur1_5hour_aep1tp24.out
Run,    Representative hydrograph
 9     dur2hour_aep1tp28.out
Run,    Representative hydrograph
10     dur3hour_aep1tp27.out
Run,    Representative hydrograph
11     dur4_5hour_aep1tp26.out
Run,    Representative hydrograph
12     dur6hour_aep1tp22.out
Run,    Representative hydrograph
13     dur9hour_aep1tp28.out
Run,    Representative hydrograph
14     dur12hour_aep1tp30.out
Run,    Representative hydrograph
15     dur18hour_aep1tp23.out
Run,    Representative hydrograph
16     dur24hour_aep1tp23.out
Run,    Representative hydrograph
17     dur30hour_aep1tp24.out
Run,    Representative hydrograph
18     dur36hour_aep1tp25.out
Run,    Representative hydrograph
19     dur48hour_aep1tp24.out
Run,    Representative hydrograph
20     dur72hour_aep1tp30.out
Run,    Representative hydrograph
21     dur96hour_aep1tp21.out
Run,    Representative hydrograph
22     dur120hour_aep1tp30.out
Run,    Representative hydrograph
23     dur144hour_aep1tp21.out
Run,    Representative hydrograph
24     dur168hour_aep1tp25.out

Elapsed Run Time (hh:mm:ss) = 00:02:32
```

RORBWin Batch Run Summary
****

Program version 6.45 (last updated 20th March 2019)
Copyright Monash University and Hydrology and Risk Consulting

Date run: 27 Aug 2021 12:46

Catchment file   : K:\Jobs Data\2000243 - 147 Wollaston Road Warrnambool_Wat\Models\RORB\Post Dev V2\2000243-POSTDEV RB V2.catg
Rainfall location: User defined
Temporal pattern : ARR2016 point temporal patterns
Spatial pattern : Uniform
Areal Red. Fact. : Based on ARR 2016 (Book 2 Chapter 4)
Loss factors   : Constant with ARI

Parameters: kc =   1.78   m = 0.80

Loss parameters	Initial loss (mm)	Cont. loss (mm/h)
	24.00	4.60

Peak	Description
01	Calculated hydrograph, Ext Flow West
02	Calculated hydrograph, West RB Inlet 1
03	Calculated hydrograph, Ext Flow East
04	Calculated hydrograph, West RB Inlet 2
05	Special storage : West RB - Outflow
06	Special storage : West RB - Inflow
07	Special storage : East RB - Outflow
08	Special storage : East RB - Inflow
09	Calculated hydrograph, END

Run	Duration	AEP	TPat	Rain(mm)	ARF	Peak0001	Peak0002	Peak0003	Peak0004	Peak0005	Peak0006	Peak0007	Peak0008	Peak0009
1	10 min	1%	21	22.00	1.00	0.0290	1.5685	0.0403	0.8324	0.1106	1.9683	0.1469	1.2880	0.2445
1	10 min	1%	22	22.00	1.00	0.0290	1.5446	0.0403	0.8539	0.1106	1.8880	0.1461	1.3116	0.2437
1	10 min	1%	23	22.00	1.00	0.0290	1.5781	0.0403	0.8161	0.1111	2.0238	0.1476	1.2681	0.2455
1	10 min	1%	24	22.00	1.00	0.0290	1.5010	0.0403	0.9417	0.1119	2.1807	0.1507	1.3983	0.2496
1	10 min	1%	25	22.00	1.00	0.0290	1.5616	0.0403	0.8392	0.1107	1.9452	0.1467	1.2953	0.2443
1	10 min	1%	26	22.00	1.00	0.0290	1.5400	0.0403	0.8660	0.1113	2.1075	0.1494	1.3112	0.2474
1	10 min	1%	27	22.00	1.00	0.0290	1.5539	0.0403	0.8461	0.1107	1.9197	0.1463	1.3029	0.2440
1	10 min	1%	28	22.00	1.00	0.0290	1.5098	0.0403	0.9221	0.1115	2.1613	0.1497	1.3792	0.2481
1	10 min	1%	29	22.00	1.00	0.0290	1.4398	0.0403	1.0189	0.1125	2.2618	0.1514	1.4425	0.2514
1	10 min	1%	30	22.00	1.00	0.0290	1.4936	0.0403	0.9524	0.1120	2.1925	0.1507	1.4054	0.2498
2	15 min	1%	21	26.80	1.00	0.0951	1.3956	0.0859	0.8793	0.1632	2.1303	0.1968	1.3168	0.3421
2	15 min	1%	22	26.80	1.00	0.0951	1.4226	0.0860	0.9837	0.1638	2.2732	0.1987	1.5250	0.3441
2	15 min	1%	23	26.80	1.00	0.0951	1.4222	0.0929	0.9396	0.1648	2.1260	0.1993	1.4743	0.3450
2	15 min	1%	24	26.80	1.00	0.0951	1.6670	0.0929	1.1399	0.1656	2.3383	0.2034	1.7802	0.3488
2	15 min	1%	25	26.80	1.00	0.0951	1.6717	0.0929	1.0504	0.1658	2.1636	0.2039	1.6998	0.3495
2	15 min	1%	26	26.80	1.00	0.0951	1.8440	0.0928	1.2178	0.1662	2.4388	0.2043	1.8246	0.3499
2	15 min	1%	27	26.80	1.00	0.0951	1.5540	0.0928	1.0608	0.1649	2.2762	0.2013	1.6914	0.3466
2	15 min	1%	28	26.80	1.00	0.0951	1.6512	0.0929	1.1145	0.1654	2.2918	0.2029	1.7616	0.3481
2	15 min	1%	29	26.80	1.00	0.0951	2.0546	0.0929	1.0816	0.1682	2.7336	0.2113	1.6993	0.3579
2	15 min	1%	30	26.80	1.00	0.0951	1.8344	0.0929	1.2219	0.1683	2.7826	0.2132	1.7603	0.3601
3	20 min	1%	21	30.10	1.00	0.1650	1.4532	0.1396	0.9876	0.2175	2.2014	0.2394	1.5723	0.4294

3	20 min	1%	22	30.10	1.00	0.1656	1.3854	0.1337	0.9602	0.2158	2.1892	0.2374	1.5094	0.4267
3	20 min	1%	23	30.10	1.00	0.1647	1.5418	0.1392	1.0720	0.2180	2.2427	0.2399	1.6635	0.4308
3	20 min	1%	24	30.10	1.00	0.1801	1.7630	0.1552	1.1185	0.2219	2.3987	0.2531	1.7646	0.4417
3	20 min	1%	25	30.10	1.00	0.1682	1.6662	0.1434	1.1661	0.2198	2.7015	0.2485	1.7457	0.4385
3	20 min	1%	26	30.10	1.00	0.1638	1.8794	0.1383	1.0987	0.2200	2.7268	0.2442	1.6900	0.4363
3	20 min	1%	27	30.10	1.00	0.1683	1.6599	0.1434	1.1590	0.2198	2.6874	0.2484	1.7327	0.4384
3	20 min	1%	28	30.10	1.00	0.1677	1.6417	0.1428	1.2054	0.2194	2.7226	0.2487	1.8126	0.4383
3	20 min	1%	29	30.10	1.00	0.1801	1.9143	0.1488	1.2646	0.2218	2.6334	0.2544	2.0282	0.4432
3	20 min	1%	30	30.10	1.00	0.1801	1.9631	0.1487	1.3120	0.2215	2.6629	0.2551	2.0852	0.4433
4	25 min	1%	21	32.60	1.00	0.2292	1.4090	0.1780	0.9809	0.2633	2.2864	0.2736	1.4381	0.5014
4	25 min	1%	22	32.60	1.00	0.2134	1.5307	0.1684	1.0261	0.2603	2.1940	0.2637	1.5845	0.4942
4	25 min	1%	23	32.60	1.00	0.2338	1.3677	0.1890	1.0020	0.2632	2.2771	0.2758	1.3976	0.5014
4	25 min	1%	24	32.60	1.00	0.2217	1.0995	0.1775	0.8123	0.2586	1.7504	0.2671	1.2395	0.4912
4	25 min	1%	25	32.60	1.00	0.2315	1.1899	0.1795	0.8936	0.2614	1.9559	0.2712	1.1759	0.4965
4	25 min	1%	26	32.60	1.00	0.2172	1.5259	0.1727	1.0228	0.2618	2.4172	0.2709	1.5257	0.5004
4	25 min	1%	27	32.60	1.00	0.2113	1.7845	0.1663	1.0722	0.2622	2.6383	0.2714	1.5607	0.5016
4	25 min	1%	28	32.60	1.00	0.2276	1.4364	0.1754	0.9858	0.2629	2.2642	0.2720	1.4976	0.5003
4	25 min	1%	29	32.60	1.00	0.2354	2.1153	0.1909	1.5237	0.2682	3.2495	0.2921	2.3430	0.5197
4	25 min	1%	30	32.60	1.00	0.2369	1.6909	0.1923	1.2139	0.2652	2.6064	0.2851	1.7330	0.5104
5	30 min	1%	21	34.60	1.00	0.2679	1.3093	0.2062	0.8922	0.2994	2.1114	0.2930	1.4312	0.5526
5	30 min	1%	22	34.60	1.00	0.2463	1.5686	0.1854	1.0575	0.2958	2.4880	0.2859	1.5741	0.5467
5	30 min	1%	23	34.60	1.00	0.2448	1.5344	0.1840	0.9734	0.2952	2.3624	0.2842	1.4561	0.5448
5	30 min	1%	24	34.60	1.00	0.2476	1.5814	0.1867	0.9543	0.2959	2.3420	0.2883	1.3940	0.5476
5	30 min	1%	25	34.60	1.00	0.2648	1.5990	0.2029	1.0631	0.3013	2.4375	0.2962	1.6443	0.5576
5	30 min	1%	26	34.60	1.00	0.2701	1.3153	0.2086	0.9729	0.3004	2.2302	0.2968	1.3670	0.5560
5	30 min	1%	27	34.60	1.00	0.2607	1.3908	0.1928	0.9416	0.2980	2.2088	0.2895	1.4429	0.5493
5	30 min	1%	28	34.60	1.00	0.2526	1.4642	0.1915	1.0429	0.2974	2.3730	0.2940	1.6240	0.5522
5	30 min	1%	29	34.60	1.00	0.2849	1.6989	0.2160	1.1593	0.3049	2.7015	0.3070	1.8422	0.5662
5	30 min	1%	30	34.60	1.00	0.2895	1.5919	0.2277	1.1744	0.3051	2.5887	0.3100	1.5689	0.5665
6	45 min	1%	21	38.90	1.00	0.3558	1.3227	0.2635	1.0352	0.3843	2.3228	0.3514	1.3236	0.6738
6	45 min	1%	22	38.90	1.00	0.3300	1.5310	0.2425	1.1038	0.3820	2.4795	0.3356	1.6588	0.6720
6	45 min	1%	23	38.90	1.00	0.3578	1.2514	0.2532	0.8003	0.3802	1.8414	0.3235	1.1847	0.6570
6	45 min	1%	24	38.90	1.00	0.3418	1.1633	0.2462	0.8965	0.3697	1.9558	0.3216	1.2681	0.6415
6	45 min	1%	25	38.90	1.00	0.3184	1.1909	0.2319	0.7886	0.3708	1.8398	0.3141	1.2401	0.6418
6	45 min	1%	26	38.90	1.00	0.3652	1.2276	0.2638	0.9469	0.3804	2.0839	0.3366	1.1034	0.6628
6	45 min	1%	27	38.90	1.00	0.3385	1.1041	0.2410	0.7685	0.3786	1.7579	0.3260	1.2182	0.6589
6	45 min	1%	28	38.90	1.00	0.3377	1.0532	0.2502	0.7896	0.3776	1.7418	0.3294	0.9915	0.6586
6	45 min	1%	29	38.90	1.00	0.3611	1.4973	0.2628	1.0876	0.3869	2.4922	0.4048	1.5740	0.7014
6	45 min	1%	30	38.90	1.00	0.3897	1.5436	0.2844	1.1610	0.3856	2.5050	0.3720	1.4831	0.6952
7	1 hour	1%	21	42.00	1.00	0.4474	1.5842	0.3173	1.1533	0.4524	2.6668	0.5952	1.5621	0.9076
7	1 hour	1%	22	42.00	1.00	0.3215	1.1265	0.2139	0.7479	0.4214	1.6940	0.3044	1.2098	0.6896
7	1 hour	1%	23	42.00	1.00	0.3647	1.3057	0.2700	0.9685	0.4389	2.1164	0.3609	1.1998	0.7309
7	1 hour	1%	24	42.00	1.00	0.3843	0.9484	0.2594	0.7242	0.4299	1.6081	0.3296	1.0121	0.7123
7	1 hour	1%	25	42.00	1.00	0.3955	1.1300	0.2692	0.8796	0.4217	1.9330	0.3318	1.0602	0.6996
7	1 hour	1%	26	42.00	1.00	0.4135	1.4333	0.2850	1.0163	0.4195	2.1032	0.3309	1.2930	0.6963
7	1 hour	1%	27	42.00	1.00	0.3591	1.1437	0.2527	0.8774	0.4355	1.8769	0.3372	1.0622	0.7255
7	1 hour	1%	28	42.00	1.00	0.4106	1.2179	0.2893	0.9084	0.4395	1.9645	0.4313	1.0183	0.7588
7	1 hour	1%	29	42.00	1.00	0.4007	1.1011	0.2767	0.8154	0.4378	1.7809	0.3852	0.8597	0.7321
7	1 hour	1%	30	42.00	1.00	0.4357	1.5633	0.3091	1.1335	0.4546	2.5796	0.5785	1.5219	0.8887
8	1.5 hour	1%	21	46.70	1.00	0.3599	1.0089	0.2247	0.7470	0.5076	1.6909	0.3106	0.9639	0.7906
8	1.5 hour	1%	22	46.70	1.00	0.4694	1.1013	0.3184	0.8187	0.5276	1.8984	0.5106	0.7826	0.9509
8	1.5 hour	1%	23	46.70	1.00	0.3732	0.8697	0.2480	0.6430	0.5021	1.4640	0.3243	0.7810	0.7729
8	1.5 hour	1%	24	46.70	1.00	0.4378	1.1506	0.2950	0.8313	0.4909	1.9443	0.3496	0.9014	0.7834
8	1.5 hour	1%	25	46.70	1.00	0.2805	1.1776	0.1832	0.7545	0.4765	1.7639	0.2807	1.1630	0.7171

8	1.5 hour	1%	26	46.70	1.00	0.4243	1.0481	0.2821	0.7899	0.5241	1.7568	0.4332	0.8896	0.8408
8	1.5 hour	1%	27	46.70	1.00	0.4457	1.0409	0.2960	0.7724	0.5208	1.7397	0.4412	0.7961	0.8572
8	1.5 hour	1%	28	46.70	1.00	0.4536	1.2147	0.3027	0.8853	0.5179	1.9027	0.4363	0.9913	0.8764
8	1.5 hour	1%	29	46.70	1.00	0.3880	1.2740	0.2731	0.9771	0.5253	2.1623	0.4011	1.3026	0.8266
8	1.5 hour	1%	30	46.70	1.00	0.5325	1.5694	0.3752	1.1570	0.5400	2.5881	0.6144	1.4975	1.0370
9	2 hour	1%	21	50.60	1.00	0.3513	0.9844	0.2193	0.7299	0.5519	1.6529	0.3060	0.9367	0.8007
9	2 hour	1%	22	50.60	1.00	0.3807	1.0390	0.2509	0.7882	0.5548	1.7342	0.3391	1.0876	0.8273
9	2 hour	1%	23	50.60	1.00	0.3762	1.4051	0.2314	0.9845	0.5247	2.2684	0.2913	1.4961	0.7887
9	2 hour	1%	24	50.60	1.00	0.4014	1.1908	0.2628	0.8711	0.5480	1.8720	0.3306	1.1906	0.8086
9	2 hour	1%	25	50.60	1.00	0.4744	1.1507	0.3104	0.8317	0.5795	1.9531	0.4609	0.8901	0.9014
9	2 hour	1%	26	50.60	1.00	0.3727	0.8026	0.2295	0.5523	0.5513	1.2662	0.3001	0.6670	0.8186
9	2 hour	1%	27	50.60	1.00	0.4686	0.9810	0.2981	0.7157	0.5768	1.6376	0.4029	0.7494	0.9178
9	2 hour	1%	28	50.60	1.00	0.3765	1.6395	0.2415	1.1171	0.5826	2.3212	0.3156	1.7164	0.8672
9	2 hour	1%	29	50.60	1.00	0.4660	1.0496	0.3058	0.7687	0.5971	1.7983	0.4727	0.7526	0.9158
9	2 hour	1%	30	50.60	1.00	0.5583	1.2653	0.3631	0.9128	0.6066	2.0978	0.6329	0.8472	1.0944
10	3 hour	1%	21	57.30	1.00	0.5836	1.2189	0.3767	0.8860	0.8669	2.0987	0.6022	0.7662	1.1458
10	3 hour	1%	22	57.30	1.00	0.3368	0.7659	0.2185	0.5148	0.4758	1.2717	0.2910	0.6378	0.7264
10	3 hour	1%	23	57.30	1.00	0.3061	0.5934	0.1762	0.4145	0.5428	1.0356	0.2437	0.5380	0.7613
10	3 hour	1%	24	57.30	1.00	0.3143	0.6973	0.2070	0.5104	0.5145	1.1777	0.2766	0.4602	0.7094
10	3 hour	1%	25	57.30	1.00	0.4054	0.8171	0.2416	0.5964	0.6261	1.5282	0.3004	0.7123	0.9077
10	3 hour	1%	26	57.30	1.00	0.4014	0.8850	0.2467	0.6594	0.7121	1.5139	0.3255	0.7182	0.9735
10	3 hour	1%	27	57.30	1.00	0.3765	0.8727	0.2264	0.6005	0.6189	1.4045	0.2970	0.5703	0.8881
10	3 hour	1%	28	57.30	1.00	0.3910	0.7663	0.2385	0.5644	0.6526	1.3294	0.3138	0.5157	0.9293
10	3 hour	1%	29	57.30	1.00	0.3995	0.8466	0.2440	0.6180	0.6019	1.5214	0.2896	0.5699	0.8838
10	3 hour	1%	30	57.30	1.00	0.4932	1.1257	0.3109	0.8291	0.8697	1.7895	0.4585	1.0412	1.1716
11	4.5 hour	1%	21	65.60	1.00	0.2254	0.4540	0.1255	0.2973	0.5156	0.7397	0.1848	0.4181	0.6963
11	4.5 hour	1%	22	65.60	1.00	0.3966	0.7917	0.2292	0.5576	0.6914	1.4433	0.2877	0.6405	0.9349
11	4.5 hour	1%	23	65.60	1.00	0.2196	0.5809	0.1275	0.4359	0.5237	0.9703	0.2102	0.5758	0.7071
11	4.5 hour	1%	24	65.60	1.00	0.2962	0.7277	0.2022	0.5065	0.4377	1.2665	0.2721	0.6134	0.6279
11	4.5 hour	1%	25	65.60	1.00	0.2548	0.5012	0.1404	0.3211	0.5693	0.7889	0.2123	0.3703	0.7618
11	4.5 hour	1%	26	65.60	1.00	0.3137	0.6647	0.2004	0.5094	0.6784	1.2070	0.2704	0.5359	0.9056
11	4.5 hour	1%	27	65.60	1.00	0.4199	0.8007	0.2485	0.5721	0.7287	1.4209	0.3001	0.5995	0.9845
11	4.5 hour	1%	28	65.60	1.00	0.3107	0.6789	0.1898	0.5117	0.6290	1.2286	0.2569	0.4991	0.8459
11	4.5 hour	1%	29	65.60	1.00	0.5420	1.1033	0.3142	0.7558	1.0528	1.7690	0.4489	0.6635	1.3683
11	4.5 hour	1%	30	65.60	1.00	0.4805	0.9934	0.2743	0.6630	1.0760	1.5798	0.3410	0.6816	1.4170
12	6 hour	1%	21	72.70	1.00	0.6239	1.2092	0.3668	0.8403	1.2086	2.0016	0.5279	0.7812	1.5474
12	6 hour	1%	22	72.70	1.00	0.3336	0.7607	0.2032	0.5568	0.5096	1.3042	0.2762	0.5356	0.7379
12	6 hour	1%	23	72.70	1.00	0.4102	0.8475	0.2453	0.6101	0.6333	1.5441	0.2719	0.5788	0.9026
12	6 hour	1%	24	72.70	1.00	0.2324	0.5839	0.1569	0.3901	0.4987	0.9676	0.2290	0.5171	0.6727
12	6 hour	1%	25	72.70	1.00	0.2715	0.5508	0.1732	0.4041	0.4566	0.9650	0.2395	0.4628	0.6230
12	6 hour	1%	26	72.70	1.00	0.4186	1.0522	0.2538	0.7613	0.5551	1.7498	0.2830	0.8498	0.7926
12	6 hour	1%	27	72.70	1.00	0.2359	0.4629	0.1343	0.3156	0.5558	0.7748	0.1948	0.2655	0.7379
12	6 hour	1%	28	72.70	1.00	0.2952	0.5983	0.1768	0.4105	0.5382	0.9819	0.2384	0.3677	0.7373
12	6 hour	1%	29	72.70	1.00	0.2257	0.4408	0.1342	0.3021	0.4974	0.7402	0.1991	0.3035	0.6650
12	6 hour	1%	30	72.70	1.00	0.3786	0.7383	0.2241	0.5106	0.8443	1.2153	0.2875	0.4214	1.0935
13	9 hour	1%	21	84.60	1.00	0.1729	0.3633	0.0944	0.2359	0.4615	0.5831	0.1506	0.2336	0.6047
13	9 hour	1%	22	84.60	1.00	0.1827	0.4055	0.1192	0.2957	0.4025	0.7000	0.1711	0.2505	0.5312
13	9 hour	1%	23	84.60	1.00	0.3798	0.8468	0.2260	0.6302	0.5908	1.4639	0.3210	0.5974	0.8640
13	9 hour	1%	24	84.60	1.00	0.2267	0.4452	0.1397	0.3178	0.5115	0.7930	0.2060	0.2921	0.7003
13	9 hour	1%	25	84.60	1.00	0.4086	0.8684	0.2428	0.5907	0.5317	1.4196	0.2975	0.6820	0.7399
13	9 hour	1%	26	84.60	1.00	0.1889	0.3953	0.1083	0.2753	0.4521	0.6690	0.1611	0.2392	0.6036
13	9 hour	1%	27	84.60	1.00	0.3233	0.6024	0.1853	0.4083	0.5992	1.0232	0.2335	0.3235	0.8014
13	9 hour	1%	28	84.60	1.00	0.2980	0.5566	0.1639	0.3640	0.6338	0.8941	0.2285	0.3236	0.8346
13	9 hour	1%	29	84.60	1.00	0.3573	0.7059	0.2076	0.4807	0.8724	1.1701	0.2659	0.3868	1.1312

13	9	hour	1%	30	84.60	1.00	0.5258	1.0786	0.3142	0.7524	1.1660	1.8356	0.3423	0.6280	1.5083
14	12	hour	1%	21	94.20	1.00	0.3880	0.7004	0.2154	0.4711	0.8415	1.1382	0.2762	0.3857	1.0922
14	12	hour	1%	22	94.20	1.00	0.2957	0.6166	0.1673	0.4106	0.5593	0.9494	0.2272	0.3970	0.7612
14	12	hour	1%	23	94.20	1.00	0.1412	0.2776	0.0882	0.2087	0.3710	0.4876	0.1506	0.2457	0.4901
14	12	hour	1%	24	94.20	1.00	0.2036	0.4094	0.1237	0.2765	0.4674	0.6961	0.1902	0.2724	0.6419
14	12	hour	1%	25	94.20	1.00	0.5240	1.0174	0.3100	0.7097	1.1270	1.7601	0.3394	0.5600	1.4310
14	12	hour	1%	26	94.20	1.00	0.1755	0.3511	0.0964	0.2328	0.4594	0.5926	0.1556	0.1890	0.6126
14	12	hour	1%	27	94.20	1.00	0.2401	0.4569	0.1416	0.3095	0.4574	0.7665	0.2027	0.2459	0.6486
14	12	hour	1%	28	94.20	1.00	0.4144	0.7321	0.2374	0.5315	0.8319	1.2859	0.2920	0.4479	1.1111
14	12	hour	1%	29	94.20	1.00	0.1989	0.3874	0.1131	0.2606	0.4886	0.6516	0.1692	0.2002	0.6457
14	12	hour	1%	30	94.20	1.00	0.2470	0.5222	0.1593	0.3524	0.5209	0.8402	0.2176	0.3759	0.7185
15	18	hour	1%	21	109.00	1.00	0.0809	0.1752	0.0479	0.1227	0.2393	0.3020	0.0964	0.1404	0.3249
15	18	hour	1%	22	109.00	1.00	0.1211	0.2562	0.0716	0.1753	0.3056	0.4231	0.1253	0.1451	0.4118
15	18	hour	1%	23	109.00	1.00	0.1442	0.2989	0.0837	0.2011	0.3586	0.4939	0.1306	0.1595	0.4875
15	18	hour	1%	24	109.00	1.00	0.2251	0.4358	0.1290	0.2940	0.5026	0.7239	0.1800	0.2283	0.6607
15	18	hour	1%	25	109.00	1.00	0.2482	0.4664	0.1422	0.3142	0.5089	0.7852	0.1935	0.2305	0.6722
15	18	hour	1%	26	109.00	1.00	0.0800	0.1761	0.0482	0.1296	0.2711	0.3048	0.1041	0.1628	0.3640
15	18	hour	1%	27	109.00	1.00	0.2205	0.3982	0.1222	0.2671	0.5018	0.6629	0.1846	0.2076	0.6788
15	18	hour	1%	28	109.00	1.00	0.2271	0.4580	0.1261	0.3068	0.3764	0.6808	0.1713	0.3266	0.5323
15	18	hour	1%	29	109.00	1.00	0.1480	0.2833	0.0907	0.1993	0.3632	0.4916	0.1319	0.1975	0.4846
15	18	hour	1%	30	109.00	1.00	0.1412	0.2781	0.0784	0.1818	0.3694	0.4558	0.1304	0.1425	0.4915
16	24	hour	1%	21	120.00	1.00	0.1520	0.2909	0.0827	0.1928	0.4011	0.4815	0.1376	0.1493	0.5286
16	24	hour	1%	22	120.00	1.00	0.0843	0.1975	0.0489	0.1389	0.2470	0.3280	0.0951	0.1324	0.3417
16	24	hour	1%	23	120.00	1.00	0.1807	0.3674	0.1029	0.2684	0.3571	0.6124	0.1557	0.2417	0.4959
16	24	hour	1%	24	120.00	1.00	0.1648	0.3522	0.1007	0.2450	0.3430	0.5908	0.1350	0.2132	0.4781
16	24	hour	1%	25	120.00	1.00	0.2117	0.4281	0.1187	0.2971	0.3904	0.6790	0.1676	0.2949	0.5580
16	24	hour	1%	26	120.00	1.00	0.1753	0.3345	0.0983	0.2282	0.3861	0.5387	0.1488	0.2099	0.5073
16	24	hour	1%	27	120.00	1.00	0.1864	0.4237	0.1152	0.2950	0.3932	0.7037	0.1504	0.2587	0.5222
16	24	hour	1%	28	120.00	1.00	0.0637	0.1642	0.0383	0.1329	0.2101	0.2901	0.0876	0.1628	0.2883
16	24	hour	1%	29	120.00	1.00	0.1704	0.4006	0.0995	0.2742	0.4078	0.6473	0.1426	0.2570	0.5430
16	24	hour	1%	30	120.00	1.00	0.1665	0.3827	0.0979	0.2786	0.3980	0.6565	0.1501	0.2515	0.5421
17	30	hour	1%	21	128.00	1.00	0.0798	0.1704	0.0448	0.1205	0.2326	0.2835	0.0888	0.1099	0.3214
17	30	hour	1%	22	128.00	1.00	0.1819	0.3622	0.1049	0.2430	0.4560	0.6027	0.1519	0.1885	0.5938
17	30	hour	1%	23	128.00	1.00	0.1075	0.2634	0.0666	0.1844	0.2607	0.4413	0.1069	0.1650	0.3343
17	30	hour	1%	24	128.00	1.00	0.0992	0.2281	0.0604	0.1575	0.2886	0.3781	0.1019	0.1332	0.3864
17	30	hour	1%	25	128.00	1.00	0.1617	0.3756	0.1029	0.2685	0.3867	0.6492	0.1905	0.2276	0.5394
17	30	hour	1%	26	128.00	1.00	0.0642	0.1618	0.0375	0.1176	0.1952	0.2788	0.0859	0.1199	0.2704
17	30	hour	1%	27	128.00	1.00	0.0496	0.1383	0.0301	0.0966	0.1664	0.2235	0.0712	0.1001	0.2377
17	30	hour	1%	28	128.00	1.00	0.0506	0.1262	0.0320	0.0897	0.1778	0.2184	0.0717	0.0772	0.2445
17	30	hour	1%	29	128.00	1.00	0.1204	0.2344	0.0666	0.1532	0.3166	0.3885	0.1141	0.1279	0.4168
17	30	hour	1%	30	128.00	1.00	0.0556	0.1397	0.0344	0.0979	0.1946	0.2383	0.0761	0.0832	0.2628
18	36	hour	1%	21	134.00	1.00	0.0463	0.1264	0.0278	0.0922	0.1730	0.2164	0.0742	0.0895	0.2412
18	36	hour	1%	22	134.00	1.00	0.0697	0.1492	0.0403	0.1072	0.2027	0.2533	0.0823	0.1017	0.2850
18	36	hour	1%	23	134.00	1.00	0.1186	0.2245	0.0659	0.1543	0.2745	0.3709	0.1073	0.1520	0.3819
18	36	hour	1%	24	134.00	1.00	0.2092	0.3665	0.1133	0.2371	0.4524	0.6180	0.1642	0.1960	0.6166
18	36	hour	1%	25	134.00	1.00	0.0958	0.1988	0.0530	0.1399	0.2594	0.3285	0.0970	0.1281	0.3563
18	36	hour	1%	26	134.00	1.00	0.0667	0.1588	0.0469	0.1174	0.1943	0.2764	0.0923	0.1062	0.2683
18	36	hour	1%	27	134.00	1.00	0.0349	0.1072	0.0222	0.0799	0.1384	0.1851	0.0603	0.0830	0.1987
18	36	hour	1%	28	134.00	1.00	0.0369	0.1222	0.0250	0.0889	0.1530	0.2097	0.0651	0.0877	0.2075
18	36	hour	1%	29	134.00	1.00	0.2892	0.5465	0.1623	0.3613	0.6287	0.9096	0.2187	0.2710	0.7922
18	36	hour	1%	30	134.00	1.00	0.1086	0.2321	0.0627	0.1547	0.3116	0.3809	0.1082	0.1246	0.4123
19	48	hour	1%	21	143.00	1.00	0.0341	0.1028	0.0218	0.0777	0.1442	0.1787	0.0692	0.0868	0.2051
19	48	hour	1%	22	143.00	1.00	0.1172	0.2362	0.0681	0.1595	0.2570	0.3951	0.1108	0.1219	0.3510
19	48	hour	1%	23	143.00	1.00	0.1825	0.3388	0.0967	0.2342	0.4228	0.5497	0.1444	0.2138	0.5673

19	48 hour	1%	24	143.00	1.00	0.0898	0.1862	0.0508	0.1289	0.2158	0.2996	0.0896	0.1293	0.3054
19	48 hour	1%	25	143.00	1.00	0.2583	0.4634	0.1436	0.3045	0.4799	0.7737	0.1931	0.2145	0.6730
19	48 hour	1%	26	143.00	1.00	0.0682	0.1581	0.0472	0.1140	0.1884	0.2730	0.0878	0.1014	0.2622
19	48 hour	1%	27	143.00	1.00	0.0538	0.1339	0.0339	0.0944	0.1575	0.2285	0.0735	0.0792	0.2226
19	48 hour	1%	28	143.00	1.00	0.0472	0.1187	0.0285	0.0833	0.1736	0.2079	0.0705	0.0758	0.2442
19	48 hour	1%	29	143.00	1.00	0.0526	0.1317	0.0328	0.0931	0.1550	0.2312	0.0678	0.0790	0.2142
19	48 hour	1%	30	143.00	1.00	0.1118	0.2649	0.0604	0.1828	0.2584	0.4268	0.0936	0.1786	0.3382
20	72 hour	1%	21	152.00	1.00	0.0092	0.0654	0.0067	0.0502	0.0824	0.1176	0.0482	0.0557	0.1204
20	72 hour	1%	22	152.00	1.00	0.0764	0.1727	0.0454	0.1203	0.2066	0.2969	0.0880	0.0979	0.2946
20	72 hour	1%	23	152.00	1.00	0.0711	0.1921	0.0437	0.1319	0.2241	0.3130	0.0760	0.1246	0.2964
20	72 hour	1%	24	152.00	1.00	0.0302	0.1054	0.0191	0.0726	0.1189	0.1703	0.0566	0.0744	0.1677
20	72 hour	1%	25	152.00	1.00	0.0119	0.0678	0.0083	0.0491	0.0678	0.1137	0.0394	0.0545	0.1073
20	72 hour	1%	26	152.00	1.00	0.0094	0.0666	0.0068	0.0480	0.0924	0.1134	0.0449	0.0541	0.1342
20	72 hour	1%	27	152.00	1.00	0.0246	0.0891	0.0162	0.0655	0.1381	0.1532	0.0576	0.0654	0.1953
20	72 hour	1%	28	152.00	1.00	0.1174	0.2778	0.0719	0.1936	0.2962	0.4587	0.1228	0.1901	0.3681
20	72 hour	1%	29	152.00	1.00	0.0789	0.1927	0.0486	0.1342	0.2006	0.3217	0.0947	0.1175	0.2953
20	72 hour	1%	30	152.00	1.00	0.0410	0.1218	0.0244	0.0881	0.1573	0.2068	0.0637	0.0876	0.2187

Run,	Representative hydrograph
1	dur10min_aep1tp26.out
Run,	Representative hydrograph
2	dur15min_aep1tp24.out
Run,	Representative hydrograph
3	dur20min_aep1tp27.out
Run,	Representative hydrograph
4	dur25min_aep1tp21.out
Run,	Representative hydrograph
5	dur30min_aep1tp21.out
Run,	Representative hydrograph
6	dur45min_aep1tp26.out
Run,	Representative hydrograph
7	dur1hour_aep1tp23.out
Run,	Representative hydrograph
8	dur1_5hour_aep1tp26.out
Run,	Representative hydrograph
9	dur2hour_aep1tp28.out
Run,	Representative hydrograph
10	dur3hour_aep1tp25.out
Run,	Representative hydrograph
11	dur4_5hour_aep1tp26.out
Run,	Representative hydrograph
12	dur6hour_aep1tp27.out
Run,	Representative hydrograph
13	dur9hour_aep1tp27.out
Run,	Representative hydrograph
14	dur12hour_aep1tp30.out
Run,	Representative hydrograph
15	dur18hour_aep1tp30.out
Run,	Representative hydrograph
16	dur24hour_aep1tp27.out
Run,	Representative hydrograph
17	dur30hour_aep1tp23.out
Run,	Representative hydrograph
18	dur36hour_aep1tp25.out
Run,	Representative hydrograph

```
 19     dur48hour_aep1tp24.out
 Run,    Representative hydrograph
 20     dur72hour_aep1tp30.out

Elapsed Run Time (hh:mm:ss) = 00:02:36
```

RORBWin Batch Run Summary
****

Program version 6.45 (last updated 20th March 2019)
Copyright Monash University and Hydrology and Risk Consulting

Date run: 13 Aug 2021 16:44

Catchment file   : K:\Jobs Data\2000243 - 147 Wollaston Road Warrnambool_Wat\Models\RORB\Post Dev V2\2000243-POSTDEV RB V2.catg
Rainfall location: User defined
Temporal pattern : ARR2016 point temporal patterns
Spatial pattern : Uniform
Areal Red. Fact. : Based on ARR 2016 (Book 2 Chapter 4)
Loss factors   : Constant with ARI

Parameters: kc =   1.78   m = 0.80

Loss parameters	Initial loss (mm)	Cont. loss (mm/h)
	24.00	4.60

Peak	Description
01	Calculated hydrograph, West RB Inlet 1
02	Calculated hydrograph, West RB Inlet 2
03	Special storage : West RB - Outflow
04	Special storage : West RB - Inflow
05	Special storage : East RB - Outflow
06	Special storage : East RB - Inflow
07	Calculated hydrograph, END

Run	Duration	AEP	TPat	Rain(mm)	ARF	Peak0001	Peak0002	Peak0003	Peak0004	Peak0005	Peak0006	Peak0007
1	10 min	20%	1	9.89	1.00	0.6457	0.3398	0.0338	0.8246	0.0467	0.5301	0.0772
1	10 min	20%	2	9.89	1.00	0.6465	0.3313	0.0336	0.7962	0.0465	0.5122	0.0770
1	10 min	20%	3	9.89	1.00	0.6456	0.3324	0.0336	0.7936	0.0465	0.5138	0.0770
1	10 min	20%	4	9.89	1.00	0.6266	0.3511	0.0335	0.7480	0.0461	0.5384	0.0769
1	10 min	20%	5	9.89	1.00	0.6500	0.3269	0.0336	0.8058	0.0465	0.5065	0.0771
1	10 min	20%	6	9.89	1.00	0.6266	0.3512	0.0335	0.7478	0.0461	0.5385	0.0769
1	10 min	20%	7	9.89	1.00	0.5885	0.4204	0.0340	0.8830	0.0490	0.6214	0.0794
1	10 min	20%	8	9.89	1.00	0.6267	0.3511	0.0335	0.7482	0.0461	0.5383	0.0769
1	10 min	20%	9	9.89	1.00	0.6316	0.3613	0.0338	0.8401	0.0476	0.5720	0.0780
1	10 min	20%	10	9.89	1.00	0.6235	0.3727	0.0338	0.8479	0.0478	0.5857	0.0781
2	15 min	20%	1	11.90	1.00	0.5974	0.3843	0.0437	0.8148	0.0595	0.6349	0.0980
2	15 min	20%	2	11.90	1.00	0.5379	0.3429	0.0435	0.7914	0.0584	0.5490	0.0971
2	15 min	20%	3	11.90	1.00	0.5300	0.3201	0.0433	0.7376	0.0583	0.5093	0.0967
2	15 min	20%	4	11.90	1.00	0.7764	0.4294	0.0449	0.9369	0.0612	0.6600	0.1008
2	15 min	20%	5	11.90	1.00	0.6701	0.4427	0.0441	0.8559	0.0606	0.6867	0.0992
2	15 min	20%	6	11.90	1.00	0.7184	0.4468	0.0444	0.8657	0.0612	0.6805	0.1001
2	15 min	20%	7	11.90	1.00	0.7872	0.4197	0.0449	0.9638	0.0613	0.6476	0.1010
2	15 min	20%	8	11.90	1.00	0.6927	0.4157	0.0442	0.8695	0.0606	0.6592	0.0996
2	15 min	20%	9	11.90	1.00	0.7663	0.4079	0.0449	0.9978	0.0613	0.6255	0.1012
2	15 min	20%	10	11.90	1.00	0.7216	0.4589	0.0449	1.0309	0.0625	0.7133	0.1022
3	20 min	20%	1	13.40	1.00	0.5392	0.3448	0.0513	0.8168	0.0675	0.5261	0.1140
3	20 min	20%	2	13.40	1.00	0.4735	0.3266	0.0517	0.7394	0.0677	0.5019	0.1147
3	20 min	20%	3	13.40	1.00	0.5773	0.3523	0.0524	0.8162	0.0684	0.5107	0.1160

3	20 min	20%	4	13.40	1.00	0.6999	0.4198	0.0531	0.8964	0.0706	0.7029	0.1179
3	20 min	20%	5	13.40	1.00	0.7378	0.5204	0.0534	1.0571	0.0717	0.7996	0.1192
3	20 min	20%	6	13.40	1.00	0.7637	0.4858	0.0535	0.9380	0.0716	0.7684	0.1191
3	20 min	20%	7	13.40	1.00	0.7593	0.4567	0.0535	0.9664	0.0715	0.7443	0.1189
3	20 min	20%	8	13.40	1.00	0.6656	0.4108	0.0531	0.8845	0.0697	0.6760	0.1172
3	20 min	20%	9	13.40	1.00	0.8030	0.5206	0.0538	0.9779	0.0723	0.7880	0.1199
3	20 min	20%	10	13.40	1.00	0.8396	0.4953	0.0539	1.0382	0.0725	0.7598	0.1200
4	25 min	20%	1	14.60	1.00	0.5260	0.3469	0.0582	0.7408	0.0747	0.5175	0.1276
4	25 min	20%	2	14.60	1.00	0.4868	0.3229	0.0574	0.7585	0.0739	0.4873	0.1265
4	25 min	20%	3	14.60	1.00	0.5196	0.3396	0.0585	0.8049	0.0748	0.5197	0.1283
4	25 min	20%	4	14.60	1.00	0.5628	0.3940	0.0586	0.8631	0.0764	0.5881	0.1294
4	25 min	20%	5	14.60	1.00	0.6076	0.4213	0.0593	0.9571	0.0774	0.6500	0.1311
4	25 min	20%	6	14.60	1.00	0.5053	0.3091	0.0587	0.7174	0.0747	0.4427	0.1284
4	25 min	20%	7	14.60	1.00	0.6886	0.4425	0.0589	0.9381	0.0765	0.6860	0.1303
4	25 min	20%	8	14.60	1.00	0.6253	0.3926	0.0589	0.9129	0.0766	0.6188	0.1304
4	25 min	20%	9	14.60	1.00	0.7704	0.4784	0.0602	0.9767	0.0795	0.7910	0.1335
4	25 min	20%	10	14.60	1.00	0.7240	0.5081	0.0601	1.0982	0.0795	0.8201	0.1334
5	30 min	20%	1	15.60	1.00	0.6023	0.3911	0.0639	0.8169	0.0807	0.6230	0.1386
5	30 min	20%	2	15.60	1.00	0.5715	0.3567	0.0625	0.8193	0.0784	0.5767	0.1365
5	30 min	20%	3	15.60	1.00	0.3994	0.2650	0.0623	0.6240	0.0778	0.3706	0.1354
5	30 min	20%	4	15.60	1.00	0.5403	0.3872	0.0644	0.8627	0.0827	0.5573	0.1411
5	30 min	20%	5	15.60	1.00	0.5972	0.4274	0.0644	0.9068	0.0829	0.6408	0.1411
5	30 min	20%	6	15.60	1.00	0.5183	0.3445	0.0638	0.8134	0.0817	0.5323	0.1400
5	30 min	20%	7	15.60	1.00	0.5871	0.4099	0.0647	0.9003	0.0839	0.6049	0.1425
5	30 min	20%	8	15.60	1.00	0.5349	0.3824	0.0631	0.8580	0.0808	0.5490	0.1384
5	30 min	20%	9	15.60	1.00	0.7302	0.4602	0.0661	0.9826	0.0859	0.7421	0.1455
5	30 min	20%	10	15.60	1.00	0.8411	0.5267	0.0661	1.0750	0.0880	0.8651	0.1472
6	45 min	20%	1	18.00	1.00	0.4327	0.2613	0.0737	0.5977	0.0889	0.4124	0.1587
6	45 min	20%	2	18.00	1.00	0.3940	0.2956	0.0734	0.6521	0.0884	0.4355	0.1580
6	45 min	20%	3	18.00	1.00	0.4849	0.2999	0.0721	0.6943	0.0850	0.5014	0.1541
6	45 min	20%	4	18.00	1.00	0.3817	0.2769	0.0736	0.5751	0.0895	0.4029	0.1574
6	45 min	20%	5	18.00	1.00	0.5981	0.4115	0.0745	0.8834	0.0937	0.6207	0.1632
6	45 min	20%	6	18.00	1.00	0.4288	0.3053	0.0753	0.6471	0.0939	0.4373	0.1632
6	45 min	20%	7	18.00	1.00	0.5891	0.3647	0.0768	0.8862	0.0951	0.5941	0.1677
6	45 min	20%	8	18.00	1.00	0.6275	0.3974	0.0740	0.8840	0.0892	0.6553	0.1602
6	45 min	20%	9	18.00	1.00	0.8099	0.5119	0.0787	1.2085	0.0999	0.8056	0.1733
6	45 min	20%	10	18.00	1.00	0.6969	0.4462	0.0773	0.9779	0.0975	0.6828	0.1693
7	1 hour	20%	1	19.80	1.00	0.4412	0.2797	0.0785	0.6575	0.0892	0.4413	0.1644
7	1 hour	20%	2	19.80	1.00	0.4127	0.2425	0.0790	0.6003	0.0911	0.3666	0.1655
7	1 hour	20%	3	19.80	1.00	0.4097	0.2627	0.0794	0.5806	0.0916	0.4197	0.1672
7	1 hour	20%	4	19.80	1.00	0.5554	0.3704	0.0833	0.8557	0.0994	0.5429	0.1791
7	1 hour	20%	5	19.80	1.00	0.3615	0.2629	0.0828	0.6028	0.1008	0.3647	0.1789
7	1 hour	20%	6	19.80	1.00	0.5467	0.3921	0.0825	0.8682	0.0998	0.5749	0.1779
7	1 hour	20%	7	19.80	1.00	0.5348	0.3562	0.0844	0.8227	0.1021	0.5774	0.1828
7	1 hour	20%	8	19.80	1.00	0.4411	0.2915	0.0821	0.6614	0.0969	0.4578	0.1750
7	1 hour	20%	9	19.80	1.00	0.9638	0.6084	0.0882	1.3861	0.1170	0.8970	0.1965
7	1 hour	20%	10	19.80	1.00	0.7206	0.4988	0.0879	1.1501	0.1149	0.7735	0.1952
8	1.5 hour	20%	1	22.50	1.00	0.3840	0.2419	0.0836	0.5843	0.0870	0.3909	0.1668
8	1.5 hour	20%	2	22.50	1.00	0.5288	0.3285	0.0845	0.7621	0.0862	0.5341	0.1654
8	1.5 hour	20%	3	22.50	1.00	0.4028	0.3036	0.0849	0.6372	0.0909	0.4710	0.1707
8	1.5 hour	20%	4	22.50	1.00	0.3167	0.2382	0.0935	0.5178	0.1095	0.3239	0.1986
8	1.5 hour	20%	5	22.50	1.00	0.5248	0.3329	0.0840	0.7781	0.0853	0.5451	0.1662
8	1.5 hour	20%	6	22.50	1.00	0.2803	0.2076	0.0897	0.4621	0.1019	0.3034	0.1875
8	1.5 hour	20%	7	22.50	1.00	0.4631	0.3132	0.0848	0.7332	0.0872	0.4693	0.1688

8	1.5	hour	20%	8	22.50	1.00	0.4580	0.3116	0.0940	0.7211	0.1101	0.4602	0.1992
8	1.5	hour	20%	9	22.50	1.00	0.5955	0.4153	0.0955	0.9035	0.1172	0.6288	0.2065
8	1.5	hour	20%	10	22.50	1.00	0.8667	0.6026	0.0983	1.3412	0.1271	0.8739	0.2179
9	2	hour	20%	1	24.70	1.00	0.3744	0.2411	0.0890	0.5281	0.0851	0.3800	0.1714
9	2	hour	20%	2	24.70	1.00	0.3578	0.2231	0.0848	0.5523	0.0760	0.3380	0.1588
9	2	hour	20%	3	24.70	1.00	0.3289	0.2056	0.0898	0.4673	0.0870	0.2594	0.1733
9	2	hour	20%	4	24.70	1.00	0.3318	0.2009	0.0986	0.4336	0.1030	0.2894	0.1977
9	2	hour	20%	5	24.70	1.00	0.4478	0.3481	0.1058	0.7442	0.1195	0.4928	0.2182
9	2	hour	20%	6	24.70	1.00	0.3321	0.2572	0.0958	0.5507	0.0993	0.3525	0.1903
9	2	hour	20%	7	24.70	1.00	0.3058	0.2279	0.0969	0.4831	0.0987	0.3380	0.1907
9	2	hour	20%	8	24.70	1.00	0.2865	0.2240	0.0948	0.4852	0.1040	0.3063	0.1938
9	2	hour	20%	9	24.70	1.00	0.3832	0.2795	0.1053	0.6127	0.1128	0.4136	0.2137
9	2	hour	20%	10	24.70	1.00	0.4706	0.2951	0.1095	0.6925	0.1210	0.4363	0.2255
10	3	hour	20%	1	28.20	1.00	0.2811	0.2040	0.1089	0.4470	0.0856	0.2480	0.1838
10	3	hour	20%	2	28.20	1.00	0.1806	0.1409	0.0896	0.3086	0.0753	0.1848	0.1623
10	3	hour	20%	3	28.20	1.00	0.2911	0.2161	0.0983	0.5522	0.0857	0.2752	0.1724
10	3	hour	20%	4	28.20	1.00	0.2855	0.2164	0.0974	0.4850	0.0851	0.3168	0.1743
10	3	hour	20%	5	28.20	1.00	0.1802	0.1406	0.1130	0.3233	0.0949	0.1673	0.2001
10	3	hour	20%	6	28.20	1.00	0.2091	0.1664	0.1155	0.3867	0.0963	0.1841	0.2077
10	3	hour	20%	7	28.20	1.00	0.1469	0.1182	0.1011	0.2543	0.0801	0.1722	0.1788
10	3	hour	20%	8	28.20	1.00	0.4349	0.3108	0.0987	0.6546	0.1094	0.4507	0.2045
10	3	hour	20%	9	28.20	1.00	0.3058	0.2234	0.1290	0.5242	0.1194	0.3163	0.2402
10	3	hour	20%	10	28.20	1.00	0.2414	0.1837	0.1287	0.4135	0.1151	0.2500	0.2362
11	4.5	hour	20%	1	32.30	1.00	0.1281	0.1001	0.1081	0.2119	0.0690	0.1323	0.1713
11	4.5	hour	20%	2	32.30	1.00	0.1831	0.1385	0.1312	0.3189	0.0859	0.1780	0.2099
11	4.5	hour	20%	3	32.30	1.00	0.2788	0.1948	0.1239	0.4380	0.0793	0.2670	0.1972
11	4.5	hour	20%	4	32.30	1.00	0.1780	0.1248	0.1180	0.2718	0.0786	0.1638	0.1866
11	4.5	hour	20%	5	32.30	1.00	0.2162	0.1478	0.1321	0.3253	0.0899	0.1948	0.2142
11	4.5	hour	20%	6	32.30	1.00	0.3182	0.2515	0.1476	0.5724	0.1067	0.2695	0.2455
11	4.5	hour	20%	7	32.30	1.00	0.2413	0.1690	0.1398	0.3532	0.0989	0.1927	0.2287
11	4.5	hour	20%	8	32.30	1.00	0.1357	0.0997	0.1242	0.2317	0.0797	0.1046	0.2004
11	4.5	hour	20%	9	32.30	1.00	0.2249	0.1728	0.1533	0.3792	0.1119	0.1807	0.2541
11	4.5	hour	20%	10	32.30	1.00	0.3201	0.2523	0.1594	0.5608	0.1228	0.2601	0.2705
12	6	hour	20%	1	35.50	1.00	0.2752	0.1922	0.1229	0.4324	0.0784	0.2626	0.1947
12	6	hour	20%	2	35.50	1.00	0.2027	0.1504	0.1034	0.3323	0.0678	0.2096	0.1648
12	6	hour	20%	3	35.50	1.00	0.0999	0.0785	0.0918	0.1700	0.0558	0.1031	0.1470
12	6	hour	20%	4	35.50	1.00	0.1737	0.1361	0.1143	0.3140	0.0746	0.1877	0.1739
12	6	hour	20%	5	35.50	1.00	0.1265	0.0955	0.1190	0.2110	0.0685	0.1280	0.1809
12	6	hour	20%	6	35.50	1.00	0.1616	0.1160	0.1312	0.2481	0.0794	0.1681	0.1984
12	6	hour	20%	7	35.50	1.00	0.1274	0.0981	0.1259	0.2182	0.0719	0.1244	0.1920
12	6	hour	20%	8	35.50	1.00	0.2781	0.2247	0.1529	0.4990	0.1100	0.2734	0.2270
12	6	hour	20%	9	35.50	1.00	0.3401	0.2377	0.1774	0.5082	0.1226	0.2581	0.2883
12	6	hour	20%	10	35.50	1.00	0.3657	0.2854	0.1824	0.6626	0.1278	0.2930	0.3001
13	9	hour	20%	1	40.70	1.00	0.1294	0.1055	0.0881	0.2403	0.0589	0.1291	0.1273
13	9	hour	20%	2	40.70	1.00	0.1393	0.0964	0.0893	0.2137	0.0551	0.1373	0.1434
13	9	hour	20%	3	40.70	1.00	0.1590	0.1136	0.1312	0.2501	0.0629	0.1375	0.1942
13	9	hour	20%	4	40.70	1.00	0.2077	0.1455	0.1377	0.3176	0.0827	0.1613	0.2059
13	9	hour	20%	5	40.70	1.00	0.1325	0.0984	0.1131	0.2311	0.0660	0.0956	0.1747
13	9	hour	20%	6	40.70	1.00	0.1518	0.1133	0.1405	0.2625	0.0808	0.1046	0.2131
13	9	hour	20%	7	40.70	1.00	0.1752	0.1287	0.1095	0.2981	0.0660	0.1350	0.1749
13	9	hour	20%	8	40.70	1.00	0.2175	0.1607	0.2006	0.3770	0.1088	0.1578	0.2945
13	9	hour	20%	9	40.70	1.00	0.1983	0.1482	0.1738	0.3578	0.1010	0.1599	0.2610
13	9	hour	20%	10	40.70	1.00	0.2648	0.1942	0.1961	0.4585	0.1083	0.1782	0.2873
14	12	hour	20%	1	44.70	1.00	0.1106	0.0798	0.0801	0.1956	0.0507	0.0993	0.1261

14	12 hour	20%	2	44.70	1.00	0.1624	0.1167	0.0877	0.2826	0.0783	0.1623	0.1606
14	12 hour	20%	3	44.70	1.00	0.0892	0.0606	0.0548	0.1391	0.0366	0.0731	0.0877
14	12 hour	20%	4	44.70	1.00	0.1155	0.0860	0.0931	0.1959	0.0580	0.0833	0.1485
14	12 hour	20%	5	44.70	1.00	0.1270	0.0977	0.1223	0.2310	0.0700	0.1154	0.1855
14	12 hour	20%	6	44.70	1.00	0.0590	0.0405	0.0581	0.0927	0.0346	0.0548	0.0925
14	12 hour	20%	7	44.70	1.00	0.1447	0.1050	0.1252	0.2384	0.0690	0.1202	0.1859
14	12 hour	20%	8	44.70	1.00	0.1847	0.1295	0.1628	0.3083	0.0806	0.1395	0.2315
14	12 hour	20%	9	44.70	1.00	0.3112	0.2105	0.2265	0.4881	0.1147	0.1940	0.3374
14	12 hour	20%	10	44.70	1.00	0.2534	0.1694	0.1543	0.3637	0.0911	0.2026	0.2319
15	18 hour	20%	1	50.70	1.00	0.0522	0.0404	0.0523	0.0897	0.0366	0.0522	0.0881
15	18 hour	20%	2	50.70	1.00	0.1335	0.0898	0.0892	0.2115	0.0729	0.1272	0.1487
15	18 hour	20%	3	50.70	1.00	0.0717	0.0615	0.0496	0.1368	0.0401	0.0769	0.0897
15	18 hour	20%	4	50.70	1.00	0.0541	0.0432	0.0590	0.1021	0.0362	0.0504	0.0925
15	18 hour	20%	5	50.70	1.00	0.0909	0.0706	0.0613	0.1450	0.0453	0.0994	0.0971
15	18 hour	20%	6	50.70	1.00	0.0525	0.0396	0.0408	0.0928	0.0308	0.0495	0.0716
15	18 hour	20%	7	50.70	1.00	0.0394	0.0284	0.0462	0.0668	0.0287	0.0343	0.0727
15	18 hour	20%	8	50.70	1.00	0.1009	0.0734	0.0965	0.1639	0.0529	0.0823	0.1494
15	18 hour	20%	9	50.70	1.00	0.0481	0.0360	0.0646	0.0832	0.0378	0.0435	0.1023
15	18 hour	20%	10	50.70	1.00	0.2474	0.1794	0.2037	0.4365	0.0915	0.1478	0.2941
16	24 hour	20%	1	55.20	1.00	0.0686	0.0468	0.0521	0.1075	0.0301	0.0619	0.0822
16	24 hour	20%	2	55.20	1.00	0.0741	0.0462	0.0485	0.1236	0.0312	0.0616	0.0773
16	24 hour	20%	3	55.20	1.00	0.1210	0.0830	0.0716	0.1778	0.0441	0.0983	0.1110
16	24 hour	20%	4	55.20	1.00	0.0426	0.0334	0.0396	0.0803	0.0246	0.0398	0.0642
16	24 hour	20%	5	55.20	1.00	0.0310	0.0226	0.0296	0.0533	0.0158	0.0298	0.0454
16	24 hour	20%	6	55.20	1.00	0.0290	0.0235	0.0270	0.0522	0.0147	0.0289	0.0417
16	24 hour	20%	7	55.20	1.00	0.1064	0.0780	0.0876	0.1914	0.0512	0.0878	0.1278
16	24 hour	20%	8	55.20	1.00	0.0965	0.0728	0.0853	0.1731	0.0486	0.0741	0.1274
16	24 hour	20%	9	55.20	1.00	0.1165	0.0819	0.1206	0.1852	0.0582	0.0840	0.1720
16	24 hour	20%	10	55.20	1.00	0.0526	0.0387	0.0518	0.0902	0.0335	0.0481	0.0833
17	30 hour	20%	1	58.70	1.00	0.0674	0.0462	0.0391	0.1086	0.0285	0.0626	0.0672
17	30 hour	20%	2	58.70	1.00	0.0469	0.0297	0.0473	0.0776	0.0295	0.0386	0.0752
17	30 hour	20%	3	58.70	1.00	0.0637	0.0469	0.0612	0.1105	0.0340	0.0546	0.0938
17	30 hour	20%	4	58.70	1.00	0.0204	0.0146	0.0249	0.0348	0.0120	0.0168	0.0362
17	30 hour	20%	5	58.70	1.00	0.1042	0.0735	0.0801	0.1699	0.0366	0.0793	0.1166
17	30 hour	20%	6	58.70	1.00	0.0287	0.0195	0.0282	0.0473	0.0161	0.0236	0.0430
17	30 hour	20%	7	58.70	1.00	0.0790	0.0560	0.0567	0.1249	0.0290	0.0630	0.0857
17	30 hour	20%	8	58.70	1.00	0.0366	0.0255	0.0446	0.0613	0.0271	0.0319	0.0693
17	30 hour	20%	9	58.70	1.00	0.0367	0.0255	0.0323	0.0609	0.0192	0.0323	0.0498
17	30 hour	20%	10	58.70	1.00	0.0509	0.0383	0.0520	0.0926	0.0341	0.0441	0.0806
18	36 hour	20%	1	61.50	1.00	0.0354	0.0246	0.0424	0.0592	0.0258	0.0306	0.0660
18	36 hour	20%	2	61.50	1.00	0.0430	0.0339	0.0373	0.0785	0.0275	0.0413	0.0616
18	36 hour	20%	3	61.50	1.00	0.0270	0.0194	0.0254	0.0428	0.0141	0.0250	0.0396
18	36 hour	20%	4	61.50	1.00	0.0354	0.0233	0.0267	0.0546	0.0147	0.0302	0.0414
18	36 hour	20%	5	61.50	1.00	0.0295	0.0211	0.0264	0.0513	0.0150	0.0252	0.0413
18	36 hour	20%	6	61.50	1.00	0.0400	0.0294	0.0334	0.0698	0.0209	0.0366	0.0511
18	36 hour	20%	7	61.50	1.00	0.0288	0.0195	0.0293	0.0466	0.0179	0.0239	0.0471
18	36 hour	20%	8	61.50	1.00	0.0695	0.0490	0.0357	0.1095	0.0265	0.0582	0.0623
18	36 hour	20%	9	61.50	1.00	0.0985	0.0706	0.0789	0.1645	0.0392	0.0767	0.1153
18	36 hour	20%	10	61.50	1.00	0.1614	0.1118	0.1656	0.2554	0.0765	0.1143	0.2421
19	48 hour	20%	1	66.00	1.00	0.0336	0.0230	0.0260	0.0517	0.0154	0.0297	0.0405
19	48 hour	20%	2	66.00	1.00	0.0490	0.0340	0.0429	0.0763	0.0261	0.0371	0.0657
19	48 hour	20%	3	66.00	1.00	0.0689	0.0537	0.0730	0.1185	0.0400	0.0604	0.1087
19	48 hour	20%	4	66.00	1.00	0.1165	0.0907	0.0788	0.1934	0.0562	0.1189	0.1350
19	48 hour	20%	5	66.00	1.00	0.0420	0.0300	0.0304	0.0724	0.0200	0.0371	0.0504

19	48	hour	20%	6	66.00	1.00	0.0865	0.0659	0.0777	0.1531	0.0482	0.0688	0.1115
19	48	hour	20%	7	66.00	1.00	0.0450	0.0337	0.0356	0.0804	0.0261	0.0412	0.0570
19	48	hour	20%	8	66.00	1.00	0.0291	0.0201	0.0215	0.0450	0.0140	0.0257	0.0348
19	48	hour	20%	9	66.00	1.00	0.1121	0.0786	0.0989	0.1807	0.0478	0.0839	0.1467
19	48	hour	20%	10	66.00	1.00	0.0403	0.0291	0.0344	0.0673	0.0206	0.0365	0.0551
20	72	hour	20%	1	72.30	1.00	0.0150	0.0081	0.0153	0.0221	0.0056	0.0084	0.0209
20	72	hour	20%	2	72.30	1.00	0.0372	0.0266	0.0354	0.0656	0.0257	0.0325	0.0564
20	72	hour	20%	3	72.30	1.00	0.0172	0.0110	0.0149	0.0278	0.0063	0.0121	0.0208
20	72	hour	20%	4	72.30	1.00	0.0325	0.0224	0.0219	0.0516	0.0130	0.0284	0.0349
20	72	hour	20%	5	72.30	1.00	0.0298	0.0211	0.0219	0.0477	0.0123	0.0265	0.0325
20	72	hour	20%	6	72.30	1.00	0.0110	0.0045	0.0076	0.0150	0.0020	0.0039	0.0096
20	72	hour	20%	7	72.30	1.00	0.0150	0.0035	0.0069	0.0159	0.0017	0.0029	0.0085
20	72	hour	20%	8	72.30	1.00	0.0358	0.0245	0.0232	0.0572	0.0140	0.0314	0.0372
20	72	hour	20%	9	72.30	1.00	0.0429	0.0308	0.0329	0.0711	0.0184	0.0382	0.0514
20	72	hour	20%	10	72.30	1.00	0.0445	0.0329	0.0315	0.0731	0.0173	0.0400	0.0487
21	96	hour	20%	1	77.20	1.00	0.0460	0.0351	0.0442	0.0836	0.0352	0.0418	0.0790
21	96	hour	20%	2	77.20	1.00	0.0360	0.0258	0.0420	0.0635	0.0292	0.0316	0.0711
21	96	hour	20%	3	77.20	1.00	0.0168	0.0096	0.0115	0.0263	0.0050	0.0104	0.0165
21	96	hour	20%	4	77.20	1.00	0.0440	0.0291	0.0304	0.0689	0.0155	0.0323	0.0459
21	96	hour	20%	5	77.20	1.00	0.0179	0.0111	0.0131	0.0287	0.0059	0.0124	0.0190
21	96	hour	20%	6	77.20	1.00	0.0371	0.0253	0.0235	0.0587	0.0125	0.0269	0.0360
21	96	hour	20%	7	77.20	1.00	0.0182	0.0118	0.0146	0.0280	0.0078	0.0135	0.0224
21	96	hour	20%	8	77.20	1.00	0.0327	0.0222	0.0258	0.0540	0.0137	0.0274	0.0395
21	96	hour	20%	9	77.20	1.00	0.0867	0.0620	0.0782	0.1441	0.0377	0.0658	0.1063
21	96	hour	20%	10	77.20	1.00	0.0413	0.0303	0.0272	0.0676	0.0162	0.0376	0.0434
22	120	hour	20%	1	81.40	1.00	0.0323	0.0231	0.0350	0.0568	0.0253	0.0278	0.0601
22	120	hour	20%	2	81.40	1.00	0.0277	0.0196	0.0295	0.0471	0.0201	0.0236	0.0496
22	120	hour	20%	3	81.40	1.00	0.0098	0.0043	0.0107	0.0142	0.0028	0.0036	0.0135
22	120	hour	20%	4	81.40	1.00	0.0208	0.0078	0.0157	0.0264	0.0048	0.0079	0.0204
22	120	hour	20%	5	81.40	1.00	0.0247	0.0132	0.0209	0.0371	0.0098	0.0146	0.0300
22	120	hour	20%	6	81.40	1.00	0.0465	0.0343	0.0314	0.0764	0.0178	0.0413	0.0493
22	120	hour	20%	7	81.40	1.00	0.0328	0.0226	0.0209	0.0521	0.0132	0.0287	0.0340
22	120	hour	20%	8	81.40	1.00	0.0778	0.0605	0.0766	0.1415	0.0494	0.0626	0.1260
22	120	hour	20%	9	81.40	1.00	0.0180	0.0110	0.0114	0.0276	0.0059	0.0125	0.0173
22	120	hour	20%	10	81.40	1.00	0.0765	0.0553	0.0680	0.1289	0.0358	0.0599	0.0938
23	144	hour	20%	1	85.40	1.00	0.0282	0.0185	0.0183	0.0447	0.0106	0.0229	0.0289
23	144	hour	20%	2	85.40	1.00	0.0636	0.0461	0.0531	0.1040	0.0241	0.0518	0.0767
23	144	hour	20%	3	85.40	1.00	0.0321	0.0231	0.0313	0.0548	0.0202	0.0281	0.0477
23	144	hour	20%	4	85.40	1.00	0.0284	0.0194	0.0262	0.0465	0.0142	0.0237	0.0398
23	144	hour	20%	5	85.40	1.00	0.0258	0.0173	0.0213	0.0405	0.0131	0.0212	0.0343
23	144	hour	20%	6	85.40	1.00	0.0504	0.0370	0.0361	0.0826	0.0192	0.0437	0.0554
23	144	hour	20%	7	85.40	1.00	0.0222	0.0148	0.0142	0.0346	0.0083	0.0177	0.0225
23	144	hour	20%	8	85.40	1.00	0.0143	0.0064	0.0101	0.0210	0.0029	0.0057	0.0128
23	144	hour	20%	9	85.40	1.00	0.0346	0.0251	0.0387	0.0594	0.0220	0.0307	0.0594
23	144	hour	20%	10	85.40	1.00	0.0957	0.0727	0.0946	0.1666	0.0562	0.0731	0.1395
24	168	hour	20%	1	89.40	1.00	0.0232	0.0167	0.0234	0.0359	0.0122	0.0205	0.0345
24	168	hour	20%	2	89.40	1.00	0.0256	0.0200	0.0185	0.0429	0.0102	0.0216	0.0287
24	168	hour	20%	3	89.40	1.00	0.0309	0.0208	0.0237	0.0523	0.0148	0.0250	0.0363
24	168	hour	20%	4	89.40	1.00	0.1204	0.0842	0.1088	0.1951	0.0437	0.0846	0.1447
24	168	hour	20%	5	89.40	1.00	0.0264	0.0107	0.0175	0.0343	0.0088	0.0120	0.0246
24	168	hour	20%	6	89.40	1.00	0.0330	0.0223	0.0228	0.0541	0.0128	0.0278	0.0356
24	168	hour	20%	7	89.40	1.00	0.0071	0.0018	0.0047	0.0080	0.0007	0.0013	0.0051
24	168	hour	20%	8	89.40	1.00	0.0316	0.0209	0.0324	0.0510	0.0204	0.0263	0.0499
24	168	hour	20%	9	89.40	1.00	0.0866	0.0610	0.0782	0.1418	0.0325	0.0649	0.1078

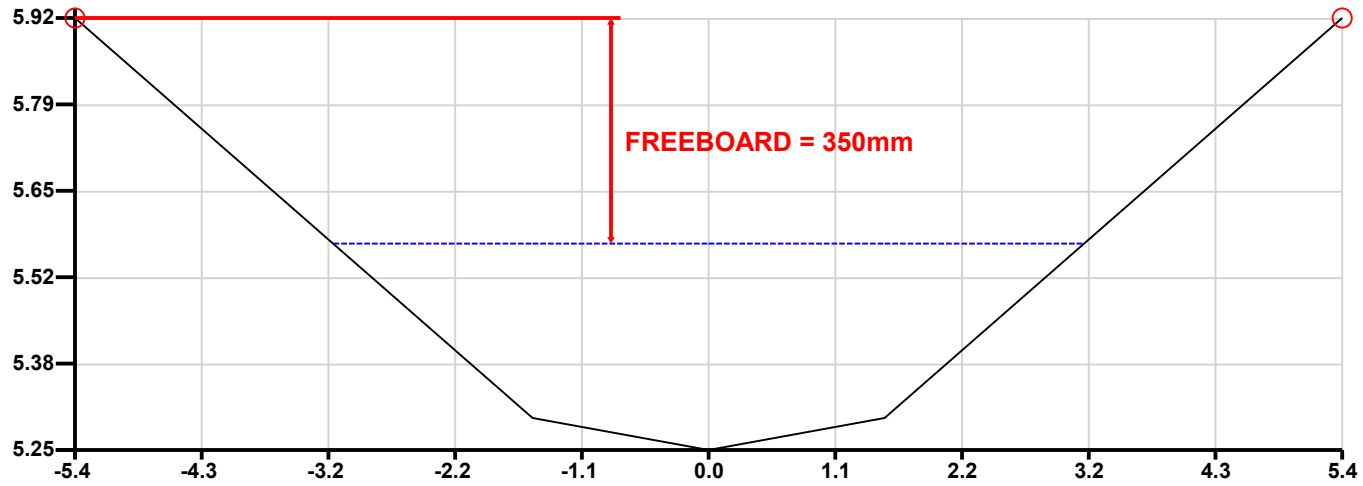
```
 24        168 hour             20%     10     89.40    1.00    0.0182    0.0118    0.0132    0.0279    0.0064    0.0135    0.0186
Run,    Representative hydrograph
 1     dur10min_aep20tp5.out
Run,    Representative hydrograph
 2     dur15min_aep20tp6.out
Run,    Representative hydrograph
 3     dur20min_aep20tp7.out
Run,    Representative hydrograph
 4     dur25min_aep20tp7.out
Run,    Representative hydrograph
 5     dur30min_aep20tp4.out
Run,    Representative hydrograph
 6     dur45min_aep20tp6.out
Run,    Representative hydrograph
 7     dur1hour_aep20tp5.out
Run,    Representative hydrograph
 8     dur1_5hour_aep20tp6.out
Run,    Representative hydrograph
 9     dur2hour_aep20tp8.out
Run,    Representative hydrograph
10     dur3hour_aep20tp5.out
Run,    Representative hydrograph
11     dur4_5hour_aep20tp5.out
Run,    Representative hydrograph
12     dur6hour_aep20tp1.out
Run,    Representative hydrograph
13     dur9hour_aep20tp4.out
Run,    Representative hydrograph
14     dur12hour_aep20tp5.out
Run,    Representative hydrograph
15     dur18hour_aep20tp5.out
Run,    Representative hydrograph
16     dur24hour_aep20tp10.out
Run,    Representative hydrograph
17     dur30hour_aep20tp2.out
Run,    Representative hydrograph
18     dur36hour_aep20tp2.out
Run,    Representative hydrograph
19     dur48hour_aep20tp2.out
Run,    Representative hydrograph
20     dur72hour_aep20tp4.out
Run,    Representative hydrograph
21     dur96hour_aep20tp10.out
Run,    Representative hydrograph
22     dur120hour_aep20tp6.out
Run,    Representative hydrograph
23     dur144hour_aep20tp3.out
Run,    Representative hydrograph
24     dur168hour_aep20tp6.out

Elapsed Run Time (hh:mm:ss) = 00:01:45
```

APPENDIX E: PC CONVEY RESULT

PROJECT: 2000243-Wollaston OFLP 10m
Comment
Print-out date: 27/08/2021 - Time: 2:06
Data File: C:\Users\nurhalimi\Documents\Lola\Work BevWill-Temp\OFLP 10m.dat

1. CROSS-SECTION:



2. DISCHARGE INFORMATION:

100 year (1%) storm event

Total discharge = 0.9 cumecs

There is no pipe discharge
Overland / Channel / Watercourse discharge = 0.900 cumecs

3. RESULTS: Water surface elevation = 5.570m

High Flow Channel grade = 1 in 200, Main Channel / Low Flow Channel grade = 1 in 200.

	LEFT OVERBANK	MAIN CHANNEL	RIGHT OVERBANK	TOTAL CROSS-SECTION
Discharge (cumecs):	0.00	0.95	0.00	0.95
D(Max) = Max. Depth (m):	0.00	0.32	0.00	0.32
D(Ave) = Ave. Depth (m):	0.00	0.21	0.00	0.21
V = Ave. Velocity (m/s):	0.00	0.71	0.00	0.71
D(Max) x V (cumecs/m):	0.00	0.23	0.00	0.23
D(Ave) x V (cumecs/m):	0.00	0.15	0.00	0.15
Froude Number:	0.00	0.50	0.00	0.50
Area (m^2):	0.00	1.34	0.00	1.34
Wetted Perimeter (m):	0.00	6.44	0.00	6.44
Flow Width (m):	0.00	6.40	0.00	6.40
Hydraulic Radius (m):	0.00	0.21	0.00	0.21
Composite Manning's n:	0.000	0.035	0.000	0.035
Split Flow?	-	-	-	No

4. CROSS-SECTION DATA:

	LEFT HAND POINT		RIGHT HAND POINT		
SEGMENT NO.	CHAINAGE (m)	R.L. (m)	CHAINAGE (m)	R.L. (m)	MANNING'S N
1	-5.400	5.920	-1.500	5.300	0.035
2	-1.500	5.300	0.000	5.250	0.035
3	0.000	5.250	1.500	5.300	0.035
4	1.500	5.300	5.400	5.920	0.035

APPENDIX F: CONCEPT LAYOUT PLAN AND CROSS SECTIONS PLAN

WARNING

BEWARE OF UNDERGROUND SERVICES

The locations of underground services are approximate only and their exact position should be proven on site.
No guarantee is given that all existing services are shown.
Locate all underground services before commencement of works

DIAL 1100 BEFORE YOU DIG

www.1100.com.au

PRELIMINARY PRINT
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRN.	APP.
P2	ISSUED FOR INFORMATION	26.08.21	J.T.	L.N.
P1	ISSUED FOR INFORMATION	18.03.21	M.F.J.	L.N.

REV	DESCRIPTION	DATE	DRN.	APP.

0 10 20 40 60 80
SCALE 1:1000 AT A1 SIZE

Designed	L. NURHALIM
Date	18.03.2021
Drawn	M.F. JAURIGUE
Approved	-
Date	
PS Number	PS1000

Beveridge Williams
1 Glenferrie Road
Malvern VIC 3144
ph: 03 9524 8888
www.beveridgewilliams.com.au

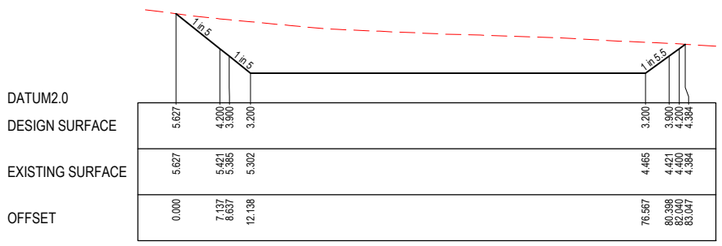
Project Details	147 WOLLASTON ROAD, WARRNAMBOOL GULL GROUP WARRNAMBOOL CITY COUNCIL
Drawing Title	CONCEPT PLAN

Sheet 01 of 02

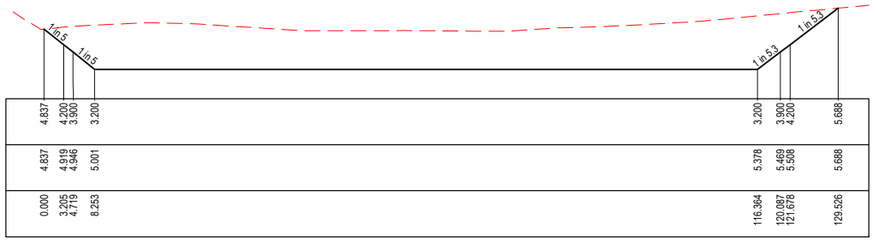
Scale 1:1000 @ A1

N

Project Ref	Stage No	Drawing No	Rev
2000243	00	551	P2

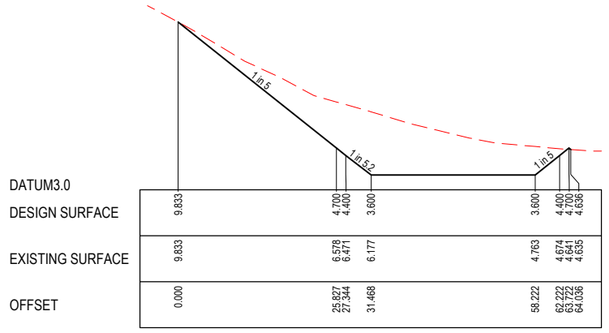


SECTION B-B

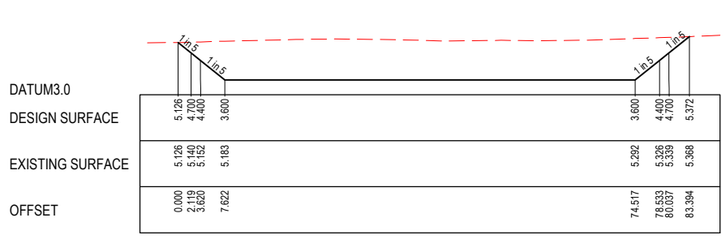


SECTION A-A

WEST SECTIONS



SECTION D-D



SECTION C-C

EAST SECTIONS

PRELIMINARY PRINT
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRN.	APP.
P2	ISSUED FOR INFORMATION	26.08.21	J.T.	L.N.
P1	ISSUED FOR INFORMATION	18.03.21	M.F.J.	L.N.

REV	DESCRIPTION	DATE	DRN.	APP.

Designed L. NURHALIM
Date 18.03.2021
Drawn M.F. JAURIGUE
Approved -
Date
PS Number PS1000

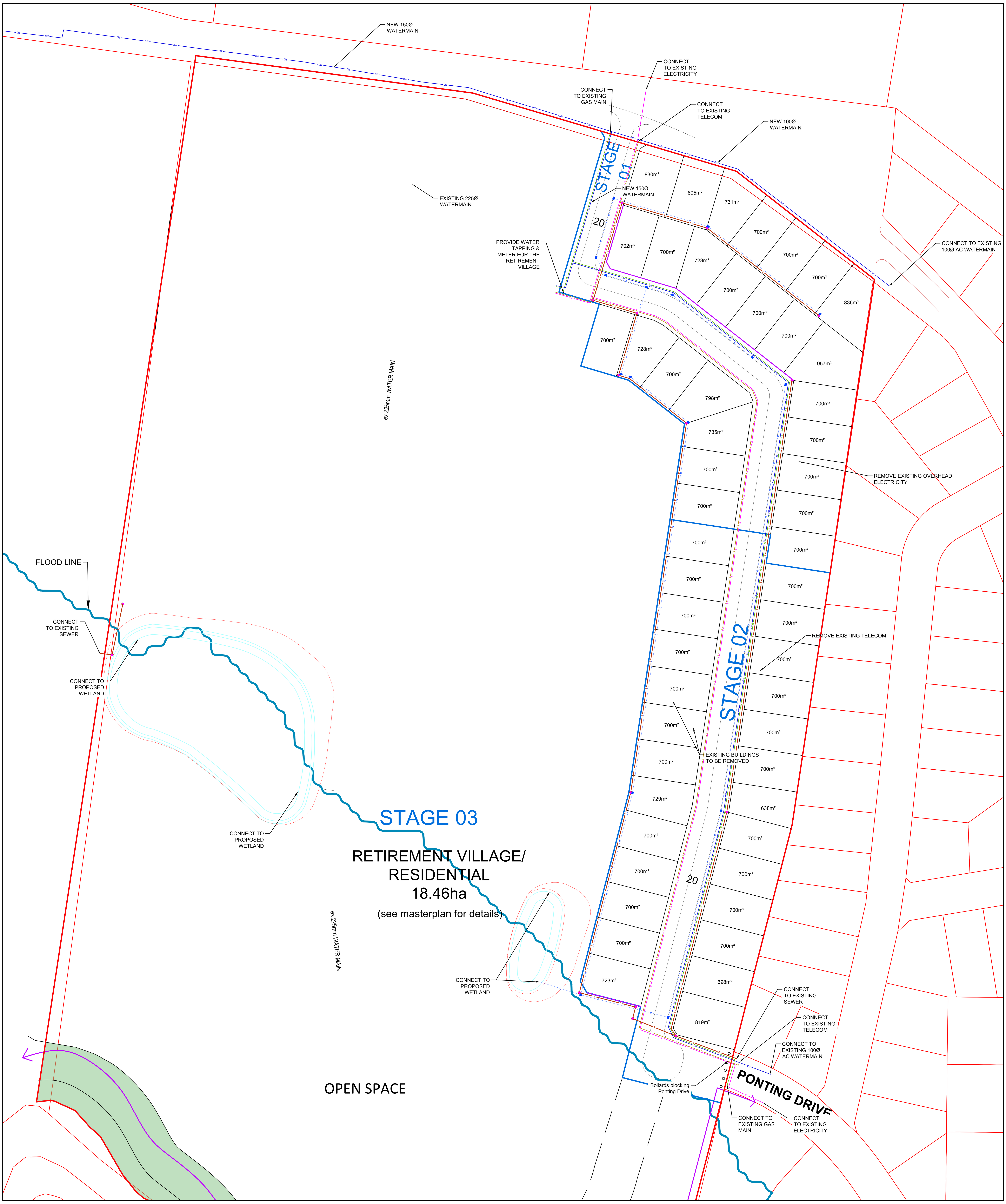
Beveridge Williams
1 Glenferrie Road
Malvern VIC 3144
ph: 03 9524 8888
www.beveridgewilliams.com.au

Project Details 147 WOLLASTON ROAD, WARRNAMBOOL
GULL GROUP
WARRNAMBOOL CITY COUNCIL

Drawing Title SECTIONS

Sheet 02 of 02
Scale AS SHOWN

Project Ref	Stage No	Drawing No	Rev
200243	00	580	P2



LEGEND - LAYOUT PLAN

- STORMWATER DRAIN, PIT & PROPERTY INLET
- MELBOURNE WATER DRAIN & PIT
- SWALE DRAIN
- S — SEWER & MAINTENANCE STRUCTURES
- H — HOUSE DRAIN
- GW — SERVICE CONDUITS
- E — ELECTRICITY (UNDERGROUND)
- O/H E — ELECTRICITY (OVERHEAD)
- O — OPTIC FIBRE
- T — TELECOMMUNICATIONS
- G — GAS
- DW — WATER
- NDW — RECYCLED WATER
- Ex D — EXISTING STORMWATER DRAIN
- ExE — EXISTING ELECTRICITY (UNDERGROUND)
- ExO/H E — EXISTING ELECTRICITY (OVERHEAD)
- ExG — EXISTING GAS
- ExO — EXISTING OPTIC FIBRE
- ExT — EXISTING TELECOMMUNICATIONS
- ExDW — EXISTING WATER
- ExNDW — EXISTING RECYCLED WATER
- Ex S — EXISTING SEWER
- H — EXISTING HOUSE DRAIN
- EXISTING SWALE DRAIN
- TACTILE PAVERS (INDICATIVE ONLY)
- 141.34 — EXISTING SURFACE LEVEL
- FS140.35 — FINISHED BUILDING LINE LEVEL
- FR157.40 — FINISHED RIDGE LINE LEVEL
- TW159.30 — TOP OF RETAINING WALL
- BW159.30 — BOTTOM OF RETAINING WALL
- RIDGE LINE
- RETAINING WALL
- ZERO LOT LINES
- PAVEMENT TREATMENT
- STRUCTURAL FILL > 200mm DEEP
- EX. STRUCTURAL FILL > 200mm DEEP
- 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
- PERMANENT SURVEY MARK
- TEMPORARY BENCH MARK
- PROPOSED DRIVEWAY

WARNING

BEWARE OF UNDERGROUND SERVICES

The locations of underground services are approximate only and their exact position should be proven on site.
No guarantee is given that all existing services are shown.
Locate all underground services before commencement of works

DIAL 1100 BEFORE YOU DIG

www.1100.com.au

PRELIMINARY PRINT
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRN.	APP.
P3	FOR DISCUSSION ONLY	04.11.22	GS	XX
P2	FOR DISCUSSION ONLY	07.09.21	NZ	XX
P1	FOR DISCUSSION ONLY	25.08.21	NZ	XX
P0	FOR DISCUSSION ONLY	21.02.20	JZ	XX

0 5 10 20 30 40 50

Designed	J.ZAAL
Date	21.02.20
Drawn	J.ZAAL
Approved	A.PPROVER
Date	XX.XX.XX
PS Number	PS

Beveridge Williams
96 Main Road
Bakery Hill VIC 3354
ph: 03 5327 2000
www.beveridgewilliams.com.au

Project Details: 147 WOLLASTON ROAD, WARRNAMBOOL
GULL GROUP
WARRNAMBOOL SHIRE COUNCIL

Drawing Title: INDICATIVE LAYOUT AND SERVICING PLAN

Sheet 01 of 01

Scale 1:500 @ A1

N

Project Ref	Stage No	Drawing No	Rev
2000243	00	100	P3

X:\20\2000243 - 147 Wollaston Road Warrnambool_Pro\DCE\PT20BAL-12-010-LAY.dwg

Aboriginal Heritage Act 2006
Section 65

Cultural Heritage Management Plan – Notice of Approval

CHMP Name:	Proposed Residential Subdivision and Retirement Community: 147 Wollaston Road, Warrnambool		
CHMP Number:	17386		
Sponsor:	Wollaston Developments Pty Ltd	**ABN:**	638 859 622
Heritage Advisor(s):	Renee McAlister		
Author(s):	Renee McAlister, Claire Nicholls and Simon Coxe (Heritage Insight Pty Ltd)		
Cover date:	15 April 2021	**Pages:**	vi + 130

TO BE COMPLETED BY THE SECRETARY (OR DELEGATE) **I have considered the Evaluation Report for this CHMP and:**	**Yes**	**No**
I am satisfied that the CHMP has been prepared in accordance with the standards prescribed for the purposes of section 53 of the Aboriginal Heritage Act 2006.	✓	
I am satisfied that the CHMP adequately addresses the matters set out in section 61.	✓	
In considering this application, I consulted with and considered the views of Aboriginal persons or bodies I considered relevant to the application.	✓	
I have given proper consideration to any relevant human rights	✓	

I, Harry Webber, Director Heritage Services Aboriginal Victoria, acting under authority delegated to me by the Secretary, Department of Premier and Cabinet, and pursuant to section 65(2) of the *Aboriginal Heritage Act 2006* hereby **approve / refuse to approve** this cultural heritage management plan:

Signed: .....

HARRY WEBBER

Dated: 13 May 2021

- **This notice of approval must be inserted after the title page and bound with the body of the management plan.**
- **The conditions in this management plan are now compliance requirements. Officers from the Department of Premier and Cabinet may attend the subject land to monitor compliance with the conditions.**

Proposed Residential Subdivision and Retirement Community: 147 Wollaston Road, Warrnambool

Cultural Heritage Management Plan

Aboriginal Victoria Management Plan Identifier: 17386

Sponsor: Wollaston Developments Pty Ltd

Heritage Advisor: Renee McAlister

Authors: Renee McAlister, Claire Nicholls and Simon Coxe

April 15, 2021

Heritage Insight Pty Ltd

Heritage Insight P/L 53 Stubbs Street Kensington VIC 3031 T: +61 3 9376 6569
6 Jennings Street Kyneton VIC 3444 T: +61 3 8578 3779
INQUIRIES: archaeology@heritageinsight.com
FAX: +61 3 9376 6526 WEB: www.heritageinsight.com

Title Page

TITLE:	Proposed residential subdivision and retirement community: 147 Wollaston Road
ACTIVITY:	Subdivision and retirement community development
LOCATION:	147 Wollaston Road
LEVEL OF ASSESSMENT:	Complex
SIZE OF ACTIVITY:	Medium
ABORIGINAL HERITAGE PRESENT:	No
AV PLAN IDENTIFIER:	17386
DATE OF COMPLETION:	April 15, 2021
SPONSOR:	Wollaston Developments Pty Ltd
ABN:	638 859 622
HERITAGE ADVISOR:	Renee McAlister
AUTHOR:	Renee McAlister, Simon Coxe and Claire Nicholls

Acknowledgments

Heritage Insight Pty Ltd would like to acknowledge and thank the following people for their assistance and participation in this study:

Eastern Maar Aboriginal Corporation:

Craig Edwards
John Clarke
Samantha Fidge
Corey Harradin
Hayden Harradin

Heritage Insight Staff

GIS mapping:	Katarina Audy
Field work:	Margaret Reith and Thanos Matanis
Data compilation:	Nessa Beasley
Report editing:	Bronwyn Hislop

Belmara Industries

Steven Weir

The Sponsor

Cameron Gull (Wollaston Developments Pty Ltd)

Disclaimer

The information contained in this Cultural Heritage Management Plan (CHMP) has been compiled from the standard heritage database sources and is accurate as far as Heritage Insight Pty Ltd is aware. However, within the timeframes available for technical heritage reporting, it is not possible to carry out comprehensive research of all published or unpublished manuscripts, journals, maps or oral history which may pertain to the study area. No responsibility can be taken for errors or omissions in primary and secondary source material cited in this report. Any opinions expressed in this report are those of Heritage Insight Pty Ltd and do not necessarily represent those of the Sponsor. Heritage Insight has endeavoured to actively consult with representatives of the RAP (EMAC) who are, to the best of our knowledge and advice, the legal and proper representatives of the local Aboriginal community. The consultants cannot, however, be held responsible for opinions or actions which may be expressed by dissenting persons or organisations. This CHMP has been prepared to comply with the approved form under Clause r.68 of the *Aboriginal Heritage Regulations 2018*. However, Heritage Insight Pty Ltd cannot be responsible for any changes in policy on the part of the Victorian Government, its agencies, or Registered Aboriginal Parties in the period since lodging a Notice of Intent to Prepare a CHMP.

Copyright Notice

Executive Summary

Compliance requirements are set out in Part 1 of the Cultural Heritage Management Plan.

This mandatory Cultural Heritage Management Plan (CHMP) has been undertaken at the request of the Sponsor, Wollaston Developments Pty Ltd for the proposed development of a residential subdivision, retirement community and sporting facilities at 147 Wollaston Road.

The southern portion of the activity area is located in an area of cultural heritage sensitivity because it is located within 200m of Merri River (r.26). The proposed activity is a high impact activity because it is for the construction of a residential subdivision (r.49), a retirement community, and a golf course and bowling green, along with associated facilities and utilities (r.46).

This is a medium-sized CHMP conducted to the level of complex assessment.

The results of the desktop assessment noted that the activity area had been subject to previous archaeological assessment which identified low archaeological potential, but identified the land near Merri River as an area of archaeological potential and noted that Aboriginal Places had been identified nearby on similar farming land and landforms.

The standard assessment was undertaken by Margaret Reith (Heritage Insight Pty Ltd) on January 11, 2021. She was assisted by Thomas Matanis (Heritage Insight Pty Ltd), Hayden Harradine and Corey Harradine (Eastern Maar Aboriginal Corporation – EMAC). Survey accessibility was excellent with the entire activity area being able to be accessed and surveyed, however, poor ground surface inhibited effective survey coverage.

The complex assessment was conducted on January 11–15, 2021 by Margaret Reith, Thanos Matanis (Heritage Insight), Corey Harradine and Hayden Harradine (EMAC). Mechanical excavation was done by Steven Weir (Belmara Industries).

A total of four 1x1m test pits (TPs) and seven 1mx5m machine trenches (MTs; note: one was discontinued) were excavated across the activity area in order to assess the likelihood of Aboriginal cultural material being present and to establish a profile of the soils within the activity area. None of the TPs or MTs exposed Aboriginal cultural materials. It was concluded that the activity area contains low archaeological potential as it is located on both a steep slope (unsuitable for camping) and the flood plain adjacent Merri River. It was noted that the flood plain is regularly inundated and has likely been highly modified since European settlement.

No Aboriginal cultural material was located during this CHMP assessment.

Table of Contents

Figures

Maps

Plates

Tables

Abbreviations

ACHRIS – Aboriginal Cultural Heritage Register and Information System
ASL – Above Sea Level
AV – Aboriginal Victoria
CBD – Central Business District
CHMP – Cultural Heritage Management Plan
DBYD – Dial Before You Dig
dGPS or differential GPS – Differential Global Positioning System
DPC – Department of Premier and Cabinet
EMAC – Eastern Maar Aboriginal Corporation
EPA – Environmental Protection Authority
EVC – Ecological Vegetation Class
GDA94 – Geocentric Datum of Australia 1994
GIS – Geographic Information Systems
HA – Heritage Advisor
HV – Heritage Victoria
ICOMOS – International Council on Monuments and Sites
LDAD – Low Density Artefact Distribution
LGA – Local Government Area
LGM – Last Glacial Maximum
MGA – Map Grid of Australia
MMBW – Melbourne & Metropolitan Board of Works
MT – Machine Transect
NDA – Net Developable Area
NOI – Notice of Intent to Prepare a CHMP
OHS – Occupational Health and Safety
PAD – Potential Archaeological Deposit
PAS – Potential Archaeological Sensitivity
PSP – Precinct Structure Plan
RAP – Registered Aboriginal Party
RTP – Radial Shovel Test Pit
SU – Survey Unit
STP – Shovel Test Pit
TO – Traditional Owner
TP – Test Pit
VAHC – Victorian Aboriginal Heritage Council
VAHR – Victorian Aboriginal Heritage Register

Please note that all maps and plans in this CHMP are prepared using Victorian Government Standard GDA94 MGA coordinates (Zone 54).

A glossary of terms is provided in Appendix 4.

Part One: Cultural Heritage Management Conditions

These conditions become compliance requirements once the Cultural Heritage Management Plan is approved. Failure to comply with a condition is an offence under Section 67A of the *Aboriginal Heritage Act 2006*.

The Cultural Heritage Management Plan must be readily accessible to the Sponsor and their employees and contractors when carrying out the activity.

1.0 Cultural Heritage Management Conditions

1.1 General Cultural Heritage Management Conditions

1.1.1 Condition 1: Cultural Heritage Induction

A cultural heritage induction must be conducted with all site workers/contractors involved in ground disturbing works by a heritage advisor and a representative of the Eastern Maar Aboriginal Corporation (EMAC) prior to, or at the commencement of, construction works.

The session must include a brief history of the Aboriginal occupation of the activity area and broader region; a summary of the archaeological investigations conducted within the activity area; specific details of all Aboriginal Places and heritage located during the CHMP assessment; a summary of the conditions and contingencies contained within the CHMP; and the obligations of site workers/contractors and Sponsors under the Victorian *Aboriginal Heritage Act 2006*.

The main aim of the cultural heritage induction is to explain the procedures outlined in the CHMP; to show the site contractors examples of the most likely Aboriginal cultural heritage material to be located within the activity area; and to explain the procedure outlined in the contingency plan section of the CHMP in the unlikely event that this material is uncovered by them during the course of construction works.

The cultural heritage induction must be organised and paid for by the Sponsor.

1.1.2 Condition 2: Contingency Plans

There must also be a system for reporting any possible Aboriginal cultural heritage which may be discovered or uncovered during the conduct of the proposed activity. To this end, the contingency plans in Section 2 must be incorporated into the development documentation and risk assessment for the project.

1.1.3 Condition 3: Approved CHMP to be Kept On-site

An approved hard copy of this management plan must be held on-site for the duration of the activity.

2.0 Contingency Plans

The approved form for a CHMP states that in accordance with Clause 13(1) Schedule 2 of the *Aboriginal Heritage Regulations 2018*, a management plan must also include specific contingency plans for:

(a) the matters referred to in Section 61 of the *Aboriginal Heritage Act 2006*;

(b) the resolution of any disputes between the Sponsor and relevant RAPs in relation to the implementation of an approved management plan or the conduct of the activity (if a RAP is evaluating the management plan);

(c) reviewing compliance with the management plan and mechanisms for remedying non-compliance;

(d) the management of Aboriginal cultural heritage found during the activity; and

(e) the notification, in accordance with the *Aboriginal Heritage Act 2006*, of the discovery of Aboriginal cultural heritage during the carrying out of the activity.

Contingency plans are required even in situations where it has been assessed that there is a low probability of Aboriginal cultural heritage being located within an activity area.

If the activity is a subdivision referred to in r.49, a management plan must also include specific contingency plans [Clause 13(2) Schedule 2 of the Regulations] for:

(a) how each lot is intended to be used or developed by the Sponsor; or

(b) if a lot is not intended to be used or developed by the Sponsor; the use or development of the lot permitted by the relevant planning scheme.

Permitted uses for the subdivision will be compliant with the General Residential Zone – Schedule 1 (GRZ1) of the City of Warrnambool (Appendix 5).

2.1 Section 61 Matters

Section 61 of the *Aboriginal Heritage Act 2006* is concerned with the avoidance and/or minimisation of harm to Aboriginal cultural heritage and with any specific measures required for the management of Aboriginal cultural heritage during and following the activity. Section 61 matters pertaining to previously unknown, unexpected or undiscovered cultural heritage that is discovered, uncovered or may become exposed during the conduct of the activity are discussed in Section 2.3.

2.2 Dispute Resolution

In the event of a dispute between the Sponsor and the Eastern Maar Aboriginal Corporation (EMAC) over the implementation of this CHMP, the following must occur:

- details of the dispute should be documented by both the EMAC and the Sponsor;
- representatives of the Sponsor and the EMAC should organise a meeting as soon as possible to attempt to resolve the dispute;
- the understanding of the issue by both parties should be clearly stated by the relevant representatives during the course of the meeting;
- if desired by both parties, external mediation by a third party may occur during the meeting;

- the objective of the meeting should be to discuss and arrive at an understanding of the matter being disputed and reach a negotiated settlement of the dispute. This may include a formal protocol between the Sponsor and the EMAC; and
- the resolution to the dispute should be recorded in writing and signed by both parties.

2.3 Discovery of Aboriginal Cultural Heritage During Works

2.3.1 Unexpected Discovery of Human Remains

If any suspected human remains are found during any activity, works must cease. The Victoria Police and the State Coroner's Office should be notified immediately. If there are reasonable grounds to believe the remains are Aboriginal, the Coronial Admissions and Enquiries hotline must be contacted immediately on 1300 888 544. This advice has been developed further and is described in the following 5-step contingency plan.

Any such discovery at the activity area must follow these steps.

1. Discovery:

a) If suspected human remains are discovered, all activity in the vicinity must stop; and

b) The remains must be left in place, and protected from harm or damage.

2. Notification:

a) If suspected human remains have been found, the State Coroner's Office and the Victoria Police must be notified immediately;

b) If there is reasonable grounds to believe the remains are Aboriginal Ancestral Remains, the Coronial Admissions and Enquiries hotline must be immediately notified on 1300 888 544;

c) The EMAC must also be independently informed of the discovery;

d) All details of the location and nature of the human remains must be provided to the relevant authorities; and

e) If it is confirmed by these authorities the discovered remains are Aboriginal Ancestral Remains, the person responsible for the activity must report the existence of them to the Victorian Aboriginal Heritage Council in accordance with section 17 of the *Aboriginal Heritage Act 2006*.

3. Impact Mitigation or Salvage:

a) The Victorian Aboriginal Heritage Council, after taking reasonable steps to consult with any Aboriginal person or body with an interest in the Aboriginal Ancestral Remains, will determine the appropriate course of action as required by section 18(2)(b) of the *Aboriginal Heritage Act 2006*; and

b) An appropriate impact mitigation or salvage strategy as determined by the Victorian Aboriginal Heritage Council must be implemented by the Sponsor.

4. Curation and Further Analysis:

a) The treatment of salvaged Aboriginal Ancestral Remains must be in accordance with the direction of the Victorian Aboriginal Heritage Council.

5. Reburial:

a) Any reburial site(s) must be fully documented by an experienced and qualified archaeologist, clearly marked and all details provided to Aboriginal Victoria; and

b) Appropriate management measures must be implemented to ensure the Aboriginal Ancestral Remains are not disturbed in the future.

Note:

a) do not take any photographs without the express request of the Coroners Office; and

b) do not contact the media.

2.3.2 Unexpected Discovery of Other Aboriginal Cultural Heritage

In the event that unexpected Aboriginal cultural heritage is discovered in the activity area, the following steps must be taken:

a) all works must cease and temporary webbing or fencing erected without ground disturbance at a distance of 10m (buffer zone) around the location of the suspected Aboriginal cultural heritage, with signage displayed at all times clearly identifying the location as a 'no-go zone'. A heritage advisor must be notified of the discovery by the site supervisor within two working days. The heritage advisor must then contact the EMAC to facilitate their participation in investigating the suspected discovery. Work may continue in other parts of the activity area away from the buffer zone;

b) the EMAC must be contacted in the first instance. A heritage advisor must facilitate their involvement. This will include an on-site investigation and assessment of the significance of the suspected Aboriginal cultural heritage;

c) the suspected Aboriginal cultural heritage must be examined by a qualified heritage advisor, a representative of the EMAC and a representative of the Sponsor. Within a period not exceeding five working days, the heritage advisor, in consultation with the EMAC will make a decision or recommendation regarding the appropriate management of the Aboriginal cultural heritage and how to proceed with works;

d) if the find is confirmed as Aboriginal cultural heritage, the heritage advisor must record and register the Aboriginal Places with the VAHR. This includes recording the location of the cultural material with a differential GPS and photography of the location of the cultural heritage. Additional measures to manage or salvage the Aboriginal cultural heritage must also be provided (see Section 2.3.3); and

e) if the find is determined to not be Aboriginal cultural heritage, works at the location may recommence and temporary fencing and signage must be removed.

2.3.3 Management or Salvage of Aboriginal Cultural Heritage Discovered During the Activity

Section 2.1 stipulates that Section 61 of the *Aboriginal Heritage Act 2006* is concerned with the avoidance and/or minimisation of harm to Aboriginal cultural heritage during and following the activity. This section outlines the steps that must be followed when there is an unexpected discovery of Aboriginal cultural heritage during the activity (confirmed at time of inspection as outlined in Section 2.3.2).

a) the heritage advisor, in consultation with the Sponsor and the EMAC, must provide a process to be followed to manage or salvage the Aboriginal cultural heritage in a manner which complies with the *Aboriginal Heritage Regulations 2018* and which is culturally appropriate. This process must be provided within a period not exceeding five working days of the Aboriginal cultural heritage being inspected and confirmed; and

b) a process to manage or salvage the Aboriginal cultural heritage must consider the significance of the find in relation to the known archaeological and cultural heritage significance of existing Aboriginal Places in the region surrounding the activity area (see below).

In addition to recording and registering the Aboriginal cultural heritage (Section 2.3.2):

c) an Aboriginal Place that is determined to be a commonly occurring archaeological site type by a heritage advisor in consultation with the EMAC, for example, isolated stone artefacts or fewer than five (5) artefacts (in either a surface or subsurface context) or fragmented shell midden material:

    i. must be collected (salvaged) and the appropriate documentation completed and submitted to AV. Post-salvage management of Aboriginal cultural material is discussed in Section 2.5; and

    ii. no further management of the Aboriginal Place is required once the above step has been completed to the satisfaction of the Sponsor, heritage advisor and the EMAC.

d) an Aboriginal Place that is determined to be a less commonly occurring archaeological site type, for example, medium to high density artefact scatters, stratified occupation deposits, hearths or stratified middens:

    i. must be protected in the first instance. A meeting with the Sponsor, heritage advisor and the EMAC must be held to discuss strategies for avoiding harm to the Aboriginal cultural heritage. If it is not possible to protect the Place in its entirety, a process to minimise harm to the Aboriginal cultural heritage must be developed. If it is not possible to minimise harm, a salvage process must be designed that uses an appropriate methodology as defined by the *Guide to Preparing a Cultural Heritage Management Plan* (Aboriginal Victoria 2016), *Guidelines for Conducting and Reporting on Aboriginal Cultural Heritage Investigations* (Aboriginal Victoria 2018a) and *Practice Note: Salvage Excavation* (Aboriginal Victoria 2018b);

    ii. at the conclusion of salvage works, the Aboriginal cultural heritage removed from the location must be recorded, catalogued and analysed and a salvage report produced of the salvage works. The salvage report must meet the standards as outlined in *Practice Note: Salvage Excavation* (Aboriginal Victoria 2018b) and be submitted to AV, the RAP and the Sponsor within six months of the completion of fieldwork, as well as registering any updates to the existing Place registration on the VAHR. Post-salvage management of Aboriginal cultural material is discussed in Section 2.5;

    iii. in the event that the Aboriginal cultural heritage is protected or a process of harm minimisation is developed, works may recommence near the location of the Aboriginal cultural heritage once the agreed measures have been put in place to the satisfaction of the Sponsor, heritage advisor and the EMAC; and

iv. in the event that salvage of the Aboriginal cultural heritage is undertaken, works may recommence within or near the location of the Aboriginal cultural heritage when the on-site salvage and recording has been completed to the satisfaction of the Sponsor, heritage advisor and the EMAC.

e) an Aboriginal Place that is determined to be a rarely occurring or unique archaeological site type, for example, earth features (mounds, rings and ovens), quarries or stone arrangements:

i. must be protected; and

ii. works may only recommence near the location of the Aboriginal cultural heritage once the agreed protection measures have been put in place to the satisfaction of the Sponsor, heritage advisor and the EMAC.

2.3.4 Protocol for Handling Sensitive Information

Where Aboriginal cultural heritage is identified before, during or after the proposed activity, the Sponsor and heritage advisor must ensure that all actions carried out to manage and protect Aboriginal cultural heritage are completed in a culturally appropriate manner. The Secretary and the EMAC consider all Aboriginal Places, objects and Ancestral Remains to be culturally sensitive.

Accordingly, unless undertaken by the heritage advisor for the purposes of recording Aboriginal Places or objects, during the course of implementing the management conditions, there must not be any contact with the media, including the use of social media, photography, film and digital images in relation to any aspect of Aboriginal cultural heritage without the written permission of the Secretary and the EMAC.

2.4 Reporting Discovery of Aboriginal Cultural Heritage During Works

It is a requirement to report the discovery of an Aboriginal Place or object to the Secretary as soon as practicable under the *Aboriginal Heritage Act 2006* (Section 24). A system of reporting any possible Aboriginal cultural heritage items which are discovered during works must be built into the development documentation and risk assessment for the site (see Section 2.3.1 and 2.3.2).

The Sponsor must appoint a suitably qualified heritage advisor for the duration of the project. The heritage advisor will need to:

a) be available to visit the site and inspect any reported items of suspected Aboriginal cultural heritage that may be found during works;

b) facilitate the involvement of the EMAC during the investigation of the suspected Aboriginal cultural heritage, completion of Aboriginal Place documentation and the further management or salvage of the cultural heritage;

c) facilitate the involvement of an appropriately qualified archaeologist for any required excavation works;

d) document any items of Aboriginal cultural heritage that are found during works and report the Place/s to AV by means of registering the cultural heritage on the VAHR;

e) advise on appropriate treatment or salvage of any Aboriginal cultural heritage; and

f) provide adequate reporting on the treatment of any Aboriginal cultural heritage to standards required by AV.

2.5 Management of Aboriginal Cultural Heritage Discovered During Works

1. When previously unrecorded Aboriginal cultural material is located during the works, it will be the responsibility of the heritage advisor to:

a) catalogue the Aboriginal cultural heritage;

b) label and package the Aboriginal cultural heritage with reference to provenance;

c) arrange storage of the Aboriginal cultural heritage in a secure location with copies of the catalogue and assessment documentation;

d) at the conclusion of all site works and within a period of no longer than 12 months, the Aboriginal cultural heritage must be reburied together with relevant documentation in a durable sealed container, unless alternative arrangements are requested by the EMAC. The Aboriginal cultural heritage must be reburied at a location agreed upon with the EMAC. The reburial location must be recorded by a heritage advisor using a differential GPS, followed by lodgement of the relevant VAHR forms to AV for entry into the VAHR; and

e) the Sponsor, as well as the EMAC, must be involved in the discussions about the reburial location to ensure that the reburied cultural heritage will not be disturbed in the future.

2. Custody of any Aboriginal cultural heritage material identified during the activity must be ascribed in the following order of priority:

a) the EMAC;

b) any relevant registered native title holder for the land from which the Aboriginal heritage is salvaged;

c) any relevant native title party (as defined in the Act) for the land from which the Aboriginal heritage is salvaged;

d) any relevant Aboriginal persons with traditional or familial links;

e) any relevant Aboriginal body or organisation which has historical or contemporary interests in Aboriginal heritage relating to the land from which the Aboriginal heritage is salvaged;

f) the owner of the land from which the Aboriginal heritage is salvaged; or

g) Museum Victoria.

2.6 Reviewing Compliance with the Plan

It is an offence under the *Aboriginal Heritage Act 2006* (s.27 and s.28) to harm Aboriginal cultural heritage unless it is in accordance with an approved CHMP or cultural heritage permit or Aboriginal cultural heritage land management agreement that applies specifically to that Aboriginal cultural heritage. Under the Act, an individual or corporate found responsible for harming Aboriginal cultural heritage can be subject to prosecution and a substantial fine. A person found guilty of an offence under s.27 of the Act is liable to a penalty not exceeding 1800 penalty units (individual), or 10 000 penalty units (corporate).

The Sponsor must ensure that compliance with this plan is reviewed. A review process must be incorporated in the risk assessment or similar document for the project. The management conditions in Section 1 must be listed in the risk assessment. There must also be a mechanism included (such as a checklist or database) to indicate when the management conditions for Aboriginal cultural heritage have been carried out. The Sponsor is responsible for maintaining this list. Any associated documentation which accompanies the conditions must be recorded on the checklist or database.

The record of compliance must be maintained by the Sponsor at all times and must be available for inspection by either an Authorised Officer under the *Aboriginal Heritage Act 2006* or other representative of the Secretary. It is illegal to harm cultural heritage outside of the conditions contained within this CHMP. Authorised Officers from AV or Aboriginal Heritage Officers from the RAP may conduct CHMP compliance audits. A checklist is provided below that specifies what measures will be undertaken to review compliance with the CHMP. The Sponsor must verify that the measures specified below have been undertaken.

Contingency Table 1: Checklist for reviewing compliance with CHMP 17368*

	Yes	No	**Date**
Prior to works occurring			
1. Has the cultural heritage induction been completed by the heritage advisor and representative of the RAP?			
2. Have the contingency plans contained in Section 2 of this report been incorporated into the development documentation and risk assessment for the project?			
3. Is a copy of this CHMP kept on-site at all times for the duration of the activity?			
Identification of human remains during works			
1. Has **all** work ceased and has webbing or fencing been erected with 'no-go zone' signage displayed at all times?			
2. Have Victoria Police and the Coroner's Office (and the Coronial Admissions and Enquiries on 1300 888 544 for suspected Aboriginal Ancestral Remains) been notified?			
3. Has a suitably qualified heritage advisor been engaged to document the find?			
4. If the remains are confirmed as Aboriginal Ancestral Remains, has the VAHC been notified?			
5. Have the VAHC management measures for the Aboriginal Ancestral Remains been implemented?			
Identification of unexpected Aboriginal cultural heritage during works			
1. Has all activity within 10m ceased and has webbing or fencing been installed with 'no-go zone' signage displayed at all times?			
2. Have a heritage advisor and the EMAC been notified?			
3. Has an on-site investigation of the suspected Aboriginal cultural heritage taken place?			
4. Has harm to Aboriginal cultural heritage occurred?			
5. Has an appropriate mitigation/salvage strategy been developed and/or implemented?			
6. Has the salvaged cultural heritage been treated in accordance with the direction of the EMAC?			
Reburial Procedure for Aboriginal cultural heritage			
1. Once a reburial site has been agreed upon with the EMAC has a suitably qualified heritage advisor been engaged to fully document the location when the reburial takes place?			
2. Has the reburial location been clearly marked, accurately recorded and details provided to the VAHR?			
3. Has a strategy been developed to ensure no further disturbance?			

*Review of this CHMP can be undertaken at any time by project delegates representing the Sponsor, or by an agreed independent reviewer to ensure that the Sponsor, heritage advisor and EMAC are complying with the terms of this CHMP.

2.7 Resolution of Non-Compliance with the Plan

Compliance with the conditions of an approved CHMP is a requirement of the *Aboriginal Cultural Heritage Act 2006*. To ensure compliance with the terms of this CHMP, the Sponsor must verify that the measures specified in the above checklist have been undertaken. If there is non-compliance with the conditions or contingency plans contained within Part 1 of this CHMP, the Sponsor must contact Aboriginal Victoria immediately.

3.0 Communications

The Sponsor and any personnel involved with supervision of future construction must read the CHMP and be aware of the legal requirements and contingency procedures concerning Aboriginal cultural heritage within the activity area. The Sponsor (or other relevant supervisory staff) must be responsible for implementing any conditions contained in the CHMP.

The Sponsor must set in place internal processes of communication to ensure that they are notified prior to any contractors conducting works (including archaeological contractors) at any of the archaeological sites on the property.

Contact Details

The Sponsor or Sponsor's Agent

Wollaston Developments Pty Ltd
Attn: Cameron Gull

Phone: 0438341592
Email: cameron@gullco.com.au

Aboriginal Victoria

GPO 2392
Melbourne VIC 3001

Phone: 1800 762 003
Email: aboriginal.heritage@dpc.vic.gov.au

Eastern Maar Aboriginal Corporation

Craig Edwards
Heritage Manager

PO Box 546, Warrnambool Victoria 3280

Phone: 0481 761 990
Email: craig.edwards@easternmaar.com.au

Victorian Aboriginal Heritage Council

GPO Box 2392
Melbourne VIC 3001

Phone: (03) 8392 5392
Email: vahc@dpc.vic.gov.au

Part Two: Assessment

4.0 Introduction

Reasons for Preparing a Cultural Heritage Management Plan

This Cultural Heritage Management Plan (CHMP) has been undertaken at the request of the Sponsor, Wollaston Developments Pty Ltd, for a proposed development of a residential subdivision, retirement community and sporting facilities at 147 Wollaston Road, Warrnambool. A CHMP is a mandatory requirement for the proposed activity because:

- all or part of the activity area is an area of cultural heritage sensitivity (*Aboriginal Heritage Regulations 2018*, Division 1, 7(a)); and
- the proposed activity is a high impact activity (*Aboriginal Heritage Regulations 2018*, Division 1, 7(b)).

The southern portion of the activity area is located in an area of cultural heritage sensitivity because it is located within 200m of Merri River (r.26).

Waterways (r.26)

> (1) Subject to subregulation (2), a waterway or land within 200 metres of a waterway is an area of cultural heritage sensitivity.

The proposed activity is a high impact activity because it is for the construction of a residential subdivision (r.49), a retirement community, and a golf course and bowling green along with associated facilities and utilities (r.46).

Subdivision of land (r.49)

> (1) The subdivision of land into 3 or more lots is a high impact activity if—
>
> > (a) the planning scheme that applies to the activity area in which the land to be subdivided is located provides that at least 3 of the lots may be used for a dwelling or may be used for a dwelling subject to the grant of a permit; and
> > (b) the area of each of at least 3 of the lots is less than 8 hectares.

Buildings and works for specified uses (r.46)

> (1) The construction of a building or the construction or carrying out of works on land is a high impact activity if the construction of the building or the construction or carrying out of the works—
>
> > (a) would result in significant ground disturbance; and
> > (b) is for, or associated with, the use of the land for any one or more of the following purposes—
> >
> > > (xv) a minor sports and recreation facility;
> > > (xviii) a place of assembly;
> > > (xxiv) a retirement village.

Sponsor for the Cultural Heritage Management Plan

The Sponsor for this CHMP is Wollaston Developments Pty Ltd (ACN 638 859 622).

Notice of Intent to Prepare a CHMP

In accordance with Section 54(1) of the *Aboriginal Heritage Act 2006*, a Notice of Intent to Prepare a CHMP (NOI; Appendix 1) was submitted on August 3, 2020 to Aboriginal Victoria (AV) and the Registered Aboriginal Party (RAP) the Eastern Marr Aboriginal Corporation (EMAC). AV replied to the NOI on August 3, 2020 and allocated the project number 17368. A copy of the NOI was also provided to Warrnambool City Council on August 3, 2020.

Name, Qualifications and Experience of Heritage Advisor

The heritage advisor and author who conducted this CHMP is Renee McAlister BA (Hons) Archaeology. Renee has formal qualifications from La Trobe University, Victoria (2010) and more than 11 years' experience working in the field of historical and Aboriginal archaeology. Renee is a senior project archaeologist and registered heritage advisor.

A co-author of this CHMP is Simon Coxe. Simon is a senior project archaeologist and registered heritage advisor. Simon holds formal qualifications in Archaeology (BA Hons) from Leicester University, UK (2006). Simon has 14 years' experience conducting a broad range of heritage management and research projects throughout the UK and Australia, with experience working in Queensland (including Torres Strait), Western Australia, the Northern Territory, New South Wales and Victoria. He is also involved in projects in Papua New Guinea, having conducted research fieldwork in Milne Bay, Caution Bay and the Simbai and Kaironk Valleys (Western Highlands).

A co-author of this CHMP is Claire Nicholls. Claire is a Technical and Project Archaeologist with formal qualifications (BA Hons) from La Trobe University, Victoria (2003) and has extensive experience in Indigenous archaeology in Victoria. Claire has over 15 years' professional archaeological experience working in south east Australia, with a particular focus on Aboriginal stone artefact analysis.

Fieldwork was supervised by listed heritage advisor Margaret Reith. Margaret has both a Masters in Archaeological Sciences (Australia National University, 2013) and Bachelor in Archaeology (La Trobe University, 2011). Margaret has 11 years' archaeological experience working on major projects in Australia, Central America and Vanuatu. In Australia, Margaret has nine years' experience as a heritage advisor specialising in Aboriginal archaeology.

Location of the Activity Area

The activity area covers an area of land which is approximately 25ha. This area comprises two allotments located at 147 Wollaston Road, Warrnambool (1 TP884446 and 1 TP99782), parish of Yangery, City of Warrnambool (Map 1). The activity area also encompasses a section of the road reserve and roads for Wollaston Road and Ponting Drive. The study area is bordered to the north by Wollaston Road, to the south by Merri River, to the west by open farmland and the east by residential development. The activity area is located approximately 226km west of the Melbourne CBD (Map 1).

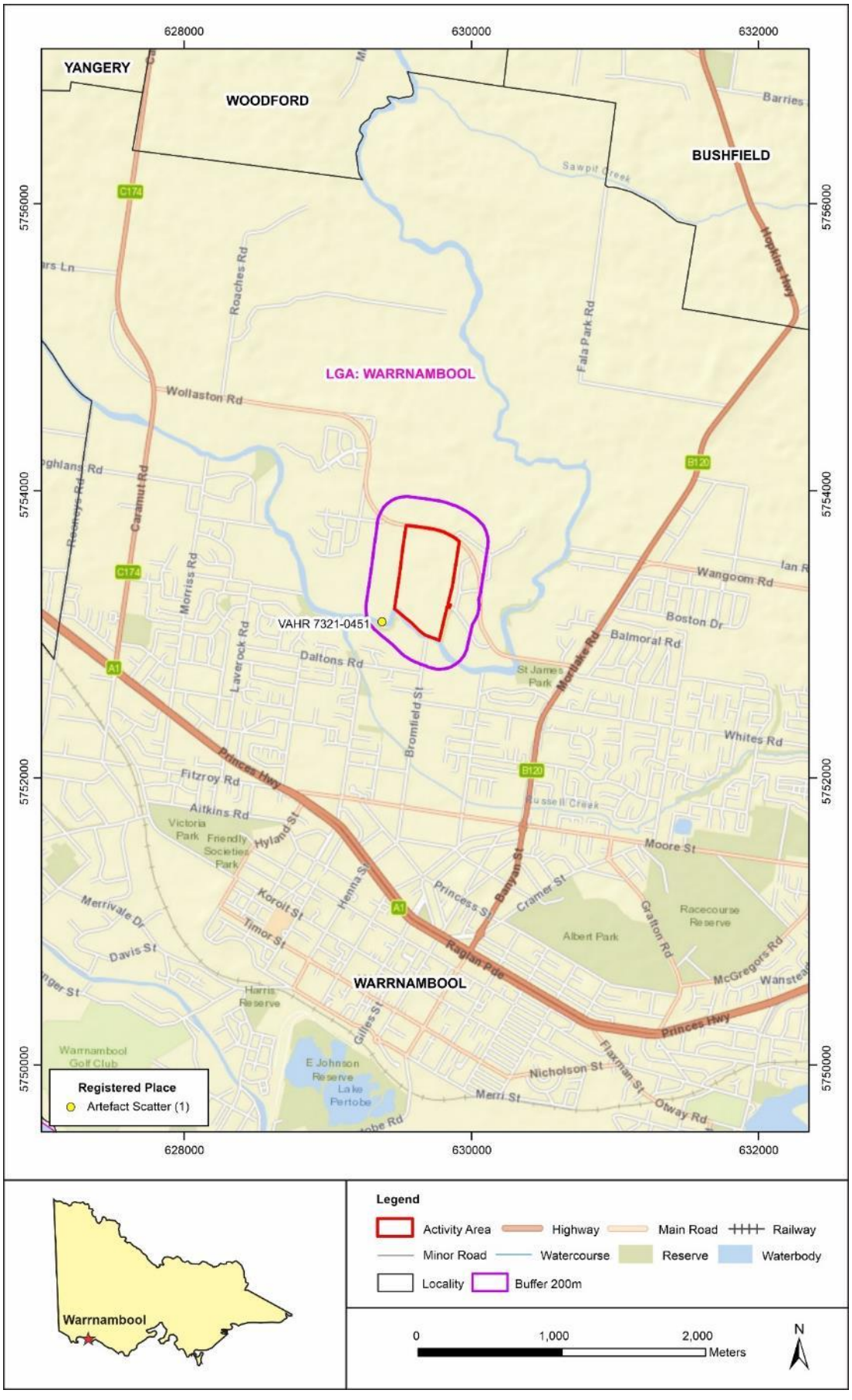
One registered Aboriginal Place is located within 200m of the south western corner of the activity area, VAHR 7321-0451.

Landowners

The activity area is owned by Wollaston Developments Pty Ltd.

RAPs with Responsibility for the Activity Area

The Registered Aboriginal Party (RAP) for the activity area is the Eastern Marr Aboriginal Corporation (EMAC). However, as the EMAC were a relatively new RAP at the time the CHMP commenced, it was advised that the CHMP would be evaluated by The Secretary under s.65(1)(b)(i) of the *Aboriginal Heritage Act 2006*. Consultation with the RAP was undertaken throughout the project.



Map 1: Location of the activity area

5.0 The Activity Area and Proposed Works

5.1 Extent of the Activity Area Covered by the Management Plan

The activity area covers an area of land which is approximately 25ha. This area comprises two allotments located at 147 Wollaston Road, Warrnambool (1 TP884446 and 1 TP99782), parish of Yangery, City of Warrnambool (Map 1). The activity area also encompasses a section of the road reserve and roads for Wollaston Road and Ponting Drive. The study area is bordered to the north by Wollaston Road, to the south by Merri River, to the west by open farmland and the east by residential development. The activity area is located approximately 226km west of the Melbourne CBD (Map 1).

The activity area comprises open farmland with a farm house and associated dwellings, paddocks, fencing and wind breaks made with mature trees. A flood overlay covers the southern section of the property and the property is steeply sloped.

5.2 Activity Description

The proposed activities are the construction of a residential subdivision, retirement community and associated community buildings, a golf course, and construction of roads and installation of services. (Map 3).

Activities will be undertaken in accordance with the requirements outlined in the General Residential Zone – Schedule 1 (GRZ1) of the City of Warrnambool (Appendix 5).

5.3 Statement of Potential Impacts

The proposed activities will involve some degree of soil disturbance to both surface and buried land surfaces. Activities which will occur during the course of the proposed works are:

a) Site preparation works including removal of existing built structures, rubbish and unwanted vegetation and fencing;

b) Construction of access roads with associated curbs, road reserve and footpaths. Construction of road will require a mix of cut and fill across the landscape; cuts may occur to a maximum depth of up to 5000mm;

c) Installation of underground services and utilities (See Table 1);

d) Preparation of individual allotments; this will involve removal of topsoil to a an average depth of 100-150mm, however, in some places this will do deeper, depending on engineering and geological requirements.

e) Installation of a wetlands feature and associated drainage infrastructure; this will involve excavation to a maximum depth of 2000mm;

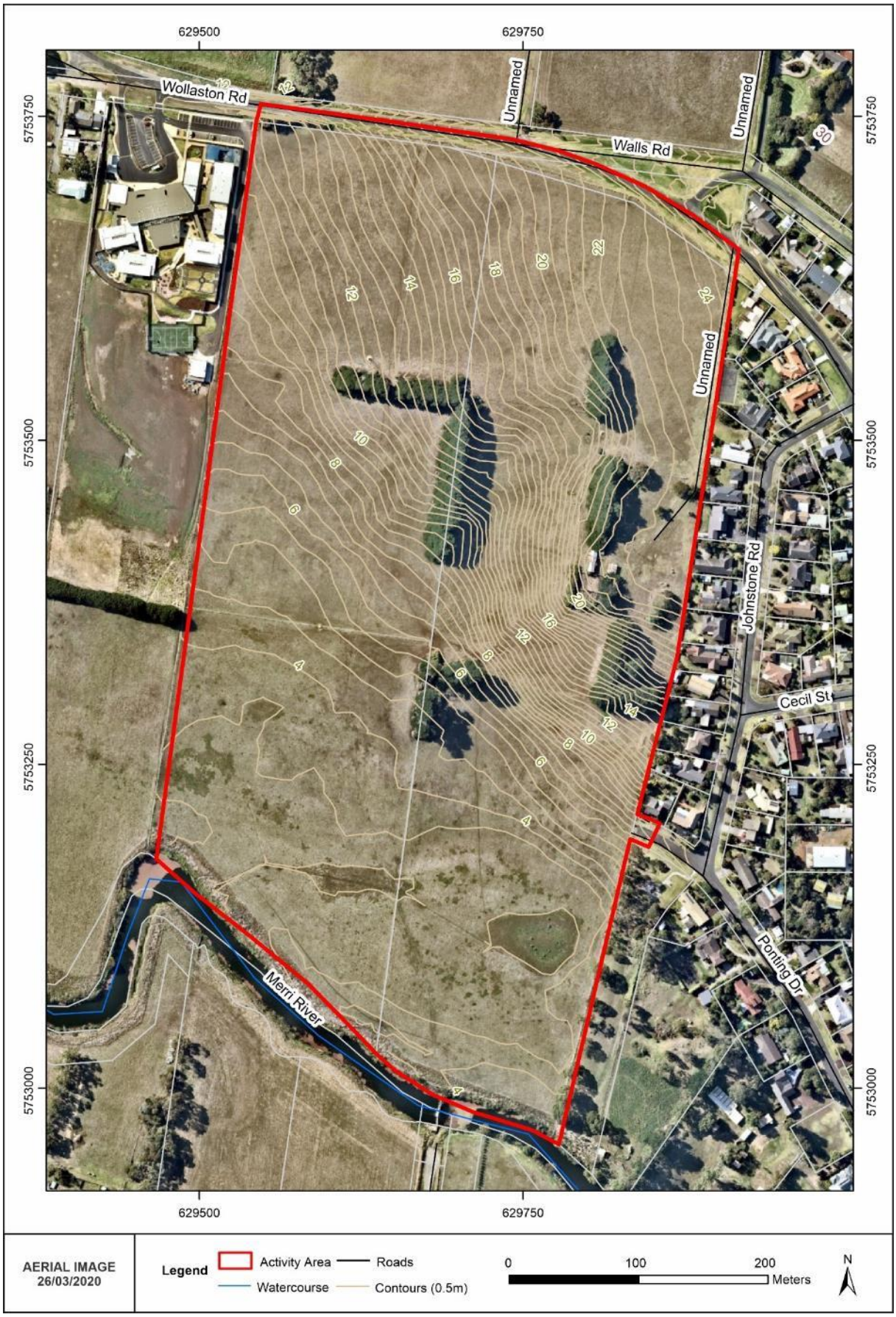
f) Construction of a community centre, lawn bowls facility and a golf course; this will require a mix of cut and fill across the landscape, cuts may occur to a maximum depth of up to 1500mm

g) Landscaping and on-going maintenance works.

Table 1 provides a list of the expected maximum depth of excavation required for the activities.

Table 1: Maximum depth of potential impacts

Activity	Maximum Depth (m)
Gas	0.9
Water	2
Sewer	2
Electricity	0.9
Telecommunications	0.9



Map 2: Aerial image showing the current (26/03/2020) conditions in the activity area

Map 3: Preliminary concept plan (provided by Beveridge Williams)

6.0 Documentation of Consultation

The Registered Aboriginal Party (RAP) for the activity area is the Eastern Marr Aboriginal Corporation (EMAC). In accordance with Section 54(1) of the *Aboriginal Heritage Act 2006*, a Notice of Intent to Prepare a CHMP (NOI; Appendix 1) was submitted on August 3, 2020 to Aboriginal Victoria (AV) and the Registered Aboriginal Party (RAP) the Eastern Marr Aboriginal Corporation. AV replied to the NOI on August 3, 2020 and allocated the project number 17368. However, as the EMAC were a relatively new RAP at the time the CHMP commenced, it was agreed that the CHMP would be evaluated by the Secretary under s.65(1)(b)(i) of the *Aboriginal Heritage Act 2006*. Consultation with the RAP was undertaken throughout the project. A copy of the NOI was sent to Warrnambool City Council on August 3, 2020 pursuant to s.54(1)(d) of the *Aboriginal Heritage Act 2006*.

6.1 Consultation in Relation to the Assessment

A project inception meeting was held on November 2, 2020 between Renee McAlister (Heritage Insight), Cameron Gull (Sponsor), Samantha Fidge and John Clarke (EMAC). At this meeting the nature of the project was discussed. It was noted that the activity area comprised a steeply sloping northern area and extended onto the flood plain adjacent Merri River. It was noted that a portion of the activity area had been subject to previous archaeological and CHMP assessment (Paynter & Rhodes 2005; O'Reilly & McAlister 2011). It was noted that four different geological landforms were mapped within the activity area. The results of the desktop assessment noted that the site prediction model stated that the activity area had low archaeological potential. A fieldwork methodology was discussed and agreed upon; four 1m^2 test pits should be excavated, one on each landform, along with a series of 5x1m machine test pits. The EMAC were asked if they could provide any cultural knowledge specific to the activity area. They noted that the Merri River was a place of cultural significance, however no specific information about the activity area was provided..

Following the completion of field work, a results and recommendations meeting was held on February 16, 2021 between Renee McAlister, Simon Coxe (Heritage Insight), Cameron Gull (Sponsor) Jackson Zaal (Beveridge Williams), Samantha Fidge and Craig Edwards (EMAC). At this meeting the results of standard and complex assessments were discussed. It was noted that the standard assessment did not find any cultural material and noted poor ground surface visibility. The complex assessment comprised excavation of four 1m^2 hand excavated test pits and seven 5x1m machine trenches. The test pits were excavated on each geological landform. Machine trenches were excavated to provide coverage across the balance of the activity area and to increase the area tested. One was placed adjacent the wetlands area in the flood plain. Testing revealed shallow soil deposits across the activity area and no Aboriginal cultural material was found. The lack of cultural material was attributed to the nature of the activity area; the land near Merri River comprises low-lying flood plain and was likely frequently inundated. It is also highly likely that this section of Merri River has undergone substantial change over the years. The northern section of the activity area comprises a steeply sloped landform, which would not have made good camping ground and so was unlikely to be utilised for occupation. However, the activity area would most likely have been utilised for collection of resources and hunting by Aboriginal people. The EMAC requested that a management condition be included requiring a cultural heritage induction for staff and contractors involved in ground disturbing works.

6.2 Participation in the Conduct of the Assessment

The standard assessment was conducted on January 11, 2021 by Margaret Reith, Thanos Matanis (Heritage Insight), Corey Harradine and Hayden Harradine (EMAC).

The complex assessment was conducted on January 11–15, 2021 by Margaret Reith, Thanos Matanis (Heritage Insight), Corey Harradine and Hayden Harradine (EMAC). Mechanical excavation was done by Steven Weir (Belmara Industries).

6.3 Summary Outcomes of Consultation

The management conditions presented in Section 1 of this CHMP have been discussed and agreed upon in consultation with the RAP, the Sponsor and the heritage advisor:

- a requirement for a cultural heritage induction;
- a requirement for a set of contingencies plans; and
- a requirement that a hard copy of the approved CHMP be kept on-site during works.

7.0 Report on the Desktop Assessment

In accordance with Clause 8, Schedule 2 of the *Aboriginal Heritage Regulations 2018*, this section contains the results of the desktop assessment.

7.1 Aims and Methodology for the Desktop Assessment

The aim of the desktop assessment was to produce an archaeological site prediction model to identify the likelihood of Aboriginal cultural heritage to be located within the activity area. In turn, this assists in the design of fieldwork (survey and/or subsurface testing) and subsequent management conditions.

The desktop assessment involved a review of:

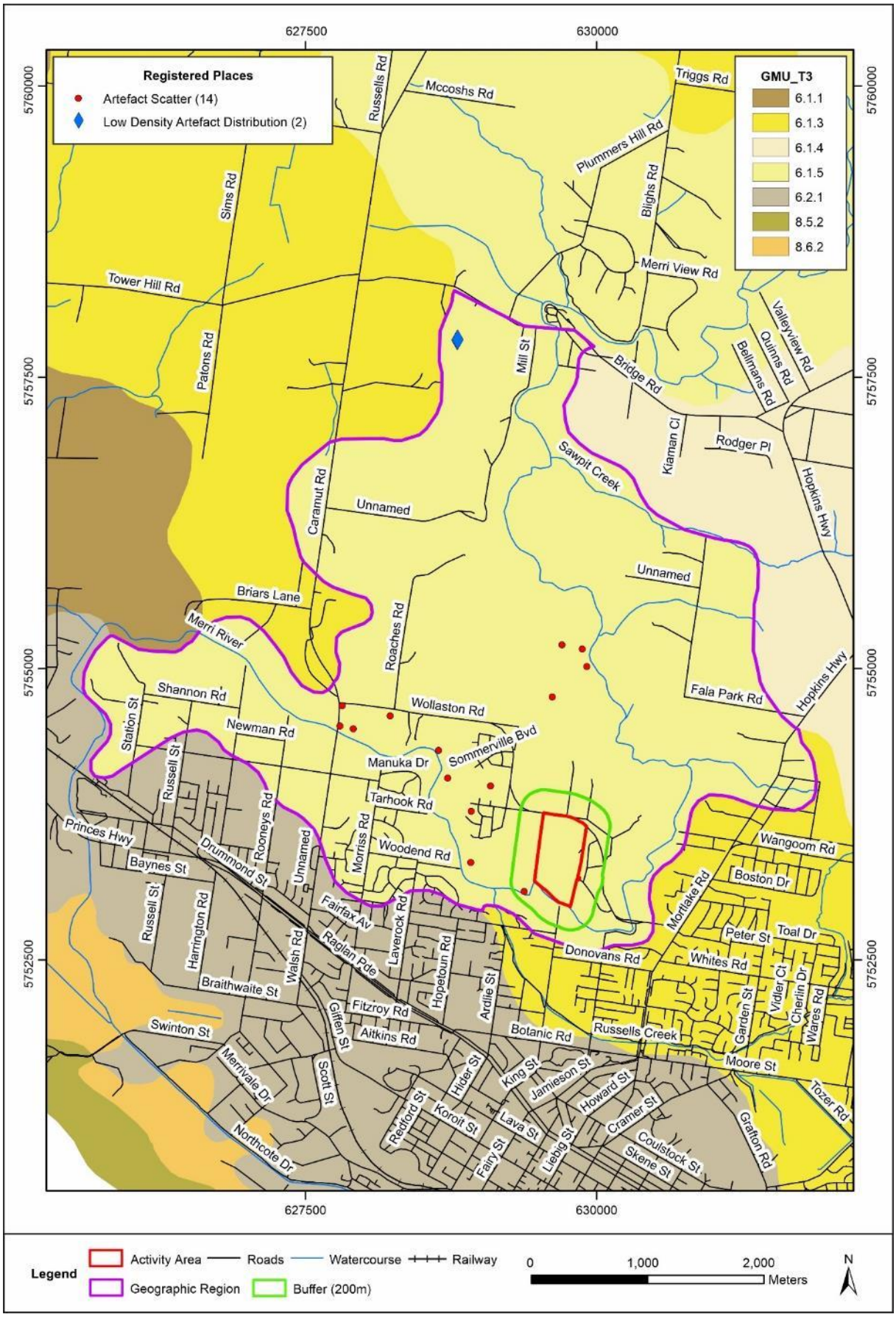
- historical and ethno-historical accounts of Aboriginal occupation of the geographic region and a review of any written and oral local history relevant to activity area;
- environmental resources available to Aboriginal people within the region of the activity area;
- the site registry at AV and previous archaeological studies to identify any previously registered Aboriginal archaeological sites either within or surrounding the activity area and the results of previous archaeological assessments;
- the land-use history of the activity area, particularly evidence for the extent and nature of past land disturbance; and
- the landforms or geomorphology of the activity area and identification and determination of the geographic region of which the activity area forms a part that is relevant to the Aboriginal cultural heritage that may be present in the activity area.

This information was used to produce an archaeological site prediction model. The site prediction model assists in determining the type of archaeological sites which may potentially occur within the activity area, the possible contents of these sites, the possible past use of the landscape by Aboriginal people and the likely extent of ground disturbance to archaeological sites.

7.2 Results of the Desktop Assessment

7.2.1 The Geographic Region

The geographic region for this project has been defined as the extent of the Tier 3 geomorphological unit (6.1.5) within and around the activity area. The activity area and land including northern Warrnambool are located on the geomorphic unit known as the Undulating Plains – Western District. Within this geomorphic unit, the geomorphology can be further subdivided into geomorphological unit 6.1.5 (Terraces, floodplains and lakes, swamps and lunettes). By utilising this geomorphological unit as the geographic region and limiting the extent to Bridge Road in the north, which allowed for a sufficient sample size, we are able to build up a profile of landforms and resources available in this area and develop a detailed site prediction model' (Map 4).



Map 4: Geographic region in relation to the activity area

7.2.2 Landforms and Geomorphology of the Activity Area

Description of Geology, Landforms and Soils

The activity area is located in the within the first tier geomorphic unit known as the Undulating Plains – Western District, part of the larger volcanic plains landform unit. The volcanic plains stretch westward from Melbourne to the South Australian border. The volcanic plains are flat to undulating and dotted with hills formed by extinct volcanos. They were derived from volcanic eruptions that mostly occurred over the last 4.5 million years, with the most recent eruptions occurring approximately 7000 years ago. Volcanos such as Tower Hill (to the east of Warrnambool) are called maars and comprise large circular craters up to 2km across (Rowan, Russell & Ransom 2000).

The southern portion of the activity area is located within the geomorphic unit known as Barrier Complexes – Discovery Bay, Gippsland lakes. This geomorphic unit stretches from Warrnambool to approximately 17km west of Port Fairy and was formed by the action of waves across bays and river mouths and was then modified by tides and winds. Erosion is a serious issue within this geomorphic unit where vegetation has been removed from dune systems (Rowan, Russell & Ransom 2000, p.41).

Third Tier Geomorphology

A review of third tier geomorphological units utilising GIS mapping notes that the entirety of the activity area is located on geomorphological unit 6.1.5 (Terraces, floodplains and lakes, swamps and lunettes) (Map 4). Unit 6.1.5 (Terraces, floodplains and lakes, swamps and lunettes) comprises alluvium terraces and flood plains associated with the lake and swamp systems within the volcanic terrain as well as drainage systems such as the Barwon, Yarrowee/Leigh and Woady Yaloak Rivers. The main rivers of the central and western part of the plains are Mount Emu Creek and the Hopkins River. Lakes and swamps, both permanent and ephemeral, dominate the volcanic plains north and west of Colac. Hydrologically, the lakes vary from hypersaline groundwater discharge lakes (e.g., Lake Beeac) to groundwater throughflow lakes with surface water input (e.g., Lake Murdeduke). In the Lough Calvert region (east of Beeac), climate changes during the Pleistocene and Holocene have resulted in a complex landscape, as lunettes and alluvium deposits trace the changes in lake levels. Alluvial terraces and lunettes have been formed and partially destroyed by oscillating lake levels. Associated soil types include black and grey self-mulching and cracking clays (Vertosols), black (and some red) sodic texture contrast (Sodosols) and dark loam soils (Dermosols) (Department of Jobs, Precincts and Regions – Agriculture Victoria – Victorian Resources Online accessed 28/07/2020).

The activity area is a sloping landform, descending towards Merri River in the south.

Geological Units

Four geological units are mapped within the activity area (Map 5): Newer Volcanic Group – basalt flows (Neo), Tower Hill Tuff (Nept), Port Campbell Limestone (Nhp) and Alluvium (Qa1). The alluvium deposits are located within the southern boundary of the activity area, close to Merri River.

Newer Volcanic Group – basalt flows (Neo) is mapped within the north eastern corner of the activity area. This geological unit is described as 'Olivine tholeiite, quartz tholeiite, basanite, basaltic icelandite, hawaiite, mugearite, minor scoria and ash, fluvial sediments: tholeiitic to alkaline; includes sheet flows and valley flows and intercalated gravel, sand, clay'. This is generally comprised shallow deposits of compact silty clay topsoils that will have been heavily impacted by ploughing (Department of Jobs, Precincts and Regions – Earth Resources GeoVic 2020, accessed 28/07/2020).

.

Port Campbell limestone (Nhp) is located within the northern and central portion of the activity area. This geological unit comprises calcarenite, minor calcilutite, which is generally fine-grained, bryozoan, mollusc, echinoid and brachiopod fragments, minor coarse-grained calcarenite, weakly cemented quartz sand and clayey silt and moderately bedded continental shelf deposits (Department of Jobs, Precincts and Regions – Earth Resources GeoVic 2020, accessed 28/07/2020).

Located between the alluvium deposits and the Port Campbell limestone are deposits of Tower Hill Tuff (Nept) which flow from Tower Hill (to the east of Warrnambool) and are described as 'Pyroclastic rocks with basaltic and sedimentary clasts; ash and lapilli with scattered blocks and bombs; well layered with planar to diffuse bedding; common cross-bedding and climbing ripples'. These soil deposits can vary in depth and often contain multiple layers of volcanic material (Department of Economic Development, Jobs, Transport and Resources – GeoVic3, accessed 28/07/2020).

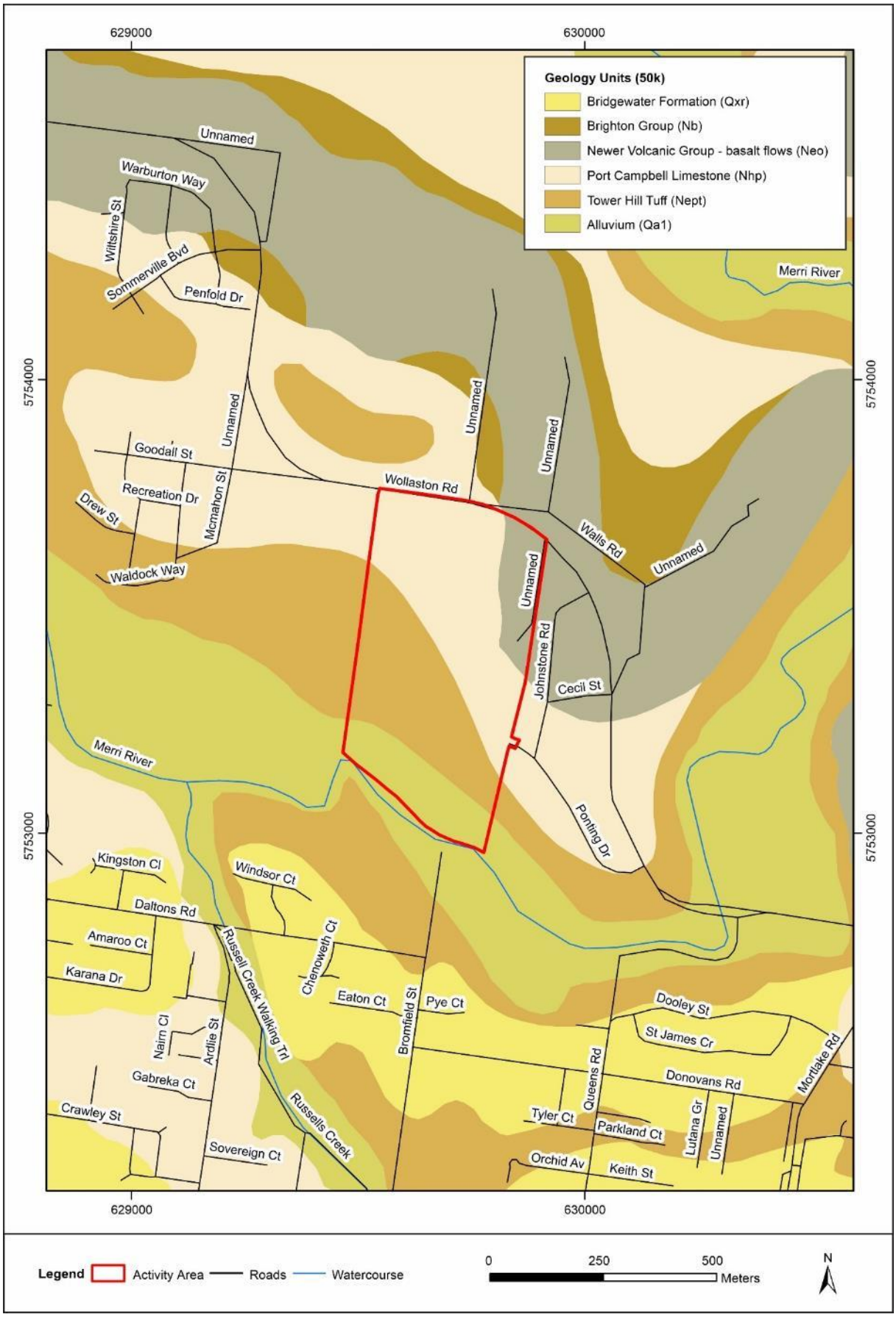
Alluvium (Qa1) deposits are mapped adjacent to Merri River within the southern boundary of the activity area. These deposits are formed by the river incising its way through the basalt plains. Alluvium deposits are described as 'gravel, sand, silt: variably sorted and rounded; generally unconsolidated; includes deposits of low terraces; alluvial floodplain deposits'. Qa1 deposits are likely sandy silt and can extend to deeper depths depending on the height of the alluvial terraces (Department of Economic Development, Jobs, Transport and Resources – GeoVic3, accessed 28/07/2020).

Merri River runs along the southern boundary of the activity area. Merri River has been undergone environmental audit by the Environment Protection Authority (EPA). The report notes that the river has been extensively modified since European settlement with over 95% of native vegetation having been removed from Merri River catchment, with willows replacing native trees for bank stabilisation works. The use of the river for both irrigation and drainage has substantially altered the flow of the river, resulting in erosion and regular flooding events. There is also substantial evidence that significant amounts of landfill have been introduced into Merri River flood plain with the goal of limiting flood damage and impact (EPA Victoria 2004).

Table 2 summarises the land system information for the region containing the activity area.

Table 2: Summary of land system data encompassing the activity area

Land System Code – Land Systems of Victoria at 1: 250,000	Land System Summary Description	
7.1PbfQ7-1 7.1PbfQ7-4 8.5PCcQ7-1	**Geomorphic Unit:**	6. Western Plains – volcanic plains 6.1.5 Terraces, floodplains and lakes, swamps and lunettes Barrier Complexes – Discovery Bay, Gippsland Lakes
	Landform:	Plain above flood level (relative relief <9 m) Escarpment
	Lithology:	Fine textured unconsolidated deposits Coarse textured unconsolidated deposits
	Soils:	Mottled earths, brown calcareous earths/ yellow earths > pH 6.5 Pale calcareous sands with low compaction and > pH 6.5
	Pre-1750 EVCs:	EVC 55 – Plains Grassy Woodland (northern portion of activity area) EVC 53 – Swamp Scrub (southern portion of activity area)
	Nearest Water Sources:	Merri River



Map 5: Geology within the activity area

7.2.3 Resources Available to Aboriginal People Within the Activity Area

Plant Resources and Pre-Contact Vegetation

The activity area lies within the Warrnambool Plain bioregion which extends along the coast from Portland to Moonlight Head. The Warrnambool Plain consists of low coastal dune formations dissected by rivers, inlets and swamps. Further inland, the Warrnambool Plain is characterised by volcanic soils with basalt outcrops or stony rises. The pre-1750 ecological vegetation classes (EVCs) indicate that the southern half of the activity area was most likely covered with Swamp Scrub (EVC 53) while the northern portion would have contained Grassy Woodland (EVC 55; Map 6).

Swamp Scrub (EVC 53) is characterised by closed scrub to 8m tall at low elevations on alluvial deposits along streams or on poorly-drained sites with high nutrient and water availability. Soils vary from organic loams to fine silts and peats which are inundated during the wetter months of the year and is dominated by either Woolly Tea-tree and/or Paperbarks Melaleuca species which often form a dense impenetrable thicket, out-competing other species. Emergent trees (e.g., Swamp Gum) may sometimes be present. Where light penetrates to ground level, a moss/lichen/liverwort herbaceous ground cover is often present (Department of Environment, Land, Water and Planning – Bioregions and EVC benchmarks, accessed 28/07/2020).

Plains Grassy Woodland (EVC 55) is characterised by open, grassy eucalypt woodland in low rainfall areas occurring on fertile soils on flats and gently undulating plains at low elevations. The understorey consists of a few sparse shrubs over a species-rich grassy and herbaceous ground layer. Plains Grassy Woodland was typically dominated by Forest Red Gum. The understorey included shrubs of Lightwood, Creeping Bossiaea and Cranberry Heath. The ground layer was usually grassy and herbaceous with sedges and lilies also present. Frequent grasses are Weeping Grass, Kangaroo Grass, Striped Wallaby-grass, Kneed Wallaby-grass, Purplish Wallaby-grass, Poa, and Veined Spear-grass (Department of Environment, Land, Water and Planning – Bioregions and EVC benchmarks, accessed 28/07/2020).

Plains grassland was a key resource for Aboriginal people with Gott theorising that over 90% of plains grassland species having a practical purpose (Zola & Gott 1992). Plants were extensively exploited by Aboriginal people for food, medicine and fibres for weaving. Plant components utilised would have included berries, fungi, roots, tubers, bulbs, leaves, pith from fleshy plants, seeds and sap. Gum was also collected from wattle and stored in known locations for seasons when food was less abundant (Zola & Gott 1992).

Today the activity area has been heavily modified through a history of farming and land clearance and is unlikely to contain any remnant native vegetation.

Fauna Resources

An abundance of native mammal species have been identified as still existing within the region (Viridans Biological Databases 2012), many of which would have been hunted by Aboriginal people. These include wallabies, eastern grey kangaroo, brush and ringtail possums, koalas, the fat-tailed dunnart and the short-beaked echidna. As well being a valuable food source, possums provided fur for the manufacture of possum skin cloaks, and echidnas provided quills which were used to make necklaces (Rhodes & Rawoteea 2007, p.18).

There have been over one hundred species of native birds recorded in the region of the activity area (Viridans Biological Databases 2012) and some of these may have been hunted or trapped or had their

eggs used by Aboriginal people. Emus and other large birds such as the bush turkey were hunted extensively by Aboriginal people (Zola & Gott 1992, p.3) and are likely to have once been present within the region of the activity area.

The native fauna in the geographic region is significantly diminished in modern times, largely as a result of the loss of habitat, with many animal species once present, now locally or regionally extinct.

Water Resources

The activity area is located close to Merri River. Merri River is a major watercourse that forms part of the Glenelg Hopkins catchment, located in the Western District of Victoria, and draining into the Bass Strait at Warrnambool.

Stone Resources

A number of stone resources used by Aboriginal people would have been available within close proximity to the activity area. Silcrete, flint and quartz were favoured stone materials for the manufacture of stone implements. Quartz pebbles were widely available in riverbeds, beaches and alluvial deposits. Flint was located in the form of nodules originating from undersea Miocene limestones which could be collected on the beaches. Basalt was used occasionally as it was in plentiful supply along the volcanic plains, but was not a preferred material as it is harder to work with due to its porous nature. Basalt can also be sourced locally at Tower Hill (Coutts et al. 1976, p.13).

Map 6: Pre-1750 EVC within the activity area

7.2.4 Search of the Victorian Aboriginal Heritage Register

The Victorian Aboriginal Heritage Register (VAHR), accessed through Aboriginal Cultural Heritage Register and Information System (ACHRIS), was searched to identify any previously registered Aboriginal Places within the geographic region for the activity area, as well as the results of previous archaeological assessments. The Register was accessed on August 17, 2020.

7.2.4.1 Aboriginal Places in the Geographic Region

A search of the VAHR identified 15 registered Aboriginal Places within the geographic region comprising a total of 16 components (Tables 3 and 4; Appendix 2). The component types represented in the geographic region are artefact scatters (n=14, 88%) and low density artefact distributions (LDAD; n=2, 12%). A full list of Aboriginal Place components within the geographic region is provided in Appendix 2. All of the Aboriginal Places within the georegion are located within close proximity to Merri River and are largely located on the Merri River flood plain. Artefact scatters and low density artefact distributions frequently contain silcrete and quartz artefacts, with chert, quartzite, coastal flint and basalt artefacts also present. Coastal flint, basalt and quartz would all have been available locally.

The details for these Aboriginal Places are listed in Table 4. These Places are all registered as artefact scatters located on the Merri River flood plain. Artefacts were located at depths of between 0–800mm. The artefacts from these Places are predominantly manufactured from silcrete, with small numbers of quartz.

There is one Aboriginal Place located within 200m of the activity area, VAHR 7321-0451 (Map 7). This Aboriginal Place is a low density artefact scatter comprising three artefacts located in a disturbed context on the Merri River flood plain.

Table 3: Summary of registered Aboriginal Places within the geographic region

Component Type	Frequency (No.)	Frequency (%)
Artefact Scatter	14	88
Low Density Artefact Distribution	2	12
Total Components	**16**	
Total Registered Places	**15**	

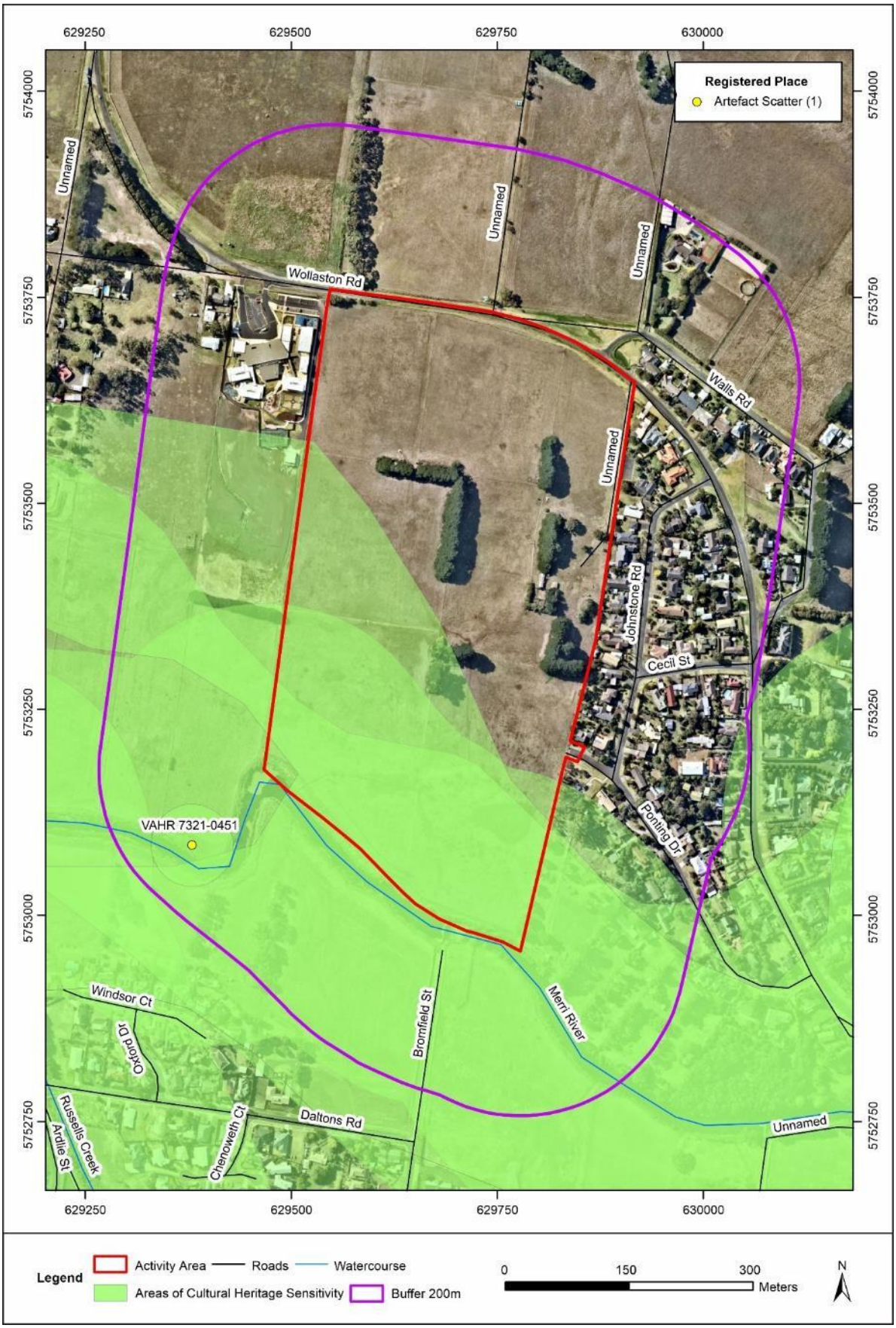
Table 4: Previously recorded Aboriginal Places within the geographic region

VAHR No.	Site Contents	Site Density	Depth of Cultural Material	Landform
7321-0347 ROACHE 1	Artefact scatter. Recorded in 1980	Not stated	Not stated	Undulating, Merri River flood plain
7321-0348 ROACHE 2	Artefact Scatter Recorded in 1980	Not stated	Not stated	Undulating, Merri River flood plain
7321-0349 ROACHE 3	Artefact scatter containing unknown number of artefacts, chert is stated as the raw material type. Recorded in 1980	Not stated	Not stated	Undulating, Merri River flood plain
7321-0350 ROACHE 4	Artefact scatter containing an unknown number of artefacts. Quartz is stated as a raw material type. Recorded in 1980	Not stated	Not stated	Undulating, Merri River flood plain
7321-0450 WOLLASTON ROAD 1	Artefact scatter containing 25 chert, quartz, silcrete and flint artefacts	< 1 artefact/10m²	Subsurface 0–400mm	Flood plain, elevated bank
***7321-0451 WOLLASTON ROAD 2**	Artefact scatter containing 3 silcrete artefacts, including a multidirectional core. Disturbed by ploughing	< 1 artefact/10m²	Surface	Merri River flood plain
7321-0479 Wollaston Rd 1	Artefact scatter containing 8 artefacts manufactured from basalt, chert, silcrete and quartz	> 1 artefact/10m²	Surface and subsurface 0–400mm	Low rise, close to Merri River
7321-0480 Wollaston Rd 2	Artefact scatter containing 11 artefacts manufactured from chert, silcrete and quartz	> 1 artefact/10m²	Surface and subsurface 0–400mm	Low rise, close to Merri River
7321-0481 Wollaston Rd 3	Artefact scatter containing 5 artefacts manufactured from chert, quartz and basalt	> 1 artefact/10m²	Surface and subsurface 200–500mm	Low rise, close to Merri River
7321-0482 Wollaston Road 4 IA	Artefact scatter containing 1 silcrete flake	< 1 artefact/10m²	Subsurface	Merri River Flood plain

VAHR No.	Site Contents	Site Density	Depth of Cultural Material	Landform
7321-0483 Wollaston Road 5 IA	Artefact scatter containing 1 silcrete flake	< 1 artefact/10m²	Subsurface 0–200mm	Merri River Flood plain
7321-0486 Wollaston Road 3 AS	Artefact scatter containing 21 quartz, silcrete, coastal flint and quartzite artefacts	< 1 artefact/10m²	Subsurface 0–400mm	Merri River Flood plain
7321-0487 Wollaston Road 6 AS	Artefact scatter containing 6artefacts manufactured from quartz (5) and silcrete (1)	< 1 artefact/10m²	Subsurface 0–200mm	Merri River Flood plain
7321-0489 Wollaston Rd 4	Low density artefact distribution of 72 silcrete, chert, basalt and quartz artefacts	> 1 artefact/10m²	Subsurface 0–600mm	Merri River flood plain
7321-0504 Woodford LDAD	Low density artefact distribution of 2 silcrete and quartz artefacts	< 1 artefact/10m²	Subsurface 200–400mm	Merri River flood plain

***closest Aboriginal Places to the activity area**

A search of the VAHR identified that there were no Aboriginal Historical Reference sites within the georegion.



Map 7: Areas of cultural heritage sensitivity and Aboriginal Places within 200m of the activity area

7.2.4.2 Previous Work in the Geographic Region

A review of previous archaeological assessments conducted within the geographic region has been undertaken for the purposes of assisting with the development of a site prediction model. A complete list of archaeological reports undertaken within the geographic region is presented in Appendix 3. Table 5 below provides a summary of relevant archaeological reports within the geographic region. These reports are primarily CHMP assessments and can be utilised to develop a site prediction model.

Previous Investigations Covering the Activity Area

An Archaeological Assessment. Wollaston Road, Warrnambool. Report No. 3396 (Paynter & Rhodes 2005)

In 2005, Paynter and Rhodes carried out a local structure plan study for land situated to the north of Merri River in Warrnambool, including the entirety of the current activity area. The study included desktop and survey components. Paynter and Rhodes' study area was divided into three sectors to enable easier field recording. Not all of the sectors were surveyed on foot due to property access issues and a windscreen survey was therefore carried out in some areas. A windscreen survey was carried out for the entirety of the current activity area. The field assessment resulted in the location of two artefact scatters, VAHR 7321-0450 (Wollaston Road 1) and VAHR 7321-451 (Wollaston Road 2). These Places were located to the west of the current activity area. The site prediction model suggested that landforms most likely to contain Aboriginal cultural heritage included Merri River flood plain, bank terraces, ridgelines, hillslopes and dunes.

A number of historical sites were also identified during the study, Merri River Hut site (H7321-0033), Wollaston Road Quarries (H7321-0032) and the Broomfield Street weir, although these were not located within the current activity area. The Broomfield Street weir is located approximately 200m to the south of the current activity area. Paynter and Rhodes (2005) also noted a number of historic tree rows and plantings toward the centre of the current activity area. The tree rows and the Broomfield Street weir is described in detail in Section 7.2.6. of this report.

Wollaston Road, Warrnambool: Housing Subdivision. Report on Salvage Investigations. Cultural Heritage Management Plan 11662 (O'Reilly & McAlister 2011)

This CHMP (11662) was conducted for a residential subdivision within close proximity to Merri River. CHMP 11662 covered a large proportion of land within western and southern portions of current activity area, and included standard, desktop and complex assessments. The desktop assessment noted that due to its close proximity to Merri River, the activity area contained the potential to locate Aboriginal cultural material. The desktop assessment also noted that the activity area had undergone disturbance in the form of vegetation clearance, ploughing and grazing. The standard assessment noted poor ground surface visibility; however, it was suggested that the entirety of the activity area was considered to have moderate to high Aboriginal cultural heritage potential in areas not previously subjected to prior disturbance.

The complex assessment included the excavation of 11 1m^2 test pits and 257 shovel test pits. The excavation base level was identified across the activity area as clay deposits. A maximum basal depth of approximately 800m was reached. Eleven shovel test pits were excavated within the current activity area. Shovel test pits were excavated within the north western corner and southern portion of the current activity area. The soil profile within the test pits comprised black friable clayey silt overlying a black compact clay to a maximum depth of approximately 400mm. No Aboriginal cultural material was identified within the current activity area.

Five Aboriginal Places were identified during the complex assessment, comprising two isolated artefact finds and three medium density artefact scatters. VAHR 7321-0486 comprised four stone artefacts located at depths of 0–400mm in clayey silt deposits (17 additional artefacts were found during later investigations). VAHR 7321-0482 was an isolated silcrete flake located as depths of 200–300mm in clayey silt. VAHR 7321-0483 was an isolated silcrete flake located at a depth of 100–200mm in silty sand, and VAHR 7321-0487 comprises six stone artefacts retrieved from depths of 0–200mm in silty clay soils, while VAHR 7321-0450 comprised 25 stone artefacts retrieved from depths of 0–400mm in silty clay soils. All five Aboriginal Places were located on the flood plain and elevated volcanic plains landforms within the western portion of the activity area. A salvage program was recommended for one of the Aboriginal Places, Wollaston Road 1 (VAHR 7321-0450), the results of which are discussed in Table 5.

Wollaston Road Development Infrastructure Works: Pipeline, Warrnambool. Cultural Heritage Management Plan 12329 (O'Reilly 2012)

CHMP 12329 was conducted for the proposed construction of water and sewer infrastructure and included a desktop assessment only. The activity area comprised a linear alignment within a road reserve and a section comprising an open paddock. The activity area for CHMP 12329 covers the north western portion of the current activity area, including a section of Wollaston Road. It was also noted that the activity area had been subject to previous archaeological survey in 2005 (Paynter & Rhodes 2005). The desktop assessment noted that, further inland from the coastline, Aboriginal Places were predominantly located within close proximity to Merri River and other water sources such as swampland. The activity area was considered to be of low archaeological sensitivity due to its location 500m from Merri River. The desktop assessment discussed prior land-use disturbances, which included initial land clearance, ploughing, grazing and road construction. Due to these land-use disturbances and the location of the activity area more than 500m away from Merri River, further assessment was deemed unnecessary.

Relevant Local and Regional Studies

The Mound People of Western Victoria: A Preliminary Statement. AAV Report 265. (Coutts et al. 1977)

This report comprises a detailed discussion of the Aboriginal mounds located in Western Victoria. The report discusses the preliminary results of the investigation and analysis of settlement patterns in relation to environment, and discusses the results of two mounds subject to excavation. The majority of mounds throughout Western Victoria are located within close proximity to water sources such as the Hopkins River, however based upon environmental reconstructions, Coutts et al. theorised that mounds were possibly associated with a wide range of biotic communities, including ephemeral swamps and water sources. This was supported by faunal assemblages located within the two excavated mounds, which included that a wide range of species from differing habitats. Stone artefacts recovered from the excavated mounds also suggested a pattern of more generalised, widespread environmental exploitation.

This report also summarised the results of the Victorian Archaeological Survey's (VAS, now AV) fieldwork, which involved the survey and investigation of mounds within selected areas of the western district. The surface survey began in 1973 and was completed in 1975. The survey included selected areas in Western Victoria, encompassing approximately 270,000 hectares. The survey focussed on Aboriginal mounds within the region, and determined that mounds were primarily located close to fresh water sources such as rivers, creeks, swamps and wetlands. The distribution of mounds was mapped and grouped into clusters within a 6km foraging range. Seven of the mounds were excavated. Both of the mounds were highly disturbed as a result of rabbit burrowing. Excavation revealed that the mounds contained charcoal, hearth stones and bones. Stone artefacts were predominantly manufactured from

quartz, with small numbers of fine-grained material (not specified). No suitable material for dating was recovered from the mounds.

An Archaeological Survey in S.W Victoria (Ellender 1989)

This report involved the survey of a proposed power line route in south west Victoria. The site prediction model noted that artefact scatters can be found across the landscape, as can earth features, including mounds. Stone arrangements representing houses, ceremonial Places or fish traps can be located in stony rises. Scarred trees can be located wherever remnant stands of native vegetation are found. Shell middens can be found in coastal areas and adjacent fresh water sources. The proposed power line route was approximately 78km in length by 50m wide and the entirety of the route was surveyed. Trees were checked for evidence of cultural scarring and sources of water such as swampland were investigated. Stone artefacts were located along tracks close to the Crawford River, the majority of which were manufactured from flint.

Discussion

A moderate amount of archaeological work has been conducted within the geographic region, with the majority of these assessments focussing along land immediately adjacent to Merri Creek. Currently, little is known of the archaeological potential of land further afield from Merri River. Only one CHMP (O'Reilly 2012) has been conducted further afield (approximately 500m) from Merri River. The review of previous research has shown that the majority of archaeological investigations within the geographic region have been conducted for service installations and residential developments. Currently, eight CHMPs have been completed within the geographic region, half of which have located Aboriginal cultural heritage (O'Reilly & McAlister 2011; Mitchell, McFarlane & Hill 2016; Fiddian & Patton 2019; Mitchell 2020). Excavation carried out as part of these CHMPs have revealed both deeper natural and disturbed topsoil soil profiles. The majority of the activity areas for these CHMPs were disturbed due to past land-use activities including land clearance, market gardening and ploughing.

A small number of surface and subsurface artefact scatters have been located during archaeological surveys and excavations carried out within the geographic region. This confirms standard archaeological theory that land adjacent rivers and creeks contains archaeological potential. The Aboriginal Places identified during previous studies were of low density and were located within both disturbed and natural surface and subsurface contexts. Stone artefacts found in the region are manufactured from a range of raw materials including quartzite, quartz, silcrete, chert and coastal flint. Artefact types included flakes, cores, and backed implements. These artefact types are representative of the Australian Small Tool Tradition, associated with the mid to late Holocene period.

Sections of the current activity area have been subjected to three separate archaeological investigations (Paynter & Rhodes 2005; O'Reilly & McAlister 2011; and O'Reilly 2012).While Aboriginal cultural heritage was located during all of these investigations on adjoining properties, none were located within the current activity area itself. All of these investigations noted disturbance as a result of previous land-use activities, including land clearance and ploughing. As a result, any Aboriginal cultural heritage in the form of stone artefact scatters and low density artefact distributions is most likely to be disturbed and/or dispersed and to be located where minimal ground disturbance has occurred.

Table 5: Previous studies relevant to the activity area

Study Name	Landform	Distance from Activity Area	Maximum Depth of Testing	Results	Aboriginal Cultural Material located
Proposed Sewer Pump Station at 391 Wollaston Road, Warrnambool (Mitchell 2020)	Merri River flood plain, flat terrain	2km north west	200mm	This CHMP (16869) was completed for the proposed construction of a sewer pump station at 391 Wollaston Road. A desktop and complex assessment were completed as part of this CHMP. The desktop confirmed that one previously registered Aboriginal Place, Wollaston Road 4 (VAHR 7321-0489) was located within the activity area. The desktop also noted that some ground disturbance as a result of agricultural activities had occurred within the activity area. The desktop concluded that the activity area contained high potential for the location of Aboriginal cultural heritage material. Two 1m² test pits and 11 50x50cm shovel test pits were excavated during the complex assessment. The complex assessment located three additional quartz stone artefacts associated with VAHR 7321-0489. Testing revealed shallow deposits of black, silty clay overlying damp, compact clay.	Previously recorded Wollaston Road 4 (VAHR 7321-0489), additional material was located during the complex assessment. Subsurface artefacts were retrieved from an approximate depth of 100–400mm.

Study Name	Landform	Distance from Activity Area	Maximum Depth of Testing	Results	Aboriginal Cultural Material located
Wollaston Road, Warrnambool: Housing Subdivision Report no. 4681 (East & O'Reilly 2011)	Undulating, flood plain	300m to the west	960mm	As part of the management recommendations outlined within CHMP 11662, a salvage excavation of stone artefact scatter Wollaston Road 1 (VAHR 7321-0450) was undertaken. This report documents the findings of the salvage works carried out in accordance with management recommendations in CHMP 11662. VAHR 7321-0450 consisted of a subsurface stone artefact scatter located during the complex assessment for CHMP 11662. VAHR 7321-0450 was located close to the elevated bank of Merri River within the western portion of the activity area for CHMP 11662. The salvage works included the excavation of two 2mx1m test pits, excavated in 1mx1m sections. Stone artefacts were located within all test pits. The soil profiles contained dark brown grey silt overlying compact dark brown clay to a maximum depth of 800–960mm. All artefacts were located between depths of 0–400mm. Artefacts were manufactured from silcrete, quartz, flint and chert.	Additional artefacts recovered from VAHR 7321-0450

Study Name	Landform	Distance from Activity Area	Maximum Depth of Testing	Results	Aboriginal Cultural Material located
Proposed Sewerage Line: Extending along Road Reserve at Shaw St and into 221 Wollaston Rd and 9 Goodall St, Warrnambool (Dugay 2019)	Merri River flood plain	Less than 100m west	300mm	CHMP 15752 was completed for a proposed sewer line extending along the road reserve from Shaw Street to Wollaston Road, Warrnambool. The desktop assessment noted that the activity area had undergone previous disturbance relating to road construction, grazing and other agricultural activities. Due to its location within close proximity to Merri River, the activity area was considered to be of moderate sensitivity for Aboriginal cultural heritage material such as stone artefact scatters and low density artefact distributions. These would most likely be located in surface and shallow subsurface contexts. The standard assessment was hampered by very poor ground surface visibility and a complex assessment was recommended. The soil profiles within the single 1m^2 test pit and six shovel test pits comprised shallow sticky clay to an approximate depth of 300mm.The complex assessment testing highlighted the shallow nature of the soil deposits and confirmed that the activity area was unlikely to contain any Aboriginal cultural material due to the flat, flood plain landform. High levels of disturbance were also noted across the activity area. No Aboriginal cultural heritage material was located.	No Aboriginal cultural heritage material was located.

Study Name	Landform	Distance from Activity Area	Maximum Depth of Testing	Results	Aboriginal Cultural Material located
Bridge Road Rural Subdivision, Woodford, Victoria (Fiddian & Patton 2019)	Flood plain, rise, swampland	4km north	400mm	CHMP 15259 was completed for a proposed residential subdivision at Woodford to the north of Warrnambool. The activity area was located within 200m of Merri River. The desktop identified that no previously registered Aboriginal Places were located within the activity area. The desktop assessment concluded that land within 200m of waterways such as Merri River is potentially sensitive for Aboriginal Places, in particular stone artefact scatters and isolated artefacts. The standard assessment failed to locate any Aboriginal cultural heritage material, however a number of areas of potential sensitivity were identified. The complex assessment included the excavation of four 1m² test pits and ninety shovel test pits across flood plain, rise and stony rise landforms. The soil profiles varied across each landform. One Aboriginal Place was located during the complex assessment, VAHR 7321-0504 (Woodford LDAD 1). VAHR 7321-0504 comprised two stone artefacts manufactured from silcrete and quartz, located on the upper slope of a rise landform within intact dark brown silt overlying grey sandy silt deposits at a depth of 200–400mm.	One new Aboriginal Place was located during this assessment, low density artefact distribution VAHR 7321-0504. Subsurface artefacts were retrieved from depths of between 200–400m. The artefacts were *in situ*, and were located within intact soil profiles.

Study Name	Landform	Distance from Activity Area	Maximum Depth of Testing	Results	Aboriginal Cultural Material located
Proposed Residential Subdivision: 159 Mortlake Road, Warrnambool (McAlister 2018)	Escarpment/flood plain	500m east	580mm	CHMP 15446 was completed for a residential subdivision at 159 Mortlake Road, Warrnambool. The desktop assessment noted that Merri River landforms are highly sensitive for low density stone artefact scatters, however much of the activity area had undergone significant disturbance as a result of installation of services, construction of a dwelling and farm building, and ploughing. The standard assessment noted that the escarpment adjacent to Merri River would not likely contain Aboriginal cultural material due to its steepness. The complex assessment included the excavation of two $1m^2$ test pits and eight machine transects. The testing confirmed disturbance across the activity area. Subsurface testing revealed very shallow topsoil deposits overlying a compact clay basal layer.	No Aboriginal cultural heritage material was located.
Proposed Residential Subdivision at Lot 2 and CA 10B, Corner of Wollaston Road and Warrnambool-Caramut Roads, Warrnambool (Mitchell, McFarlane & Hill 2016)	Flood plain/alluvial terrace, hill crest and gentle slope	1.3km to the north west	740mm	This CHMP (11656) was conducted for a residential subdivision adjacent Merri River. The standard assessment identified the flood plain, alluvial terrace, slope and hill crest within the activity area as being of moderate to high archaeological potential. The complex assessment comprised the excavation of 16 $1m^2$ test pits, 18 shovel test pits and 39 mechanical test pits. Subsurface testing revealed deposits of compact loamy clay and silty clay over a clay or limestone base. Cultural material was identified on both the alluvial terrace and hill crest.	Four new Aboriginal Places were located during this assessment, all artefacts scatters (VAHR 7321-0479, 7321-0480 7321-0481 and 7321-0489). Subsurface artefacts were retrieved from depths of between 0–600mm.

Study Name	Landform	Distance from Activity Area	Maximum Depth of Testing	Results	Aboriginal Cultural Material located
Residential Subdivision, 123 Queens Road, Warrnambool, Victoria (Chandler 2014)	Flood plain and /Rise	250m south	680mm	This CHMP (12906) was conducted for a residential subdivision adjacent Merri River. The desktop assessment noted both the flood plain landform and elevated volcanic rise contained areas of archaeological potential. The standard assessment noted poor ground surface visibility. The complex assessment comprised excavation of a 1m² test pit and 23 shovel test pits. This showed much of the activity area was located within a low-lying flood zone. Testing on the flood plain showed shallow deposits of silty clay, while testing on the rise showed deeper deposits of sandy silt over rock.	No Aboriginal cultural heritage material was located.
Proposed Residential Subdivision at 17–19 Mortlake Road, Warrnambool (Mitchell 2014)	Undulating plain	500mm south east	640mm	This CHMP (13111) was conducted for a residential subdivision. The desktop assessment noted that the activity area had undergone previous disturbance in the form of construction of residential dwellings, market gardens and associated infrastructure. The complex assessment comprised excavation of a 1m² test pit and 12 shovel test pits. This showed much of the activity area had undergone previous ground disturbance. Subsurface testing revealed deposits of silty sand over clay.	No Aboriginal cultural heritage material was located.
North Dennington Trunk Sewer & Dales Road Water Storage Duplication, Warrnambool (Long 2007)		4km west	N/A	Report Number 4070 details the results of an archaeological assessment of two proposed water management projects at Dennington, Warrnambool. The study areas were both located within 200m of Merri River, which is generally considered to be of high sensitivity for Aboriginal Places, particularly stone artefacts. A survey of the study area failed to locate any Aboriginal cultural heritage material and this was deemed likely due to very poor ground visibility within the two project areas. It was considered likely that there would be a low risk of any Aboriginal cultural heritage material present within the study areas as the proposed works lay within previously disturbed low-lying land between dune ridges.	No Aboriginal cultural heritage material was located.

Study Name	Landform	Distance from Activity Area	Maximum Depth of Testing	Results	Aboriginal Cultural Material located
An Archaeological Survey of the Hopkins River (Schell 1995)	N/A	N/A	N/A	This survey was carried out for the Framlingham Aboriginal Trust and Aboriginal Affairs Victoria. The Hopkins River is to the east of Warrnambool. The aim of this survey was to document and establish present threats to eel traps and other sites. Previous archaeological research in the Western District has emphasised the importance of river and swamp environments. Common site types recorded along Hopkins River include oven mounds, eel traps and stone circles (believed to be the base of shelters). These sites reflect the importance of aquatic plant and animal resources in the traditional Aboriginal economy.	NA

7.2.5 Historical and Ethno-Historical Accounts in the Geographic Region

Archaeological evidence suggests that Aboriginal people have occupied south eastern Australia for at least 40,000 years (Flood 1995, pp.284–7). One of the oldest dated archaeological sites in Victoria is at Keilor in Melbourne, where charcoal from a hearth excavated in 1973 has been dated to 31,000 years BP (Flood 1995, p.286). The information used to establish pre-settlement Aboriginal spatial organisation is mostly based on observations made by Europeans during the initial period of Contact and subsequent settlement (Barwick 1984; Goulding 1988; Clark 1990; Presland 1994).

The people who occupied the activity area have been identified by Clark (1990: 54–55) as the *Tarerergundidj* in the *Dhauwurd wurrung* language area (also referred to as *Gundidjmara*). Clans speaking the *Dhauwurd wurrung* language managed the country in an area bounded by the Hopkins River in the east, the Glenelg River in the west and the Wannon River in the north (Clark 1990, p.54).

The clan name '*Tarerer*' referred to a large swamp between Merri River and Tower Hill, most likely the area known as Kellys Swamp today (Clark 1990: pp. 55, 78). Previous archaeological work has demonstrated that both Kellys Swamp and Tower Hill contain significant Aboriginal occupation sites. The Tarerer Swamp was described by Robinson in 1841 as a place where large gatherings of coastal clans occurred when whales were present along the coastline (Clark 1990: p. 78). Tower Hill is also known as a place of traditional religious significance to clans in the area. In April 1841, the clan head of the *Tarerergundidj* was described to Robinson as a man named Wone.der.rac (Presland 1977, p.62).

Aboriginal clans in the Western District lived a hunter-gatherer lifestyle, moving from one locality to another to make use of seasonal resources, trading opportunities and to meet ritual and kinship obligations. Ethno-historical records suggest that in some seasons Aboriginal people of the Western District lived a more settled life than Aboriginal people in other areas of south east Australia. These beliefs are based on the presence and observations of shelters and 'villages' in the Western District (Schell 1995, p.8).

Assistant Protector William Thomas provides a description of an Aboriginal 'village' near Warrnambool:

> There was on the banks of the creek between 20 and 30 huts of the form of a beehive or sugar loaf, some of them capable of holding a dozen people … These buildings were all made of a circular form, closely worked and then covered with mud (Stephens 2014).

Robinson observed the presence of many huts in Western Victoria (Clark 1998: p 19; Presland 1977: pp 36, 38, 73, 85). He records that in the stony rises there were 'plenty of huts of dirt and others built of stones' (Clark 1998, p.19) However, whether these huts or villages were inhabited on a permanent or semi-permanent basis, or were returned to seasonally, is not known.

Critchett (1992) discusses the significance of Tower Hill, a volcanic crater to the west of Warrnambool that was considered an important meeting place for different clan groups and speculates that ceremonial and trading activities took place there. The fresh water source combined with mixed deposits of cultural heritage material (indicating domestic activity) and the number of burial sites in the region supports her theory.

The diet of the Western District Aboriginal people consisted of a wide range of mammals, fish, birds, plant food and fungi (Dawson 1881, pp.18–22; Lourandos 1980, p.112). Ethnohistorical accounts suggest

the daisy yam was a staple plant food, being available year round, although less palatable in early winter (Gott 1983, pp.6–8).

Dawson (1881) refers to a gum which was used by the Aboriginal people near the Hopkins River; his reference reflects how the distribution and availability of a food source was affected by the arrival of the Europeans:

> Another kind of manna, also called buumbuul, is deposited in considerable quantities by the large dark coloured cicadae on the stems of white gum trees near the River Hopkins. The natives ascend the trees and scrape off as much as a bucketful of waxen cells filled with a liquid resembling honey, which they mix with gum dissolved in cold water and use as a drink. They say that, in consequence of the great increase of opossums, caused by the destruction of the wild dog, they never get any buumbuul now, as the opossums eat it all (Dawson 1881:21).

Eels were seasonally exploited and would have been an important food source in the autumn months. There are numerous accounts of eel fishing and trapping and the eel trapping infrastructure remains in some places including along the Hopkins River (Schell 1995, p.9).

Plants such as myrnong, bracken and tree ferns provided staple foods for Aboriginal people, while medicines could be made from species such as Black Wattle (*Acacia mearnsii*), and the wood or bark from Silver Wattle (*Acacia dealbata*) could be used to manufacture implements. The grasses and water reeds, paperbark trees and Eucalypts all provided raw material for baskets and bark and wooden implements. The bark from Stringy Bark (*yangoro*) and Mountain Ash (*yowork*) was selected for the manufacture of bark canoes. Apart from the manufacture of implements and access to food and medicinal resources, the bark from these trees would also have been removed for other ceremonial and social purposes. The roots (rhizomes or tubers) of the Cumbungi (*Typha orientalis*), Water ribbon (*Triglochin procerum*) and Common Reed (*Phragmites australis*) were harvested and cooked in earth ovens. In the case of the Cumbungi, after being cooked, the centre part of the rhizome was knotted then chewed to extract starch, and the remaining fibre was used for string (Gott & Conran 1998). These resources would have existed within or adjacent to the activity area.

The Aboriginal population of Western Victoria was estimated to be around 3500; after Contact, disease, conflict and denial of access to land and resources reduced these numbers dramatically (Lourandos 1980, p.89). From 1839–1849 the British Government established an Aboriginal Protectorate to mediate between Aboriginal communities and European colonists, with George Augustus Robinson employed as the Chief Protector of Aborigines.

Four Assistant Protectors were employed and assigned jurisdiction over an area. CW Sievwright was assigned to the Western District in 1841 (Cannon 1983, p.365). In 1850 William Gray, the Commissioner of Crown Lands for Portland Bay, provided a census of the Aboriginal population in the district. He recorded 20 adult males, 15 adult females and four children (Clark 1990, p.45). In 1858, a select Committee of the Legislative Council was appointed to inquire into the condition of Aboriginal people in the State. Reports from squatters in the area estimated that the Aboriginal population in the area had been reduced by 75 percent during the 1840s and 1850s (Clark 1990, pp.197–198).

Violence between Aboriginal groups and European pastoralists was common throughout the region. Aboriginal people were forced off their traditional lands, with many squatters prohibiting Aboriginal people access to their runs. There are extensive reports of 'guerrilla warfare; between Aboriginal people and squatters and their employees' throughout the 1840s (Critchett 1990). Ethnographic records tell of

Aboriginal people using the stony rises around Eumeralla River as a base for attacking the European settlers who had dispossessed them, a conflict which has been called the Eumeralla War (Critchett 1990).

Aboriginal people in search of food and other basic items began living on the fringes of Warrnambool, where government rations were available from 1860 onwards (Clark 1990: 40). These people were moved to the Framlingham Aboriginal Mission when it opened in 1861. This Aboriginal reserve covered 3500 acres near the Hopkins River; a large section of land that included the Framlingham forest, the only forested area in the region. In 1867 the Board decided to close Framlingham and move the inhabitants to the new station at Lake Condah, however the people living on the mission refused to leave and successfully protested, resulting the reopening of Framlingham in 1869 (Critchett 1992).

In 1877, a census conducted by the police listed 69 Aboriginals at the Framlingham Aboriginal Station (Barwick 1971). The number of people at Framlingham represents the gathering together of people at the station rather than an increase in population, as the total Aboriginal population of south western Victoria decreased from 727 in 1863 to 236 in 1877. By 1863 the Aboriginal population of Victoria was less than 2000, or 13 percent of the estimated pre-European Aboriginal population (Barwick 1971, p.288).

The decline of the Aboriginal population in the area following European Contact can be attributed to a number of causes: racial conflict, disease, dispossession of land and depletion of traditional food sources (Lourandos 1980, p.89). In 1886, the introduction of the *Aborigines Protection Act* meant that only people considered as 'full-blooded' or 'half-caste' people over 35 years of age were allowed to remain on the Mission Stations.

In 1890 the olonial Government reserved an area of 582 acres for the use of Aboriginal people at Framlingham, but refused to staff the station or provide assistance such as teachers, equipment and livestock. In the 1930s public concern was raised regarding conditions of the Aboriginal people at Framlingham. Under mounting pressure, the government agreed to build an additional twelve cottages and a school was opened and residents given weekly rations. There were multiple attempts to close Framlingham over the years, however the residents remained strongly attached to their land and defeated attempts to remove them (Critchett 1992).

In 1970, under the *Aboriginal Lands Act*, Framlingham was handed to the Framlingham Trust and resumed operation under Aboriginal ownership and management. In the 1980s, Land Rights claims were issued for 1,000 acres of the Framlingham Forest surrounding the Mission Station. This continued from 1980–87, when the land was handed over to the Kirrae Whurrong Aboriginal Corporation at Lake Condah and Framlingham. Aboriginal people still live on the mission land and continue to manage the land there (Agreements, Treaties and Negotiated Settlements website, accessed 9/1/2018).

A Registered Aboriginal Party has been appointed for the area within which the activity area is located; the Eastern Marr Aboriginal Corporation (EMAC).

Oral History Relating to the Activity Area

The EMAC were invited to provide oral history in relation to the activity area and surrounding region. No oral history was provided by the EMAC (see Section 6.1).

7.2.6 Land-Use History of the Activity Area

French scientist and navigator Nicholas Baudin, sailing with the *Geographe*, is credited with being the first European explorer to sight and record Warrnambool Bay in 1802. Records of sealers and whalers working the Bass Strait from the early 1800s exist, and while it is likely they camped near Warrnambool, no established settlements were made. In 1836 Major Mitchell explored the western district and was quickly followed by early settlers and squatters establishing large pastoral runs. The township of Warrnambool was surveyed and gazetted and land sales began in 1847 (Warrnambool & District Historical Society, accessed 27/07/2020).

Early industries were pastoral settlement, fishing, limestone quarrying and dairying. While Warrnambool was never a major port, the introduction of the railroad in 1890 turned Warrnambool into a flourishing rural city with a population of over 6000 by 1900. By the early 1900s Warrnambool had a strong industrial sector, with wool and cloth manufacturing industries along with food products. Warrnambool also become a major commercial/retail sector for the surrounding area (Victorian Places, accessed 27/08/2020).

A map of the Parish of Yangery from 1894 (Figure 1) indicates that at this time the activity area and adjoining property was under the ownership of Thomas Manifold (1809–1875). Manifold and his brothers migrated to Tasmania from England, later arriving in the Port Philip District in 1836. On July 9, 1839, with one of his brothers, Thomas put ashore what he claimed to be the first sheep ever landed at Point Henry, and proceeded to occupy both sides of the Moorabool River. Towards the end of 1836, Thomas returned to Tasmania, leaving bothers John and Peter to run the new station. Thomas visited several times, during one of which the three brothers examined the country near Ballarat (Australian Dictionary of Biography, accessed 27/07/2020). In December 1838, John and Peter Manifold reached Lake Purrumbete and the Mount Leura country, and Thomas soon joined his brothers. They occupied the Purrumbete run in January 1839, breeding both sheep and cattle, until Thomas travelled to the Grassmere run on Merri River near Warrnambool in 1844. The gold rush saw many of Thomas' men move to the goldfields and he sold the land and returned to England with his family. He later returned to settle in Melbourne (Australian Dictionary of Biography, accessed 27/07/2020).

Wollaston Estate

A parish plan from 1922 (Figure 2, from Paynter & Rhodes 2005, p.13) indicates that Thomas Manifold's land was later subdivided to form the Wollaston Estate. The Wollaston Estate comprised 17 allotments (Paynter & Rhodes 2005, pp.12–13). Lot 16, owned by TJ Harwood, and Lot 17, owned by J Windmill, covered the activity area. Information obtained from the Warrnambool and District Historical Society states that:

> There is a poster advertising the sale of part of the Wollaston Estate in Warrnambool in 1919. The sections for sale were Allotments 1, 18 and 19 which included the Wollaston Homestead. The original Wollaston property of 679 acres was selected by Thomas Manifold in the late 1840s. This land, on the northern side of the Merri River, near the Woodford Road was three kilometres from the Warrnambool town. The first farmer we know who leased the property was William Simpson. Walter Manifold inherited the property and he took it over in 1884. The swing bridge he built in 1890 still stands today. In 1919 the Closer Settlement Board of Victoria acquired Wollaston and 17 lots were sold to returned soldiers for farming purposes. By 1930 there were only five soldier settlers remaining. In 2009 further subdivision took place with lots sold for residential purposes. The homestead allotments were sold separately in 1919 with various owners of the homestead itself recorded since that time. (Victorian Collections, accessed 27/07/2020).

A parish plan from 1958 indicates that at this stage the activity area was under the ownership of JAJ Wall (Figure 3).

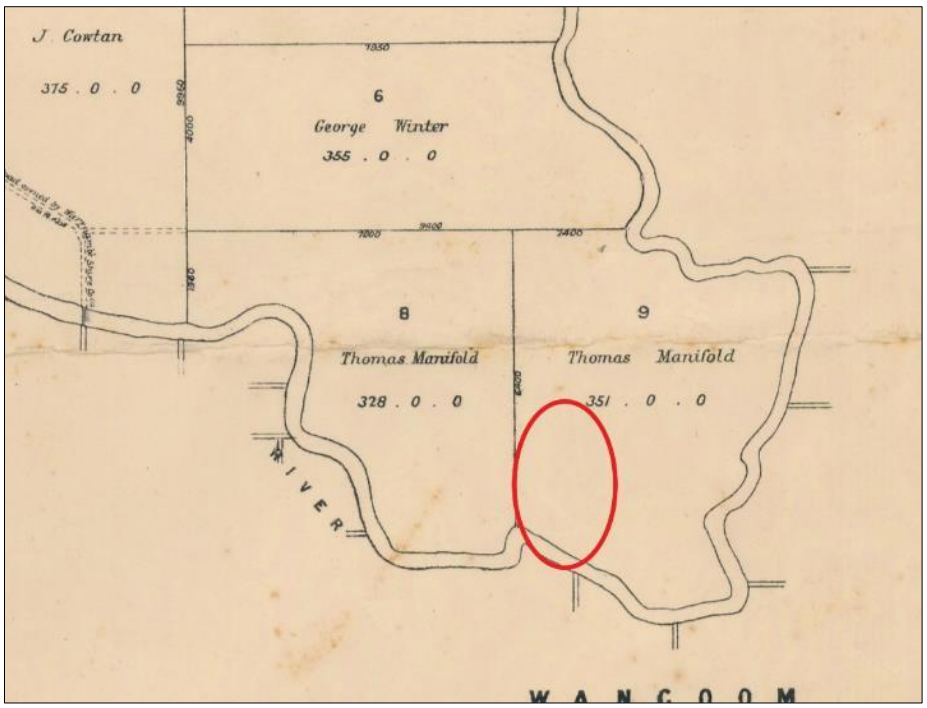


Figure 1. 1894 Yangery Parish Map, with the approximate activity area denoted in red (State Library of Victoria)

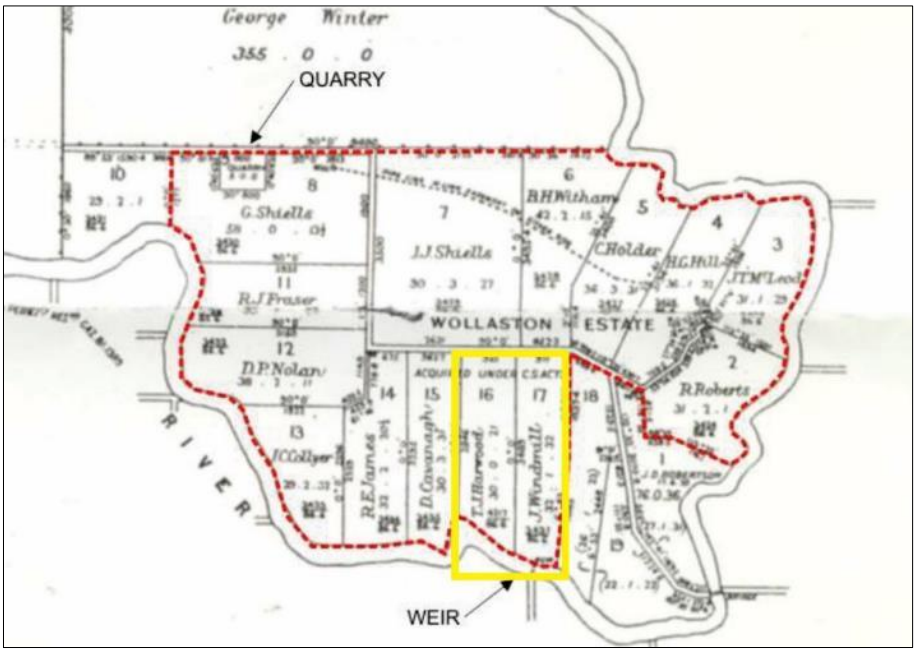


Figure 2. 1922 Parish map showing the Wollaston Estate (from Paynter & Rhodes 2005, pp.12–13). Paynter and Rhodes' study area is denoted in red, while the approximate current activity area is marked in yellow

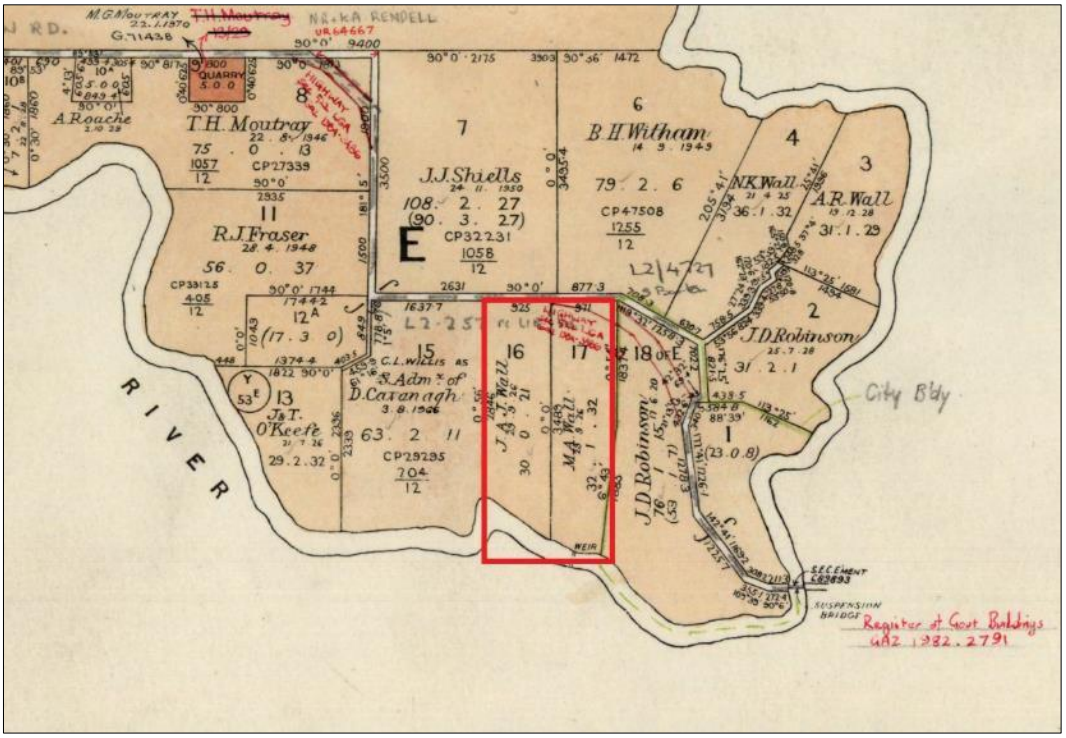


Figure 3. 1958 Yangery parish map with the activity area denoted in red

Historical Features Within or Close to the Activity Area

The Broomfield Street weir was noted during an investigation by Paynter and Rhodes in 2005, and is located adjacent to the southern boundary of the activity area. The weir can be seen in the parish maps from 1894, 1922 and 1958 (Figures 1–3). The bluestone weir was constructed in 1891 as part of the Merri River Water Scheme as means of supplying fresh water to the township of Warrnambool (Paynter & Rhodes 2005, 24). The weir was once connected to a pumping station and holding basins, although the location of these is currently unknown. A stone ramp to allow for the movement of fish through the weir was constructed at its southern end. Paynter and Rhodes (2005) noted that the weir was in excellent condition and was considered to be of high local significance due to its association with technological innovation and industrial advances during the late nineteenth century (Paynter & Rhodes 2005, p.28).

The activity area contains a number of exotic plantings, including tree rows. These were noted during a windscreen survey of the land encompassing the current activity area (Paynter & Rhodes 2005, p.27). Paynter and Rhodes suggested that the tree rows and plantings of exotic vegetation may have been associated with historical farm buildings and outbuildings and therefore concluded that there may be potential for locating historical archaeological sites within the vicinity of some of these plantations (Paynter & Rhodes 2005, p.27).

Historical Aerial Imagery

As part of this assessment, historical aerial photography has been obtained.

An aerial image from 1948 (Figure 4) shows that at this time the activity area was predominantly cleared of vegetation and comprised open agricultural land. A number of paddocks appear to have been ploughed and/or cropped. Tree row plantings are evident within the southern and eastern portions of the activity area. A dwelling and farm buildings are located adjacent to the eastern activity area boundary, with tree

rows evident surrounding the buildings. A track is located along the north eastern activity area boundary, leading towards a dwelling and outbuildings. Land within the southern portion of the activity area appears to contain market gardening and/or crops adjacent to Merri River. The surrounding land is cleared, open agricultural land.

A 1969 image (Figure 5) shows the activity area remaining as cleared paddocks, with some additional tree row plantations close to the buildings and dwelling and along the western boundary of the activity area. The surrounding properties remain as rural paddocks containing ploughed or cropped agricultural land. The land adjacent Merri River appears as cropped paddocks, possibly no longer used for market gardening. A cleared track or pathway can be seen along Merri River near the weir.

The 1979 aerial image (Figure 6) indicates that conditions within the activity area have remained relatively unchanged. A track, dwelling and outbuildings remain within the eastern section. A number of the smaller tree rows have been removed. The ground surface close to a number of the tree rows appear to have been cleared or graded. A dam is now located within the south eastern portion of the activity area. The surrounding properties remain as rural cleared paddocks, with the exception of land to the east of the activity area which contains a residential development.

An aerial image from 1985 (Figure 7) shows that conditions within the activity area at this time have remained similar to that seen in 1979. The dam within the south eastern section of the activity area appears to be either dry, or completely filled in at this stage. Urban development continues to grow within land to the east of the activity area.

An aerial image from 2003 (Figure 8) shows large areas of ploughed land in the northern and southern sections of the activity area. The majority of the buildings in the eastern portion have been removed. Established residential areas are evident to the east of the activity area, while the remainder of surrounding properties remain as agricultural land.

The 2013 aerial photograph (Figure 9) indicates that the central portion of the activity area has been cropped or ploughed by this stage. The tree row plantations remain.

By 2014 (Figure 10), conditions within the activity area have remained relatively unchanged, with the exception of a track constructed through the centre of the property extending in a north-south direction from Wollaston Road to the weir crossing Merri River. This is most likely associated with the construction of water pipeline installation, as indicated by Dial Before You Dig mapping (DBYD; see below and Figure 12).

By 2019 (Figure 11), the track appears to no longer be in use and is covered in vegetation. The 2019 aerial image shows a number of buildings have been constructed in the property to the west of the activity area.

Dial Before You Dig

A DBYD search has shown that there are number of services located within the activity area or close to the activity area boundary. A Wannon Water pipeline is located through the centre of the activity area (Figure 12). A gas pipeline is mapped as being located within the Wollaston Road reserve to the north of the activity area and Johnstone Road along the eastern boundary (Figure 13). National Broadband Network (NBN) infrastructure is located within the Wollaston Road reserve and extends into the activity area in the north western corner (Figure 14). Telstra infrastructure is also located in these areas. The works associated with the installation of these services would have caused ground disturbance within the activity

area, predominantly through the central portion and along the northern and eastern activity area boundaries.

Discussion

A review of the land-use history has determined that the activity area has undergone a number of disturbances as early as the middle to late 1800s, when land clearance region was undertaken in order to make way for grazing and agricultural purposes. From the early 1900s, the activity area was subdivided as part of the Wollaston Estate, whose allotments were utilised by returned soldiers for farming purposes. The construction of a dwelling and farm buildings, tree row plantations and tracks may have caused ground disturbance within the activity area. Ploughing, grazing, crop plantations and the installation of water and telecommunications services may have also caused disturbance within the activity area.

Figure 4: 1948 aerial photograph (Department of Environment, Land, Water & Planning – LANDATA)

Figure 5: 1969 aerial photograph (Department of Environment, Land, Water & Planning – LANDATA)

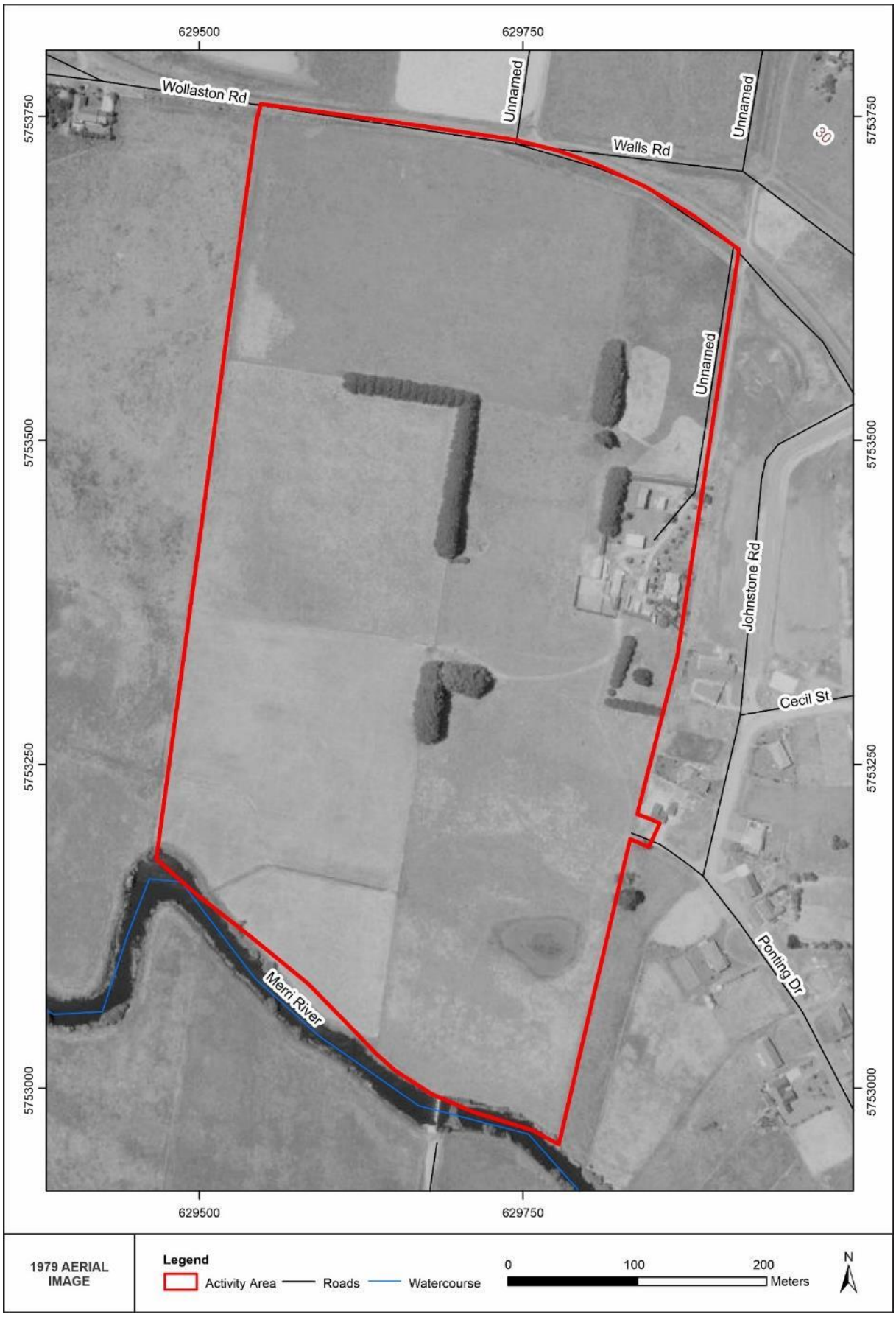


Figure 6: 1979 aerial photograph (Department of Environment, Land, Water & Planning – LANDATA)

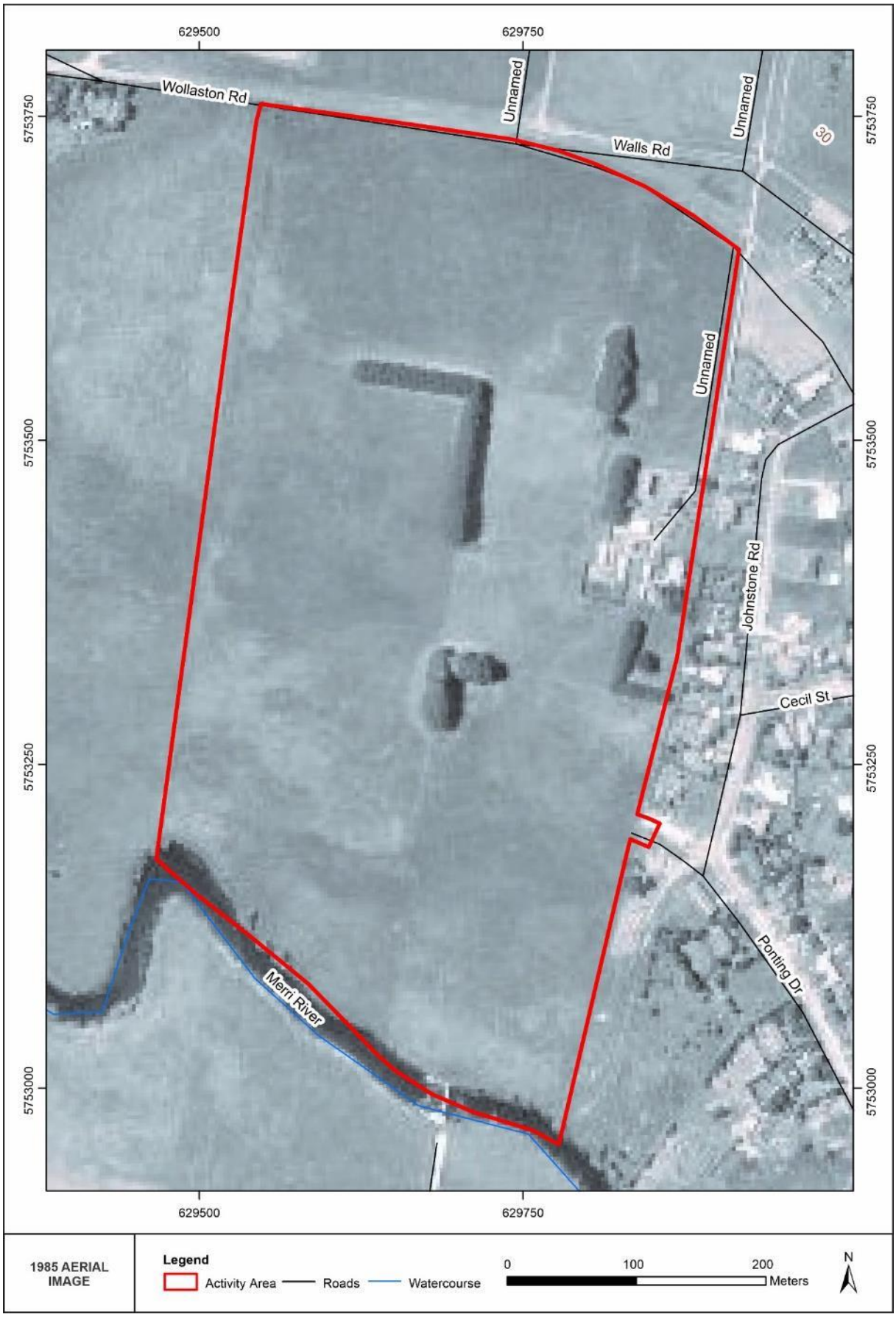


Figure 7: 1985 aerial photograph (Department of Environment, Land, Water & Planning – LANDATA)

Figure 8: 2003 aerial image (Google Earth)

Figure 9: 2012 aerial image (Google Earth)

Figure 10: 2014 aerial image (Nearmap)

Figure 11: 2019 aerial image (Nearmap)

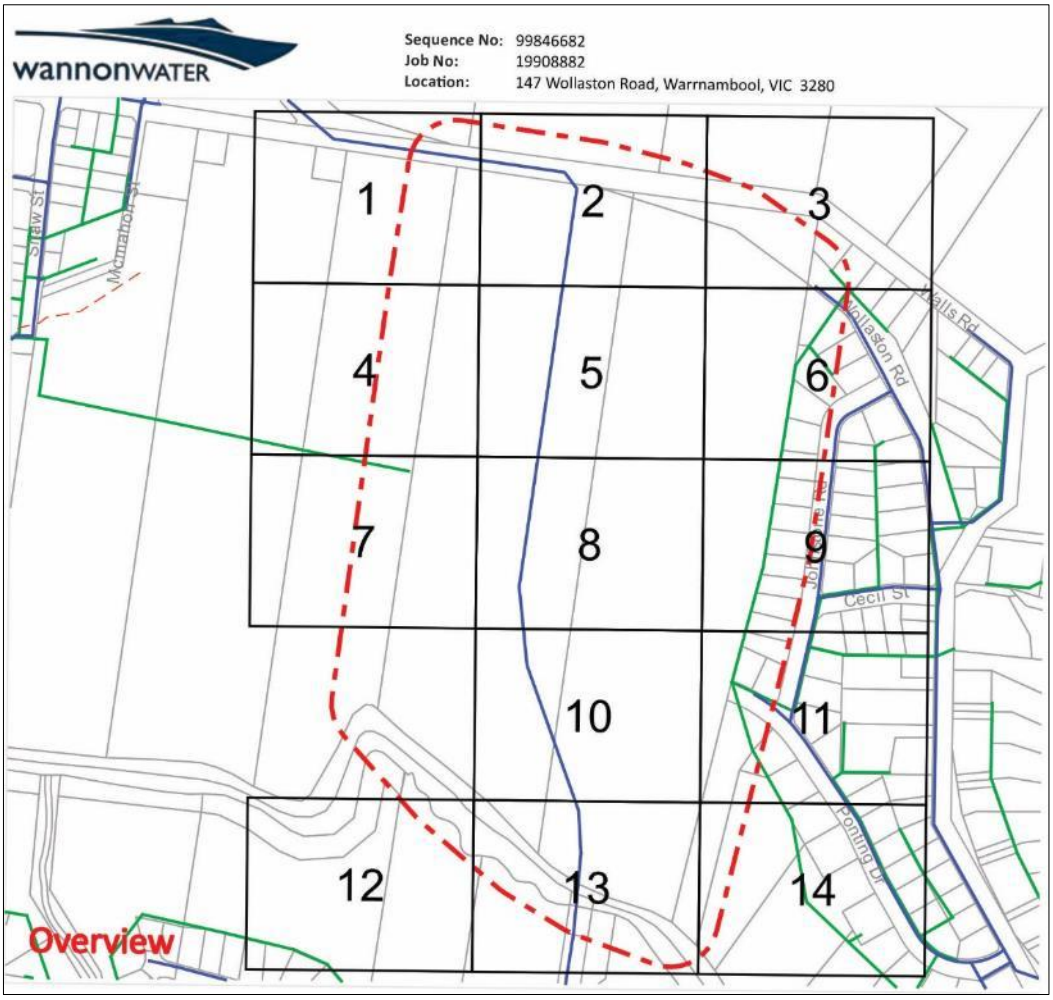


Figure 12: Showing the location of the Wannon Water pipeline through the centre of the activity area (DBYD, accessed 21/07/2020)

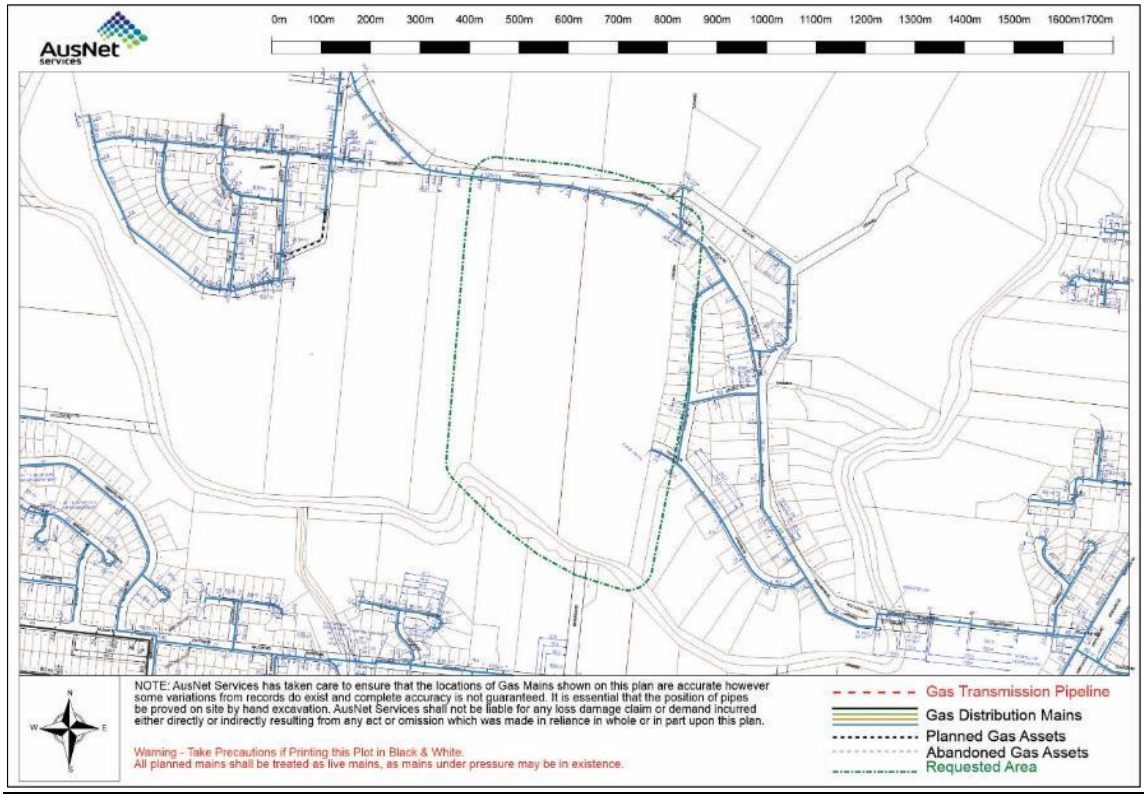


Figure 13: Showing the location of Ausnet gas services in relation to the activity area (DBYD, accessed 21/07/2020)

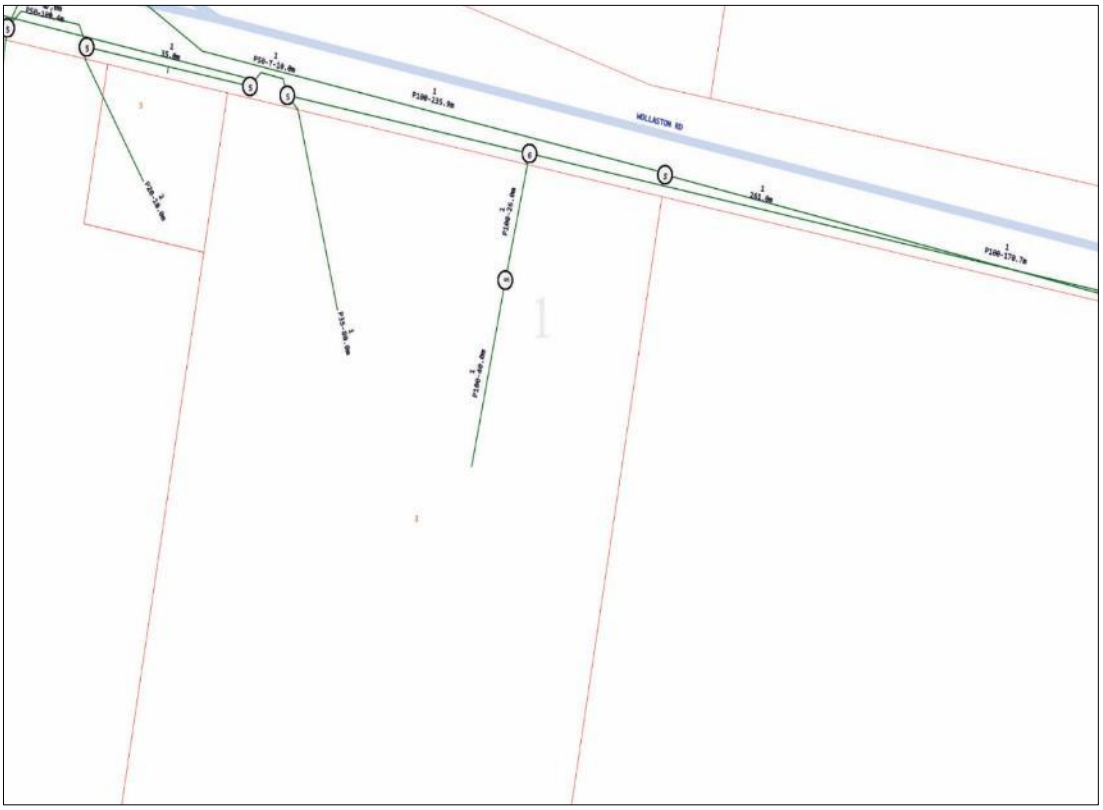


Figure 14: Showing the location of NBN services in the north western portion of the activity area (DBYD, accessed 21/07/2020)

7.3 Site Prediction Model

The desktop assessment for the activity area has allowed a site prediction model to be developed. A site prediction model is intended for use as an indication of the types of Aboriginal archaeological sites that may occur in a given area. The site prediction model can later be tested against the results of the field survey and/or subsurface testing. A review of the environmental data relevant to human settlement and the ethnographic and archaeological data relevant to the local area has indicated that:

- the activity area is located close to Merri River. Merri River would have been a key waterway used as a source of a wide range of animal and plant resources, as well as providing fresh water and a route through the landscape;
- the activity area is located on the geomorphic unit known as the Undulating Plains – Western District. These are basalt plains created through volcanic activity. Soils in these areas are characterised by shallow deposits of silty clay over a clay base;
- the activity area is located within the third tier geomorphological unit 6.1.5 (Terraces, floodplains and lakes, swamps and lunettes);
- the landforms identified in the activity area comprises a steep slope, sloping down south to the Merri River flood plain:
- the activity area would have been characterised by Plains Grassy Woodland and Swamp Scrub vegetation prior to European settlement. Plains grassland and swamp scrub species provided food, fibre and medicine, and are a key cultural resource to Aboriginal people;
- there are 15 registered Aboriginal Places within the geographic region, comprising 16 components. These Places comprise artefact scatters (88%) and low density artefact distributions (12%). The majority of these Places are located in association with the flood plains, alluvial terraces and elevated ridgelines along Merri River. Currently, there have been very few Aboriginal Places located on the open undulating plains landform further afield from Merri River;
- stone artefacts throughout the geographic region are most likely to be manufactured from raw materials such as quartz, silcrete, quartzite, chert, basalt and coastal flint. Coastal flint, basalt and quartz would all have been available locally;
- a moderate amount of CHMPs and reports have been carried out in the geographic region, however these investigations have focussed on the land immediately adjacent Merri River rather than further inland. Approximately half of these investigations have located Aboriginal cultural material in both disturbed and natural soil profiles;
- three archaeological investigations have covered portions of the activity area. No Aboriginal Places were located within the current activity area as a result of these investigations;
- the closest registered Aboriginal Places are located approximately 250–600m to the west and south west of the activity area. These Places are all registered as artefact scatters located on the Merri River flood plain. Artefacts were located at depths of between 0–800mm. The artefacts from the from these Places are predominantly manufactured from silcrete, with small numbers of quartz;
- the activity area is located within an open plain landform. Previous archaeological research on the open plain landform suggests it contains low archaeological potential for the discovery of low densities of stone artefacts in disturbed contexts;

- the activity area has been subject to previous ground disturbance in the form of vegetation clearance and use of the area for agricultural purposes such as grazing ploughing and crop plantations. The construction of a dwelling and farm buildings, the planting of tree rows and the construction of a water pipeline and other utility services may have also caused disturbance within the activity area;
- the Aboriginal Place types most likely to be located within the activity area are low densities of stone artefacts within disturbed surface and subsurface contexts; and
- there is little or no potential for culturally scarred trees due to broad scale native vegetation clearance.

7.4 Conclusions from the Desktop Assessment

While a moderate amount of archaeological work has been conducted within the geographic region, only one CHMP has been conducted further afield of Merri River (O'Reilly 2012; 500m). Excavation carried out as part of these CHMPs have revealed both deeper natural and disturbed topsoil soil profiles. The majority of the activity areas for these CHMPs were disturbed due to past land-use activities including land clearance, market gardening and ploughing. The activity area itself has undergone disturbance in the form of clearance of native vegetation, installation of underground services, the use of the area for agricultural and pastoral practices, plantation of tree rows, and construction of a dwelling and associated farm buildings.

Parts of the current activity area have been subjected to three separate archaeological investigations (Paynter & Rhodes 2005; O'Reilly & McAlister 2011; O'Reilly 2012). While Aboriginal cultural heritage was located during all of these investigations on adjoining properties, none was located within the current activity area itself. All of these investigations noted disturbance as a result of previous land-use activities, including land clearance and ploughing. As a result, any Aboriginal cultural heritage in the form of stone artefact scatters and low density artefact distributions are most likely to be disturbed and/or dispersed, and to be located where minimal ground disturbance has occurred.

The information reviewed as part of the desktop assessment has indicated that it is difficult to determine whether or not Aboriginal cultural heritage may be present within the activity area. This is predominantly due to the lack of archaeological investigations further afield from Merri River, where the activity area is located. As a result, it must be assumed that it is possible for Aboriginal cultural heritage to occur in the activity area. Therefore, in accordance with r.62 of the *Aboriginal Heritage Regulations 2018*, a standard assessment will be required to detect the presence of Aboriginal cultural heritage within the activity area.

8.0 Report on the Standard Assessment

In accordance with Clause 8, Schedule 2 of the *Aboriginal Heritage Regulations 2018*, this section contains the results of the standard assessment and field survey.

8.1 Aims and Methodology for the Standard Assessment

A standard assessment is a surface archaeological survey. This may locate evidence of surface sites but will not necessarily find buried archaeological deposits. The methodology for the standard assessment is informed by the desktop assessment and the site prediction model.

The aim of the field survey was to:

- identify any surface evidence of Aboriginal cultural heritage; and
- identify areas of potential sensitivity for Aboriginal cultural heritage.

The field survey was undertaken in accordance with proper archaeological practice, pursuant to r.63 of the *Aboriginal Heritage Regulations 2018*.

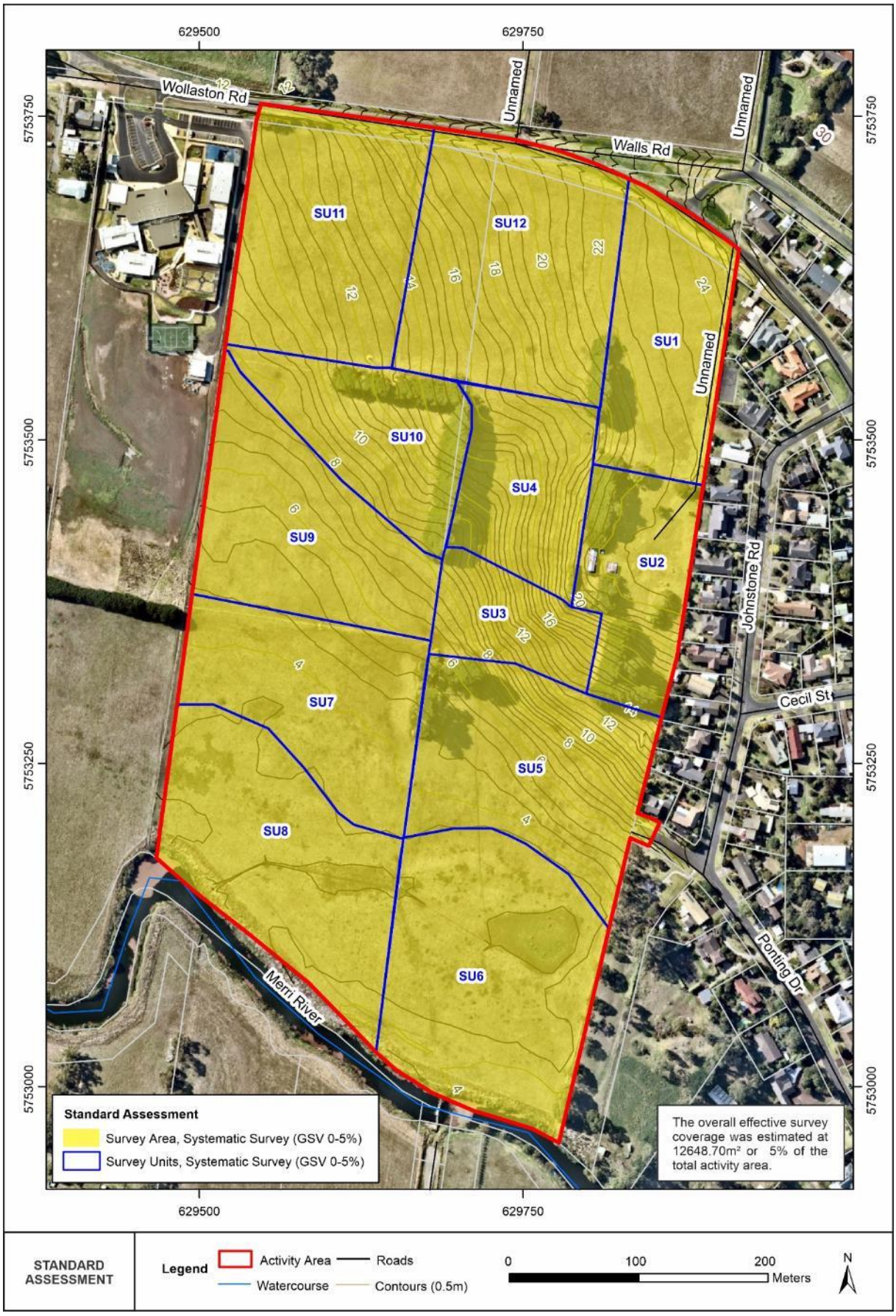
A systematic pedestrian survey was undertaken with the field team walking closely spaced (approximately 2m) pedestrian transects across the entire activity area.

Areas of bare ground surface exposure were inspected closely. The general percentage (%) of ground surface visibility was recorded throughout the activity area. All evidence of prior ground disturbance was also recorded. All mature trees within the activity area were examined for the presence of scars. The activity area was also examined for the presence of caves, cave entrances or rock shelters.

If any surface archaeological sites were located during the assessment, the following would be undertaken:

- completion of a standard recording form;
- photography of the general location of the surface site and cultural material; and
- drawing a plan of the site in relation to landmarks within the activity area and recording the location of the cultural material with a differential GPS.

A discussion of the results of the survey took place on-site with the field representative/s from the EMAC.



Map 8: Standard assessment field survey

8.2 Results of the Standard Assessment

8.2.1 Area Surveyed

The field survey was undertaken by Margaret Reith (Heritage Insight Pty Ltd) on January 11, 2021. She was assisted by Thanos Matanis (Heritage Insight Pty Ltd), Hayden Harradine and Corey Harradine (EMAC). Survey accessibility was excellent with the entire activity area being able to be accessed and surveyed (Map 8).

8.2.2 Ground Surface Visibility and Other Constraints on Field Survey

No modification to vegetation, such as slashing or cutting, had occurred with the activity area prior the survey. All parts of the activity area are in open paddocks covered in vegetation in the form of pastoral grasses. Visibility was generally poor, with few open bare patches and higher visibility under trees and in areas affected by stock rubbing and erosion. The general level of ground surface visibility was estimated at <5% throughout the entire activity area (Map 8). As such, the general effective survey was estimated at 12648.70m² or 5% of the total activity area.

8.2.3 Survey Results

For the purpose of discussing the survey results, the activity area was divided into 12 survey units (SU) (Map 8), relating to the four differing geologies discussed in the desktop assessment or topographic features observed in the field.

8.2.3.1 SU 1: New Volcanic Basalt

This section is situated in the north eastern corner of the activity area. It is also the highest elevated part of the activity area. This area is open paddocks with thick grass coverage. The area slopes gently down to the south west.

Plates 1–2 show conditions in SU 1 of the activity area. The majority of the area comprised open paddock with uncropped grass and poor ground surface visibility.

No Aboriginal cultural material was noted in this section and no areas of archaeological potential were identified.

Plate 1: SU 1 facing south (photo by M Reith 11/1/21)

Plate 2: SU 1 facing north (photo by M Reith 11/1/21)

8.2.3.2 SU 2: Farmyard Outbuildings

Survey unit 2 is situated in the centre of eastern part of the property and is defined by a series of farmyard structures and outbuildings. These are made from timber, corrugated iron and concrete. In one area, basalt cobbles were used for paving a crude surface. The area is also fringed by mature pines and low shrubs, many of which were probably planted in the early to mid-twentieth century when the farm was first constructed.

Plates 3–10 show conditions in SU 2 of the activity area. The majority of the area comprised small open paddocks with uncropped grass and poor ground surface visibility; some areas are evidently used for livestock grazing. Livestock trampling was noted under the pine trees close to a feeding trough. Areas close to the pine trees show evidence of splash erosion, resulting in some exposed sediments under the dripline.

No Aboriginal cultural material was noted in this section and no areas of archaeological potential were identified.

Plate 3: Farmyard paddock in SU 2 – facing north (photo by M Reith 11/1/21)

Plate 4: Outbuildings and livestock in SU 2 – facing south north (photo by M Reith 11/1/21)

Plate 5: Visibility under pines – facing north (photo by M Reith 11/1/21)

Plate 6: Milking shed in SU 2 – facing west (photo by M Reith 11/1/21)

Plate 7: Pine trees and feeding trough – facing north (photo by M Reith 11/1/21)

Plate 8: Concrete structures in SU 2 – facing east (photo by M Reith 11/1/21)

Plate 9: Basalt boulders used for paving in Area 2 – facing north (photo by M Reith 11/1/21)

Plate 10: Driveway along fence line in Area 2 – facing south (photo by M Reith 11/1/21)

8.2.3.3 SU 3, 4, 11 and 12: Point Campbell Limes tone

Survey units 3, 4, 11 and 12 taken together are predominantly located in the north and centre of the property, running north west by south east. The north western area (SU 11) is dominated by open paddocks with the central part (SU 12) bound by pine trees to the west and east, behind which lay the farm outbuilding. In the south (SU 3 and 4) the paddock gently inclines to the south and west.

Plates 11–16 show conditions in SU 3, 4, 11 and 12. The majority of the area comprised paddocks with uncropped grass and poor ground surface visibility; some areas are evidently used for livestock grazing and cropping of hay. Livestock trampling was noted close to a drinking trough. Areas close to the pine trees show evidence of splash erosion, resulting in some exposed sediments under the dripline.

No Aboriginal cultural material was noted in this section and no areas of archaeological potential were identified.

Plate 11: Facing north along midslope in SU 3 (photo by M Reith 11/1/21)

Plate 12: Facing west downslope on edge of crest in SU 3 (photo by M Reith 11/1/21)

Plate 13: Facing north upslope in SU 4 (photo by M Reith 11/1/21)

Plate 14: Facing south on gentle slope down to flood plain in SU 4 (photo by M Reith 11/1/21)

Plate 15: Centre of paddock in SU 11 – facing north (photo by M Reith 11/1/21)

Plate 16: Water trough showing exposed sediments in SU 12 (photo by M Reith 11/1/21)

8.2.3.4 SU 5, 7, 9 and 10: Towerhill Tuff

Survey Units 5, 7, 9, and 10 taken together are located in the south-central and eastern-central portions of the property. The south-central area (SU 5 and 7) is dominated by open paddocks on gently sloping simple slopes. The eastern-central part (SU 9 and 10) is also dominated by open paddocks that are bound by pine trees to the east and north.

Plates 17–20 show conditions in SU 5, 7, 9 and 10. The majority of the area comprised paddocks with uncropped grass and poor ground surface visibility. Some areas are evidently used for livestock grazing and cropping of hay. Areas close to the pine trees show evidence of splash erosion, resulting in some exposed sediments under the dripline.

No Aboriginal cultural material was noted in this section and no areas of archaeological potential were identified.

Plate 17: Facing south towards Merri River in SU 9 (photo by M Reith 11/1/21)

Plate 18: Facing east midslope down to flood plain in SU 7 (photo by M Reith 11/1/21)

Plate 19: Facing south midslope down to flood plain in SU 5 (photo M Reith 11/1/21)

Plate 20: Facing west towards pine trees in SU 10 (photo by M Reith 11/1/21)

8.2.3.5 SU 6 and 8: Flood Plain Alluvium

Survey Units 6, and 8 taken together are located in the southern part of the activity and are bounded by Merri Creek which runs along the southern boundary of the property. These areas are dominated by open paddocks on a gently sloping simple slope that runs down to Merri River and becomes a low-lying flood plain. A dam has been constructed on the eastern side of SU 6.

Plates 21–26 show conditions in SU 6 and 8, which comprised paddocks with uncropped grass and poor ground surface visibility. Some areas are evidently used for livestock grazing and cropping of hay. The area in and around the dam has some exposed sediments where the water has dried out.

No Aboriginal cultural material was noted in this section and no areas of archaeological potential were identified.

Plate 21: Facing north dam on flood plain in SU 6 (photo by M Reith 11/1/21)

Plate 22: Exposed sediments in base of dry dam in SU 6 (photo by M Reith 11/1/21)

Plate 23: Facing west on flood plain near dry dam in SU 6 (photo by M Reith 11/1/21)

Plate 24: Facing west drain from dam feeding into Merri River in SU 6 (photo by M Reith 11/1/21)

Plate 25: Facing south drain feeding in Merri River in south of property in SU 8 (photo by M Reith 11/1/21)

Plate 26: Facing south drain towards Merri River in SU 8 (photo by M Reith 11/1/21)

8.2.4 Aboriginal Cultural Heritage

No Aboriginal cultural materials were found during the standard assessment.

8.2.5 Areas of Potential Archaeological Sensitivity

The activity area is considered to contain low archaeological potential. The southern section that borders Merri River is a flood plain that has been modified through historical ploughing and agricultural practices and the construction of a dam. The north east part of the activity area comprises a gentle sloped open paddock that has also been impacted by historical land clearance, grazing and ploughing.

However, some areas of archaeological potential may be present, either near the top of the slope in the north eastern corner, or adjacent to Merri River that runs along the southern portion of the activity area.

8.3 Conclusions from the Standard Assessment

The activity area contains no caves, rock shelters or stony rises. Some basalt floaters present in the northern section likely represent the edge of an eroding lava flow. Some remnant mature Eucalypts are present in and near the activity area. These were inspected for signed of cultural scarring. No cultural modification was noted.

The desktop assessment noted that the activity area likely contained low archaeological potential for the discovery of stone material. The activity area did not contain any stony rises which may have contained higher archaeological potential. It was also noted that the activity area comprises a combination of low-lying flood plain and gently inclined simple slopes.

The standard assessment noted that the activity area has undergone ground disturbance through ploughing, grazing and land clearance. The standard assessment was inhibited by poor ground surface visibility. The archaeological potential of the activity area is considered to be low, with the only areas of potential archaeological sensitivity being identified as either near the top of the slope in the north eastern corner and/or adjacent Merri River, which runs along the southern portion of the activity area. It is considered unlikely that the activity area contains moderate to high densities of stone artefacts or *in situ* cultural heritage deposits, however low densities of stone artefacts may be present.

Due to the poor ground surface visibility and the proximity of the activity area to Merri River, a complex assessment was required to further test for the potential of subsurface deposits of Aboriginal cultural material, as per r.64 of the *Aboriginal Heritage Regulations 2018*.

9.0 Report on the Complex Assessment

In accordance with Clause 8, Schedule 2 and Clause 9, Schedule 2 of the *Aboriginal Heritage Regulations 2018*, this section contains the results of the complex assessment.

9.1 Aims and Methodology for the Complex Assessment

A complex assessment subsurface testing program was determined to be necessary to investigate the subsurface potential for Aboriginal cultural heritage. As well as undertaking sampling to assess proposed impact areas for Aboriginal cultural heritage, the excavation also provided information regarding any soil disturbance within the activity area that would affect the preservation of subsurface Aboriginal cultural heritage sites. The methodology for the complex assessment was discussed and agreed upon in consultation with the RAP prior to the field assessment (Section 6.1).

A complex assessment (subsurface testing by excavation) was carried out as part of this assessment on January 11 and 15, 2021 and was supervised by a qualified archaeologist (Margaret Reith, Heritage Insight Pty Ltd). A brief discussion of the results of the complex assessment took place on-site with the field representatives from the EMAC on both occasions.

Excavation of the Test Pits

As required by the *Aboriginal Heritage Regulations 2018*, a 1x1m test pit (TP) was first excavated on each landform to determine the soil stratigraphy and to explore the possibility of Aboriginal cultural heritage existing within a subsurface context (Map 9). The TPs were labelled numerically (i.e., TP 1, TP 2, etc.). TP 1 was placed on the flood plain close to Merri River on the mapped Alluvium (Qa1) geology. TP 2 was placed in the western-central part of the activity area on the mapped Tower Hill Tuff (Nept) geology. TP 3 was situated on Port Campbell Limestone (Nhp) in the north eastern quadrant of the activity area. TP 4 was placed in the north eastern corner of the activity area on the mapped Newer Volcanic Group – basalt flows (Neo).

Initially, the grass layer was removed from the TP location with a square, flat blade spade measuring 200mm in width. Excavation was then undertaken manually in units of 100mm depth (spits) in order to provide a good profile of the horizontal and vertical distribution of any cultural remains identified through the different soil layers. Changes in soil context were recorded within the spits. This process continued until the presence of a sterile basal layer was established. Levels were taken on the surface and at the base of each spit with an automatic level (dumpy). Levels were also taken for any *in situ* Aboriginal cultural heritage. Any identified features within each spit were drawn to scale on graph paper. A soil section was drawn of a minimum of one wall of the test pit once excavation was completed. A photographic record of the surface, any features identified during excavation, the base of each spit and the soil section was made. A range pole with increments of 200mm was included in all photographs. Soil descriptions and other natural and cultural features were recorded on standard excavation forms. Soil descriptions were based on the Australian Soil Classifications and the standard Munsell Soil Chart. Soil pH levels were taken for each spit and soil context using a standard garden variety test kit.

All of the soil from the test pit was passed through a sieve with a 5mm mesh. In the event that any Aboriginal cultural heritage was recovered, the procedure was to place the find in an appropriate bag (based on the nature of the find) with labels identifying the context. By agreement with the EMAC, any Aboriginal cultural heritage recovered from the excavation was to be retained for later analysis at the office of Heritage Insight Pty Ltd.

Coordinates for the location of the test pits were recorded using a differential GPS and backfilling took place in order to comply with OHS requirements.

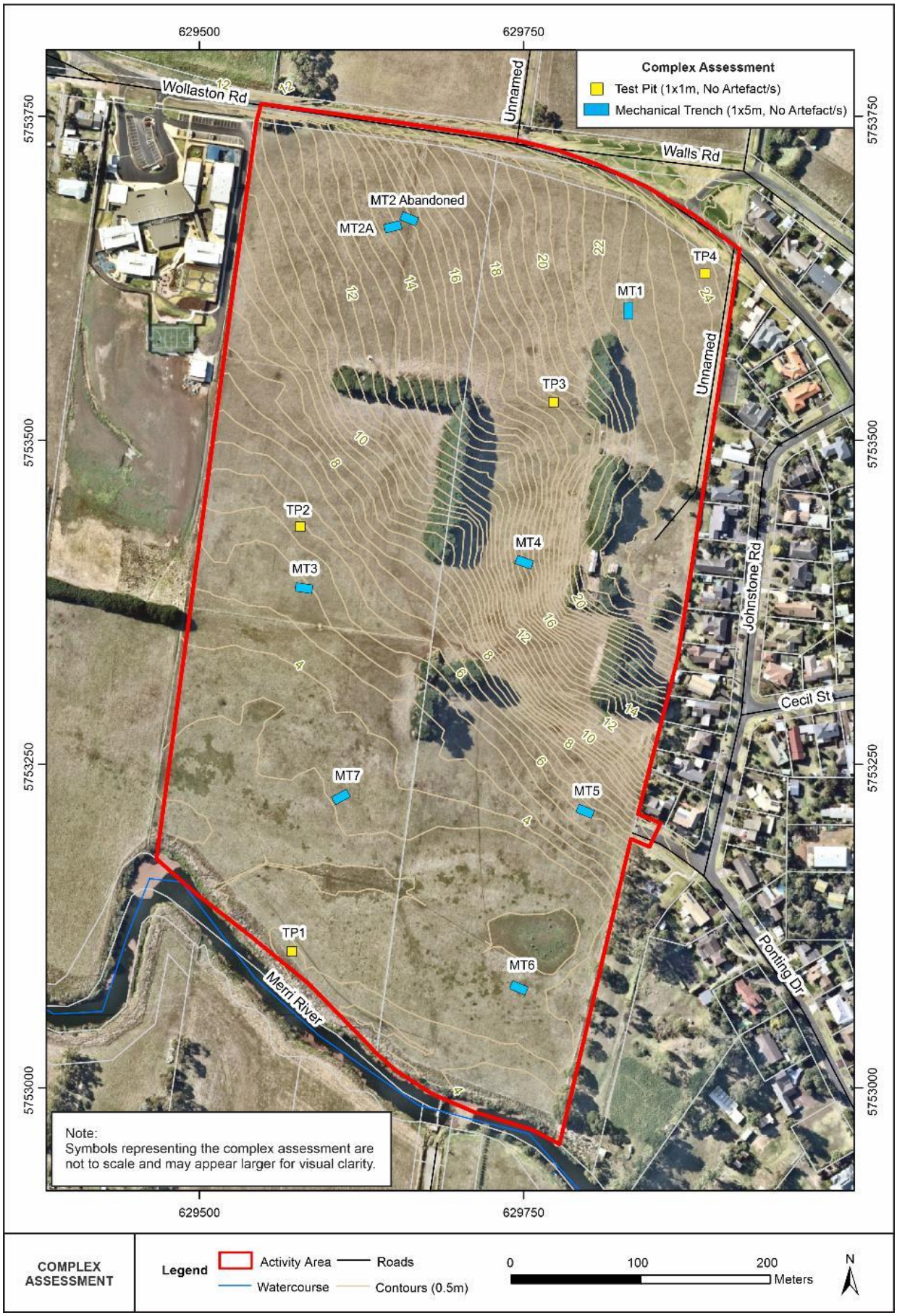
Machine Transects

Machine transects (MTs) were excavated in order to further assess the likelihood of Aboriginal cultural material being located within the activity area and to provide a more extensive sample of the surface and subsurface soils (Map 9). Machine excavation was used at the request of the RAP to obtain a larger sample size and because it is a more efficient testing methodology that STPs on a shallow landform. The MTs measured 5mx1m and were placed on the crest landform element situated in the north eastern part of the activity area. MTs were labelled numerically (i.e., MT 1, MT 2, etc.).

Soil within the MTs was excavated in increments of approximately 100mm in order to provide a good profile of the horizontal and vertical distribution of any cultural remains identified through the different soil layers. This process continued until the presence of the sterile basal layer was located. In the event that Aboriginal cultural features (including concentrations of six or more artefacts) were identified during excavation of the MT, controlled manual excavation would then be undertaken of the feature in 50mm spits until the base of the feature was established. Mechanical excavation would then continue. Soil sections were drawn of one wall of each MT once excavation was completed. A photographic record of the surface, any features identified during excavation and the soil section was made. A range pole with increments of 200mm was included in all photographs. Soil descriptions and other natural and cultural features were recorded on standard excavation forms. Soil descriptions were based on the Australian Soil Classifications and the standard Munsell Soil Chart. Soil pH levels were taken for each spit and soil context using a standard garden variety test kit.

All of the soil from the MTs was passed through a sieve with a 5mm mesh. In the event that any Aboriginal cultural heritage was recovered, the procedure was to place the find in an appropriate bag (based on the nature of the find) with labels identifying the context. By agreement with the EMAC, any Aboriginal cultural heritage recovered from the excavation was to be retained for later analysis at the office of Heritage Insight Pty Ltd.

Coordinates for the location of each MT were recorded using a differential GPS and backfilling took place in order to comply with OHS requirements.



Map 9: Subsurface testing locations

9.2 Constraints on the Complex Assessment

No major constraints on fieldwork were encountered during complex assessment. MT 2 was relocated from its original location by approximately 2m due to the exposure of a potential service trench. This newly relocated trench was called MT 2A.

9.3 Results of the Complex Assessment

The complex assessment was conducted on January 11–15, 2021 by Margaret Reith, Thanos Matanis (Heritage Insight), Corey Harradine and Hayden Harradine (EMAC). Mechanical excavation was done by Steven Weir (Belmara Industries).

A total of four 1x1m TPs and seven 1mx5m MTs (one was discontinued) were excavated across the activity area in order to assess the likelihood of Aboriginal cultural material being present and to establish a profile of the soils within the activity area. None of the TPs or MTs exposed Aboriginal cultural materials. The results of the excavation are outlined below.

9.3.1 Test Pit 1

TP 1 was excavated in the south western corner of the activity area on the flood plain close to Merri River on the mapped Alluvium (Qa1). This test pit contained shallow deposits of friable to compacted very dark greyish-brown silts and silty clays lying over very firmly compacted dark brown clay. No notable inclusions were noted throughout the soil profile, with some bioturbation observed within Context 1. This test pit was excavated to a maximum depth of 360mm. The clay was identified as culturally sterile basal deposits.

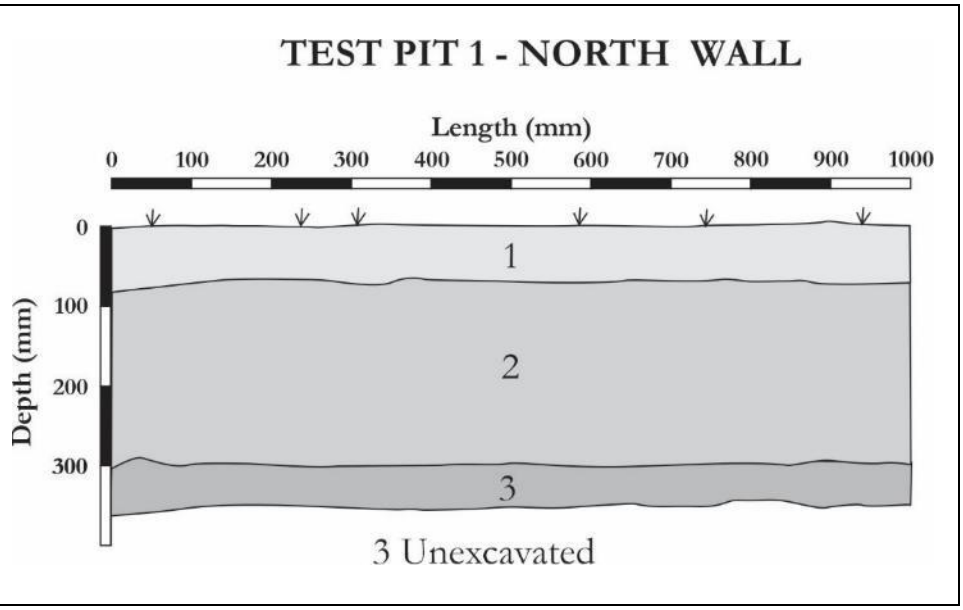
No Aboriginal cultural material was located in this test pit.

Map 9 shows the location of TP 1. Table 6 below provides a summary of excavation data.

Table 6: Test Pit 1 excavation summary

Test Pit	1	
GDA 94 Coordinates (Zone 54)	**NW** 629570.809E/ 5753104.892N	**NE** 629570.809E/ 5753105.892 N
	SW 629571.809E/5753105.892N	**SE** 629571.809E/5753104.892N
Stratigraphy **Context 1** **Context 2** **Context 3**	0–80/90mm: Moist friable silt with grass roots and bioturbation. Smooth, diffused transition to Context 2. Munsell: 10YR 3/2 (very dark greyish-brown), pH: 6.5. 80/90–/300mm: Compact silty clay with smooth, diffused transition to Context 3. Munsell: 10YR 3/2 (very dark greyish-brown), pH: 6.5. 300–350/360: Highly compact dark brown clay. Munsell: 10YR 2/1 (dark brown), pH: 6.5.	
Depth of Excavation	**360mm**	
Evidence of Disturbance	None	

Aboriginal Cultural Heritage	None
Test Pit 1 – End of excavation (facing north) **(Photo by M Reith 12/1/2021)**	
Test Pit 1 – Close up of stratigraphic profile (facing north) **(Photo by M Reith 12/1/2020)**	

Section Drawing (north wall)	

9.3.2 Test Pit 2

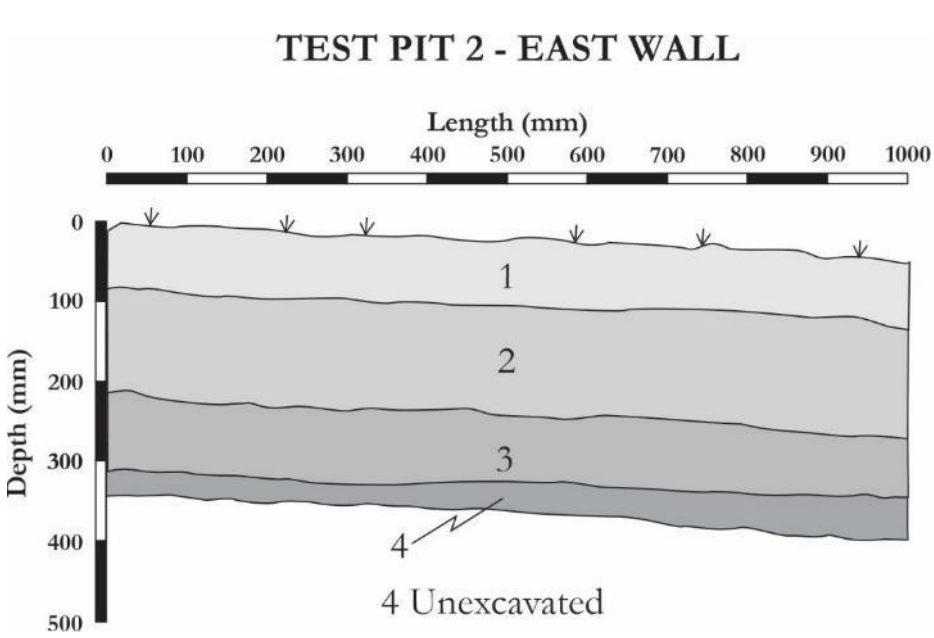
TP 2 was placed in the western-central part of the activity area on the mapped Tower Hill Tuff (Nept) geology. This test pit contained shallow deposits of friable to compact dark brown silts, dark brown clayey silts and very dark brown silty clays lying over strongly compacted dark brown clay. Inclusions of rounded 'buckshot' (pisolite) were noted throughout much of the lower part of the soil profile, with a higher accumulation at the boundary with the basal clay. The presence of pisoliths is indicative of retarded drainage. This test pit was excavated to a maximum depth of 400mm. The clay was identified as culturally sterile basal deposits.

No Aboriginal cultural material was located in this test pit.

Map 9 shows the location of TP 2. Table 7 below provides a summary of excavation data.

Table 7: TP 2 excavation summary

Test Pit	2	
GDA 94 Coordinates (Zone 54)	**NW** 629577.371E/5753432.989N	**NE** 629577.371E/5753433.989 N
	SW 629578.371E/5753433.989N	**SE** 629578.371E/5753432.989 N
Stratigraphy **Context 1**	0–80/140mm: Moist, friable silt with grass root inclusion and bioturbation. Smooth, diffused transition to Context 2. Munsell: 7.5YR 3/2 (dark brown), pH: 6.5.	
Context 2	80/140–210/280mm: Moist, friable clayey silt with buckshot inclusions. Smooth and diffuse transition with Context 3. Munsell: 7.5YR 3/2 (dark brown), pH: 6.5.	
Context 3	210/280–310/340mm: Moist, compact silty clay with frequent buckshot inclusion. Smooth and diffuse transition with Context 4. Munsell: 7.5YR 2.5/3 (very dark brown), pH: 6.5.	
Context 4	310/340–340/400mm: Moist, highly compact clay with some buckshot inclusion. Munsell: 7.5YR 3/3 (dark brown), pH: 6.	
Depth of Excavation	**400mm**	
Evidence of Disturbance	None	
Aboriginal Cultural Heritage	None	
Test Pit 2 – End of excavation (facing north) **(Photo by M Reith 14/1/2021)**		

Test Pit 2 – Close up of stratigraphic profile (facing east) **(Photo by M Reith 14/1/2021)**	
Section Drawing (east wall)	

9.3.3 Test Pit 3

TP 3 was situated on Port Campbell Limestone (Nhp) in the north eastern quadrant of the activity area. This test pit contained shallow deposits of friable dark brown silty loam and dark greyish-brown silty clay lying over firmly compacted very dark brown clay. Inclusions of rare limestone pebbles in Context 2. Inclusions of rounded 'buckshot' (pisolite) were noted throughout much of the lower part of the soil profile, with a slightly higher accumulation at the boundary with the basal clay. The presence of pisoliths is indicative of retarded drainage. This test pit was excavated to a maximum depth of 360mm. The clay was identified as culturally sterile basal deposits.

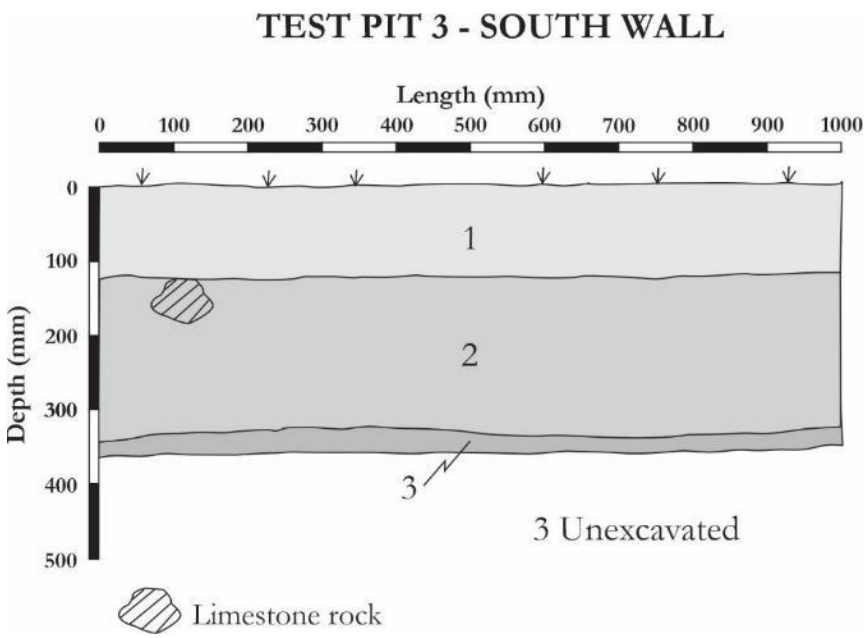
No Aboriginal cultural material was located in this test pit.

Map 9 shows the location of TP 3. Table 8 below provides a summary of excavation data.

Table 8: TP 3 excavation summary

Test Pit	3	
GDA 94 Coordinates (Zone 54)	**NW** 629773.163 E/5753528.702N	**NE** 629773.163 E/5753529.702N
	SW 629774.163 E/5753529.702N	**SE** 629774.163 E/5753528.702N
Stratigraphy **Context 1** **Context 2** **Context 3**	0–120mm: Moist, friable silty loam with abundant small rootlets. Smooth and diffuse transition with Context 2. Munsell: 10YR 3/3 (dark brown), pH: 6. 120–320/340: Moist, moderately compacted silty clay with rare sub-rounded degraded limestone cobbles (~100mm) and uncommon fine rounded buckshot inclusions. Smooth and diffuse transition with Context 3. Munsell: 10YR 3/2 (very dark greyish-brown), pH: 6. 320/340–360mm: Moist, firmly compacted clay with uncommon fine rounded buckshot inclusions. Munsell: 10YR 2/2 (very dark brown), pH: 6.	
Depth of Excavation	**360mm**	
Evidence of Disturbance	None	
Aboriginal Cultural Heritage	None	

Test Pit 3 – End of excavation (facing north) **(Photo by M Reith 14/1/2021)**	
Test Pit 3 – Close up of stratigraphic profile (facing south) **(Photo by M Reith 14/1/2021)**	

Section Drawing (south wall)	

9.3.4 Test Pit 4

TP 4 was placed in the north eastern corner of the activity area on the mapped Newer Volcanic Group – basalt flows (Neo). This test pit contained shallow deposits of compact dark brown clayey silts and firmly compacted dark brown silty clays lying over strongly compacted very dark brown clay. Inclusions of sub-angular degraded basalt were observed within Contexts 2 and 3. This test pit was excavated to a maximum depth of 310mm. The clay was identified as culturally sterile basal deposits.

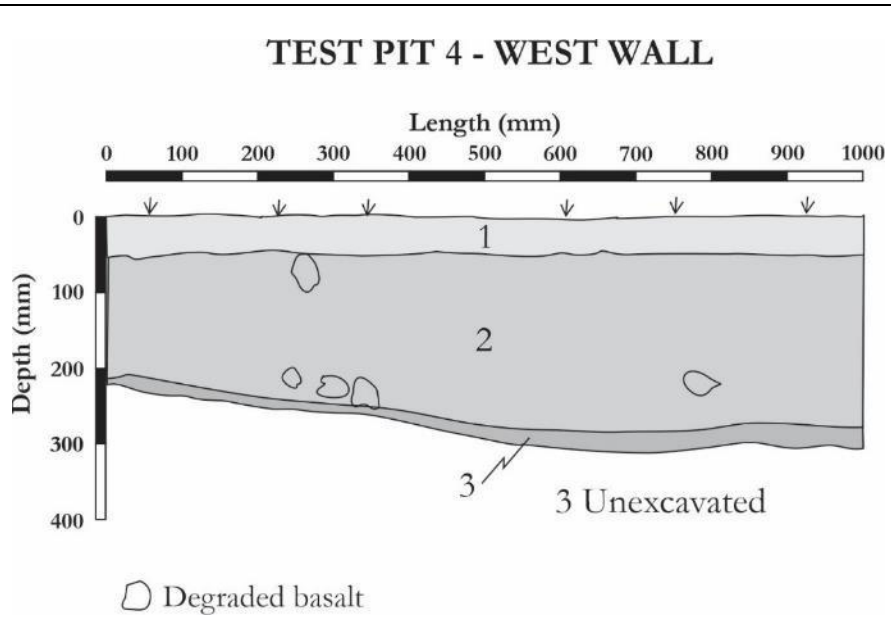
No Aboriginal cultural material was located in this test pit.

Map 9 shows the location of TP 3. Table 9 below provides a summary of excavation data.

Table 9: Test Pit 4 excavation summary

Test Pit	4	
GDA 94 Coordinates (Zone 54)	**NW** 629889.738E/5753628.080N	**NE** 629889.738E/5753629.080N
	SW 629890.738E/5753629.080N	**SE** 629890.738E/5753628.080N
Stratigraphy **Context 1** **Context 2** **Context 3**	0–50mm: Moist, compact clayey silt with grass roots and bioturbation. Smooth and diffuse transition with Context 2. Munsell: 7.5YR 3/2 (dark brown), pH: 6. 50–210/280mm: Moist, firmly compacted silty clay with uncommon degraded, sub-angular medium sized (~50–150mm) basalt inclusions throughout. Smooth and diffuse transition with Context 3. Munsell: 7.5YR 3/2 (dark brown), pH: 6. 210/280–220/310mm: Moist, strongly compacted clay with rare degraded, sub-angular, medium sized (~50–150mm) basalt inclusions. Munsell: 7.5YR 2.5/3 (very dark brown), pH: 6.	
Depth of Excavation	310mm	
Evidence of Disturbance	None	
Aboriginal Cultural Heritage	None	

Test Pit 4 – End of excavation (facing north) **(Photo by M Reith 15/1/2021)**	
Test Pit 4 – Close up of stratigraphic profile (facing west) **(Photo by M Reith 15/1/2021)**	

Section Drawing (west wall)	

9.3.5 Machine Transects

Seven machine transects (MTs), measuring 1x5m, were excavated across the activity area (Map 9). These focused on particular landform elements: simple slopes (MTs 2A, 3, 4 and 5), lower waning slope (MT 3), flat (MT 7) and crest (MT 1) part of the activity area.

MT 1 was situated on the Newer Volcanic Group (Neo); MT 3 and MT 7 were situated on soils forming on Tower Hill Tuff (Nept); MT 2, MT 2A, MT 4 and MT 5 were situated on soils forming over Port Campbell Limestone (Nhp); and MT 6 was situated on soils forming on Alluvium (Qa1). Throughout the activity area the topsoils are generally no deeper than ~300mm to the basal clays.

The soil horizons recorded within MT 1 (described as dark brown clayey silts and silty clays) are comparable in soil composition, consistency and chemical makeup to TP 4 and are consistent with soils formed over basalt. At the time of excavation, the sediments were noted to be moist and the presence of 'buckshot' inclusions is indicative of retarded drainage at this test location. Basal deposits consisted of moist, black compacted clay. Evidence of ploughing was also noted within MT 1, suggested by the mixing of black basal clays within Context 2 (120–200mm).

The soil horizons recorded within MTs 3 and 7 (described as dark brown silts, clayey silts, and silty clays) are comparable in soil composition, consistency and chemical makeup to TP 2. The sediments were noted to be moist at the time of excavation with occasional inclusions of degrading volcanic tuff observed in MT 7. Basal deposits consisted of moist black or dark reddish-brown compacted clay.

The soil horizons recorded within MTs 2, 4 and 5 (described as very dark brown, or very dark grey clayey silts and silty clays) are comparable in soil composition, consistency and chemical makeup to TP 3. The sediments were noted to be moist at the time of excavation with occasional 'buckshot' and limestone inclusions. Basal deposits consisted of very dark brown, dark brown or dark reddish-brown compact clay. Modern glass was recovered from Context 1 (0–100mm) in MT 2.

The soil horizons observed within MT 6 (described as very dark greyish-brown clayey silt and silty clay), are comparable in soil composition, consistency and chemical makeup to TP 1 and are consistent with soils formed on alluvium. The sediments were noted to be moist at the time of excavation with no observable stony inclusions. Basal deposits consisted of moist very dark brown compact clay.

No Aboriginal cultural material was located within any of the machine trenches.

Summary data for the MTs is provided in Tables 10–16. The location of machine trenches is shown on Map 9.

Table 10: MT 1 excavation summary

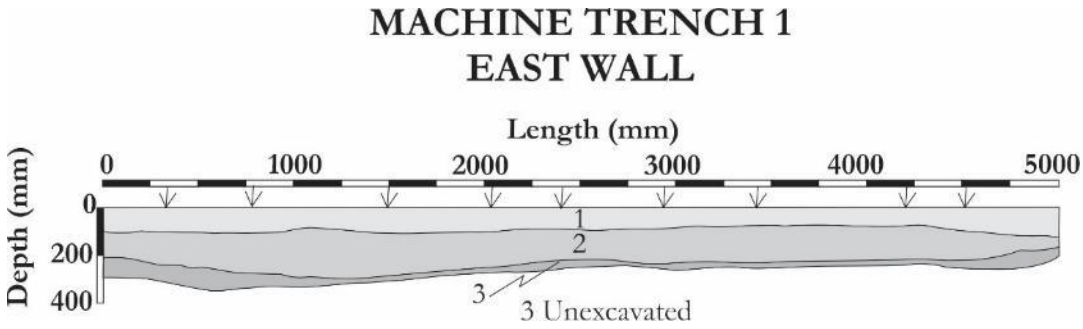
Machine Trench 1	
GDA 94 Coordinates (Zone 54)	**Soil Description**
E629830.606 N5753597.440 E629830.606 N5753602.440 E629831.606 N5753602.440 E629831.606 N5753597.440	**Context 1** 0–120mm: Moist, friable clayey silt with grass root inclusions. Munsell: 7.5YR 3/2 (dark brown), pH: 6.5. **Context 2** 120–160/200mm: Moist, compact silty clay with clay inclusions, buckshot inclusions, potentially ploughed in the past. Munsell: 7.5YR 3/2 (dark brown silty clay) with 4/6 (strong brown clay inclusions), pH:6. **Context 3** 160/200/200–320mm: Moist, compact clay. Munsell: 7.5YR 2.5/1 (black), pH: 7. **Cultural Material:** None.
Stratigraphic Profile	
	
Photos by M Reith (11/01/2021)	
 	

Table 11: MT 2A excavation summary

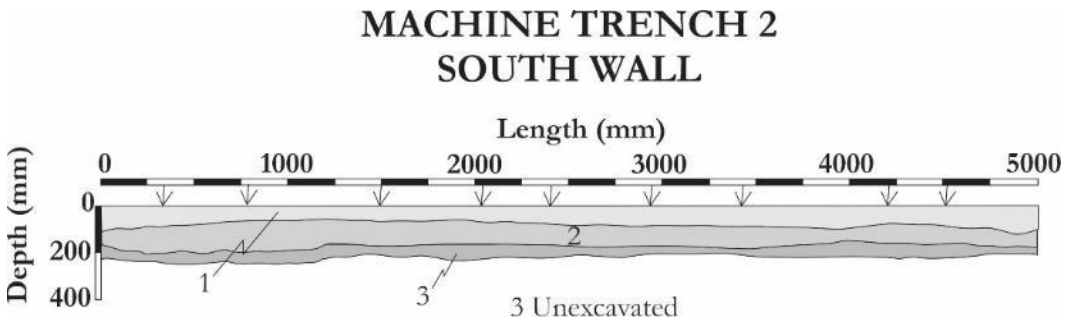
Machine Trench 2A	
GDA 94 Coordinates (Zone 54)	**Soil Description**
E629649.060 N5753664.801 E629648.813 N5753665.770 E629653.658 N5753667.005 E629653.905 N5753666.036	**Context 1** 0–100mm: Moist silt with grass root inclusions, 3 glass pieces and bioturbation. Munsell: 7.5YR 3/2 (dark brown), pH: 6.5. **Context 2** 100–170/180: Moist, compact silty clay with some clay included. Munsell: 7.5YR 4/6 (strong brown clay), pH: 6. **Context 3** 170/180–200/220mm: Compact clay. Munsell: 7.5YR 2.5/2 (very dark brown), pH: 7. **Cultural Material:** None
Stratigraphic Profile	
	
Photos by M Reith (11/01/2021)	
	

Table 12: MT 3 excavation summary

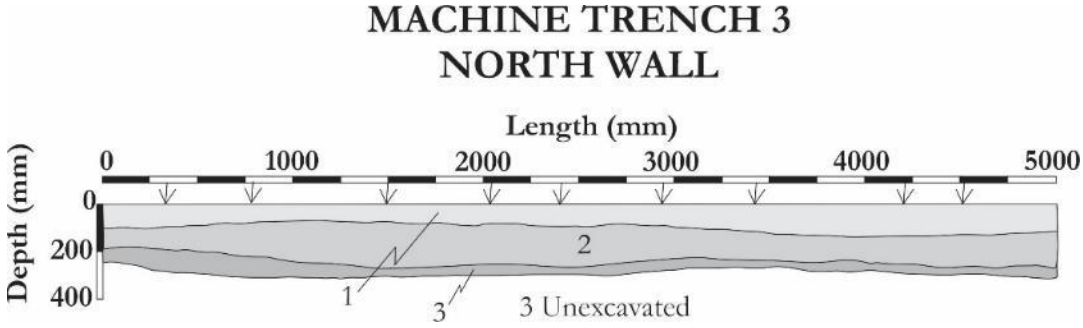
Machine Trench 3	
GDA 94 Coordinates (Zone 54)	**Soil Description**
E629577.674 N5753386.210 E629577.812 N5753387.200 E629582.764 N5753386.513 E629582.627 N5753385.523	**Context 1** 0–100/110mm: Moist, friable silt with grass roots and bioturbation. Munsell: 7.5YR 3/2 (very dark brown), pH: 6. **Context 2** 100/110–190/260mm: Compact silty clay. Munsell: 7.5YR 3/2 (dark brown), pH: 6.5. **Context 3** 190/260–240/300mm: Moist, compact clay. Munsell: 7.5YR 2.5/1 (black), pH: 6.5. **Cultural Material:** None.
Stratigraphic Profile	
	
Photos by M Reith (12/01/2021)	
	

Table 13: MT 4 excavation summary

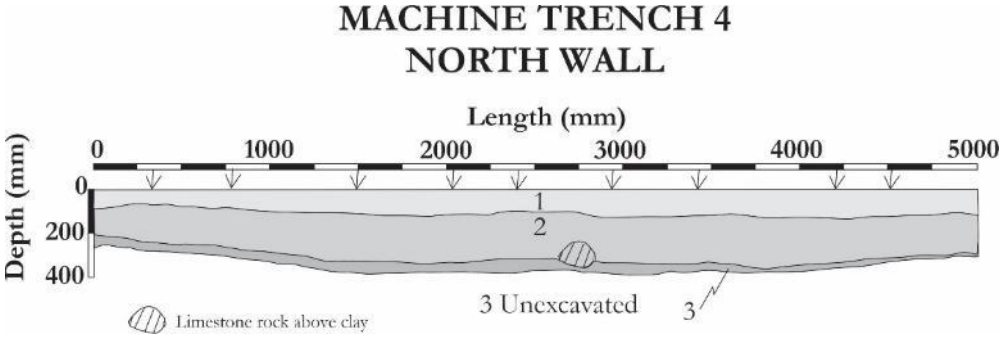
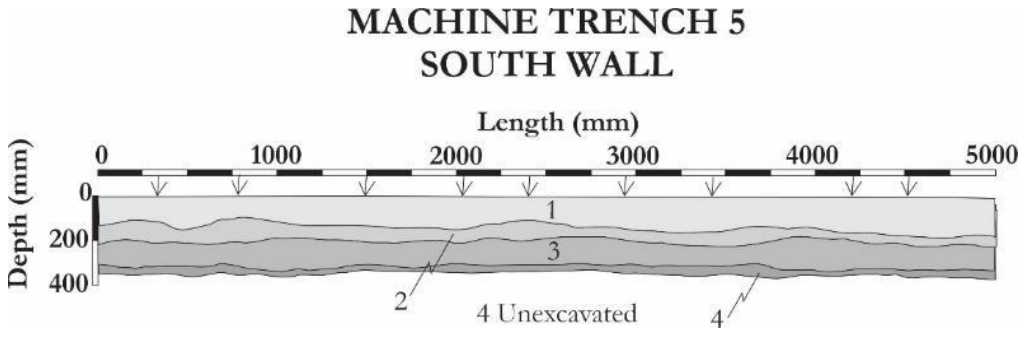
Machine Trench 4	
GDA 94 Coordinates (Zone 54)	**Soil Description**
E629748.153 N5753406.181 E629748.486 N5753407.124 E629753.200 N5753405.458 E629752.867 N5753404.515	**Context 1** 0–80/100mm: Damp, friable silty-clay with grass roots. Munsell: 7.5YR 3/1 (very dark grey), pH: 6. **Context 2** 80/100–200/270mm: Damp, compact clay. Munsell: 7.5YR 2.5/1 (black), pH: 6. **Context 3** 200/270–250/330mm: Dry compact block structured clay with a limestone rock sitting above the clay. Munsell: 5YR 2.5/2 (dark reddish-brown), pH: 7. **Cultural Material:** None
Stratigraphic Profile	
	
Photos by M Reith (12/01/2021)	
	

Table 14: MT 5 excavation summary

Machine Trench 5	
GDA 94 Coordinates (Zone 54)	**Soil Description**
E629795.775 N5753214.151 E629796.159 N5753215.074 E629800.776 N5753213.154 E629800.391 N5753212.230	**Context 1** 0–100/180mm: Moist, friable silt with grass root inclusion and bioturbation. Smooth, diffused transition to Context 2. Munsell: 7.5YR 3/2 (dark brown), pH: 6.5. **Context 2** 100/180–200/220mm: Moist, friable clayey silt with buckshot inclusions and a smooth, diffused transition with Context 3. Munsell: 7.5YR 3/2 (dark brown), pH: 6.5. **Context 3** 200/220–300/350mm Moist, compact silty clay with frequent buckshot inclusion. Smooth, diffused transition. Munsell: 7.5YR 2.5/3 (very dark brown), pH: 6.5. **Context 4** 300/350–340/380mm: Moist, highly compact clay with some buckshot inclusion. Munsell: 7.5YR 3/3 (dark brown), pH: 6. **Cultural Material:** None.
Stratigraphic Profile	
	

Photos by M Reith (12/1/2021)

Table 15: MT 6 excavation summary

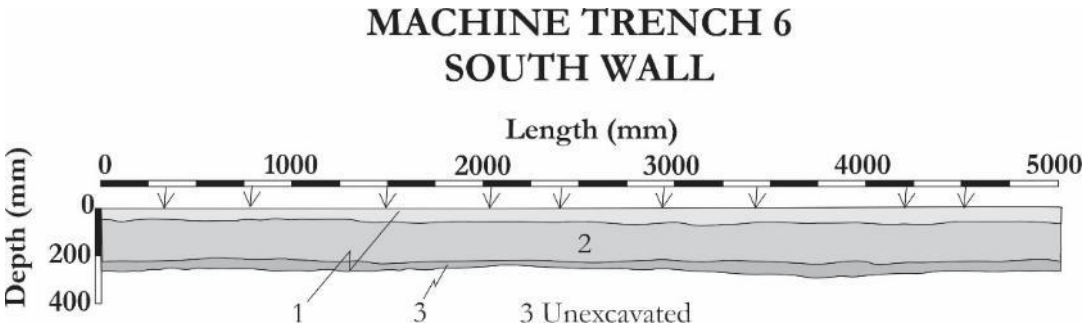
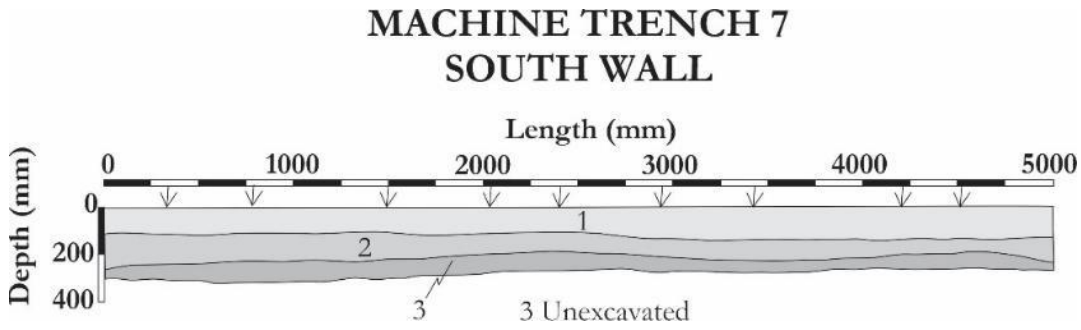
Machine Trench 6	
GDA 94 Coordinates (Zone 54)	**Soil Description**
E629743.136 N5753078.056 E629743.520 N5753078.979 E629748.137 N5753077.058 E629747.752 N5753076.135	**Context 1** 0–50/60mm: Moist, friable clayey silt. Munsell: 10YR 3/2 (very dark greyish-brown), pH: 6.5. **Context 2** 50/60–220mm: Moist compact silty clay. Munsell: 10YR 3/2 (very dark greyish-brown), pH: 6.5 **Context 3** 220–260mm: Moist compact clay. Munsell: 10YR 2/2 (very dark brown), pH: 6 **Cultural Material:** None
Stratigraphic Profile	
	
Photos by M Reith (13/01/2021)	
	

Table 16: MT 7 excavation summary

Machine Trench 7	
GDA 94 Coordinates (Zone 54)	**Soil Description**
E629607.844 N5753223.656 E629607.437 N5753224.569 E629612.006 N5753226.602 E629612.412 N5753225.688	**Context 1** 0–90/110mm: Moist, friable clayey silt with grass roots and bioturbation. Munsell: 5YR 3/3 (dark reddish-brown), pH: 6. **Context 2** 90/110–230/260mm: Moist, compact silty clay. Munsell: 5YR 3/3 (dark reddish-brown), pH: 6. **Context 3** 230/260– 270/300mm: Moist compact clay with red degrading volcanic tuff inclusion in the last 2m of base in western end of trench. Munsell: 5YR 2.5/2 (dark reddish-brown clay) with 5YR 5/8 (yellowish-red volcanic tuff), pH: 6.5. **Cultural Material:** None.
Stratigraphic Profile	
	
Photos by M Reith (13/01/2021)	
	

9.3.6 Aboriginal Cultural Heritage

No Aboriginal cultural heritage material was found during the complex assessment and no areas of archaeological potential were identified.

9.4 Conclusions from the Complex Assessment

The complex assessment investigated all regions of the activity area. A total of four general soil profiles were identified, each relating to the mapped geological units within the activity area. Minor characteristics, such as colour, were variable within each of the four soil profiles.

The soil profiles observed in TP 1 and MT 6, both located on the flood plain to the south of the activity area, are on the mapped alluvium (Qa1) geology. The shallow topsoils comprise of moist, very dark greyish-brown clayey silts and silty clays and contained no observable stony inclusions. Basal deposits consisted of highly compact dark brown clays.

The soil profiles observed in TP 2 and MTs 3 and 7, located in the western part of the activity, are on the Volcanic Tuff (Nept) geology. The shallow topsoils comprise moist, dark brown silts clayey silts and silty clays, and contained occasional stony inclusions of degraded volcanic tuff. Basal deposits consisted of dark brown highly compact clays.

The soil horizons recorded within TP 3 and MTs 2, 4 and 5, located in the north west and central portions of the activity area, are on the Port Campbell Limestone (Nhp) geology. The shallow topsoils comprise moist, very dark brown, or very dark grey clayey silts and silty clays, and contained occasional 'buckshot' and limestone inclusions. Basal deposits consisted of firmly very dark brown compacted clays.

The soil horizons recorded within TP 4 and MT 1, located in the north eastern corner of the activity area, are on the Newer Volcanic Group (Neo) geology. The shallow topsoils comprise moist, dark brown clayey silts and silty clays, and contained occasional rounded 'buckshot' stony inclusions. Basal deposits consisted of very dark brown strongly compacted clays.

The land-use history section of the desktop assessment indicated that the activity area had been subject to land clearance for grazing and agricultural purposes since the mid-to-late 1800s. Ploughing and cropping has also occurred throughout the activity area since at least the early twentieth century and into the twenty-first century. Evidence of ploughing was noted within MT1 and modern glass was recovered from Context 1 (0–100mm) in MT 2A.

The results of the complex assessment are consistent with the site prediction model and conclusions of the desktop assessment (Sections 7.3 and 7.4). Based on previous testing conducted within the geographic region (e.g., Paynter & Rhodes 2005, O'Reilly & McAlister 2011 and O'Reilly 2012), the activity area contained low potential for any *in situ* subsurface Aboriginal cultural materials, despite to its proximity to Merri River. This is primarily due to the activity area having been disturbed by prior initial land clearance and agricultural activities. It is along noted that the activity area is located on both a steep slope (unsuitable for camping) and the flood plain adjacent Merri River. The flood plain lies within a flood overlay and is regularly inundated and has likely been highly modified since European settlement

No Aboriginal cultural heritage was identified during the complex assessment. Therefore, based on the research and testing undertaken during this CHMP, there is very low potential for low densities of Aboriginal cultural heritage to be present within the activity area.

10.0 Consideration of Section 61 Matters – Impact Assessment

In accordance with Section 61 of the *Aboriginal Heritage Act 2006*, a CHMP must consider whether the activity will be conducted in a way that avoids harm to Aboriginal cultural heritage.

Section 61 matters are a requirement of the CHMP process and are an assessment of whether:

- harm to Aboriginal cultural heritage can be avoided or minimised (s.61 (a) and (b));
- specific measures are required for the management of Aboriginal cultural heritage (s.61 (c));
- particular contingency plans are required in relation to disputes, delays and other obstacles that may affect the conduct of the activity (s.61 (d)); and
- requirements relating to the custody and management of Aboriginal cultural heritage during the course of the activity are needed (s.61 (e)).

10.1 Section 61 Matters in Relation to Aboriginal Cultural Material

10.1.1 Can Harm to Aboriginal Cultural Material be Avoided and/or Minimised?

In accordance with Section 61 of the *Aboriginal Heritage Act 2006*, it is stated that harm to Aboriginal cultural heritage cannot be avoided or minimised if located within activity area. However, no Aboriginal cultural material was located during the conduct of this CHMP, and the results of the CHMP assessment note that it is highly unlikely that Aboriginal cultural material is present in the activity area.

10.1.2 Cumulative Impact Statement

No Aboriginal material was located during this assessment and no areas of archaeological potential were identified.

At the time of writing there were 15 registered Aboriginal Places within the geographic region, comprising a total of 16 components (Table 3; Appendix 3). The component types represented in the geographic region are artefact scatters (n=14, 88%) and LDADs (n=2, 12%).

All of the Aboriginal Places within the georegion are located within close proximity to Merri River, and are mostly located on the Merri River flood plain. Artefact scatters and low density artefact distributions frequently contain silcrete and quartz artefacts, with chert, quartzite, coastal flint and basalt artefacts also located.

The desktop assessment concluded that the activity area may contain potential for Aboriginal cultural material given the proximity of Merri River, but noted that previous research within the activity area had identified low potential. The standard assessment noted some areas of archaeological potential, however noted that potential was low. The complex assessment did not locate any cultural material. However, the information presented in this CHMP will add to our knowledge of the Warrnambool area and future site prediction models.

10.1.3 Are Specific Measures Needed for the Management of Aboriginal Cultural Material?

No specific measures are needed for the management of Aboriginal cultural heritage as no Aboriginal cultural heritage was located during the assessment for this CHMP.

10.1.4 Necessary Contingency Plans

The approved form for a CHMP (*Aboriginal Heritage Regulations 2018*, Schedule 2, 13(1)) states that a management plan must include specific contingency plans for:

a) the matters referred to in Section 61 of the Act;

b) the resolution of any disputes between the Sponsor and relevant RAPs in relation to the implementation of the plan or the conduct of the activity;

c) reviewing compliance with the CHMP and mechanisms for remedying non-compliance;

d) the management of Aboriginal cultural heritage found during the activity; and

e) the notification, in accordance with the Act, of the discovery of Aboriginal cultural heritage during the carrying out of the activity.

There are several contingency plans that may be necessary during the conduct of this project. In particular, it is necessary to have contingency plans in place for the following:

- unexpected discovery of isolated or dispersed cultural material and for the unexpected discovery of a burial; and
- reviewing compliance with the management plan and mechanisms for remedying non-compliance.

These and other contingency plans are discussed in detail in Section 2.

10.1.5 Necessary Custody and Management Arrangements

In the unlikely event that Aboriginal cultural material is located during the proposed works, management and custody arrangements will be required. Further information regarding the Aboriginal cultural heritage custody and management arrangements are contained in Section 2.

References

Legislation

Aboriginal Heritage Act 2006

Aboriginal Heritage Regulations 2018

Internet Resources

Agreements, Treaties and Negotiated Settlements
(https://www.atns.net.au/)

Australian Dictionary of Biography: Manifold Thomas
(https://adb.anu.edu.au/biography/manifold-thomas-2424)

Department of Environment, Land, Water and Planning – Bioregions and EVC Benchmarks 2020
(https://www.environment.vic.gov.au/biodiversity/bioregions-and-evc-benchmarks)

Department of Environment, Land, Water & Planning – LANDATA 2020
(https://www.landata.vic.gov.au/)

Department of Jobs, Precincts and Regions – Agriculture Victoria – Victorian Resources Online 2020
(http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/vrohome)

Department of Jobs, Precincts and Regions – Earth Resources GeoVic 2020
(https://earthresources.vic.gov.au/geology-exploration/maps-reports-data/geovic)

Department of Premier and Cabinet – Aboriginal Cultural Heritage Register and Information System 2020
(https://achris.vic.gov.au/#/onlinemap)

Nearmap 2019
(https://au.nearmap.com/)

Warrnambool & District Historical Society
(https://warrnamboolhistory.org.au/)

Victorian Collections: Document, Wollaston sale 1919
(https://victoriancollections.net.au/items/597fe8af21ea67114ca8bee1)

Victorian Places: Warrnambool
(https://www.victorianplaces.com.au/warrnambool)

Reports and Published Resources

Aboriginal Victoria 2016, *Guide to preparing a Cultural Heritage Management Plan*, Department of Premier and Cabinet, Melbourne, Vic, accessed from <https://www.aboriginalvictoria.vic.gov.au/cultural-heritage-management-plans>.

Aboriginal Victoria 2018a, *Guidelines for Conducting and Reporting on Aboriginal Cultural Heritage Investigations (other than cultural heritage management plans)*, Aboriginal Victoria Department of Premier and

Cabinet, Melbourne, Vic, accessed from <https://www.aboriginalvictoria.vic.gov.au/archaeological-surveys-and-investigations>.

Aboriginal Victoria 2018b, '*Aboriginal Heritage Act 2006* Practice Note: Salvage Excavation', accessed from <https://www.aboriginalvictoria.vic.gov.au/cultural-heritage-management-plans>.

Barwick, D 1971, 'Changes in the Aboriginal Population of Victoria 1863-1966.', in *Aboriginal man and environment in Australia*, Canberra.

Barwick, D 1984, 'Mapping the Past: an Atlas of Victorian Clans 1835-1904. Part 1', *Aboriginal History*, vol. 8, no. 1–2, pp. 100–131.

Cannon, M (ed.) 1983, *Historical Records of Victoria: Aborigines and Protectors 1838-1839*, Victorian Government Printing, Melbourne.

Chandler, J 2014, *Residential Subdivision, 123 Queens Road, Warrnambool, Victoria*, Biosis Pty Ltd, Port Melbourne.

Clark, I 1990, *Aboriginal Languages and Clans: An Historical Atlas of Western and Central Victoria, 1800–1900*, Department of Geography and Environmental Science Monash University, Melbourne.

Clark, ID (ed.) 1998, *The Journals of George Augustus Robinson, Chief Protector, Port Phillip Aboriginal Protectorate*, Heritage Matters Pty Ltd, Ballarat.

Coutts, P, Witter, D, McIlwraith, M & Frank, R 1977, *The Mound People of Western Victoria: a preliminary statement*, Victoria Archaeological Survey, Melbourne.

Coutts, PJF, Witter, DC, Cochrane, RM & Patrick, J 1976, *Sites of Special Scientific Interest in the Victorian Coastal Region: A Report on the Archaeological Aspects*, Victorian Archaeological Survey, Melbourne.

Critchett, J 1990, *Distant Field of Murder: Western District Frontiers 1834-1848*, Melbourne University Press, Melbourne.

Critchett, J 1992, *Our Land Till We Die: A History of the Framlingham Aborigines*, Warrnambool Institute Press, Warrnambool.

Dawson, J 1881, *Australian Aborigines. The Languages and Customs of Several Tribes of Aborigines in the Western District of Victoria, Australia*, George Robertson, Melbourne.

Dugay, L 2019, *Proposed Sewerage Line: Extending along road reserve at Shaw St and into 221 Wollaston Rd and 9 Goodall St, Warrnambool*,.

East, EK & O'Reilly, S 2011, *Wollaston Road, Warrnambool: Housing Subdivision. Report no. 4681.*,.

Ellender, I 1989, *An Archaeological Survey in S. W. Victoria*, Isabel Ellender (Consultant Archaeologist).

EPA Victoria 2004, *Environmental Audit: Merri River Estuary: Findings and Recommendations*, EPA Victoria, Southbank.

Fiddian, J & Patton, K 2019, *Bridge Road Rural Subdivision, Woodford, Victoria*,.

Flood, J 1995, *Archaeology of the Dreamtime: The story of prehistoric Australia and its people*, Angus & Robertson, Sydney.

Gott, B 1983, 'Murnong – *Microseris scapigera*: A study of a staple food of Victorian Aborigines', *Australian Aboriginal Studies*, no. 2, pp. 2–18.

Gott, B & Conran, J 1998, *Victorian Koorie plants : some plants used by Victorian Koories for food, fibre, medicines and implements* 2nd edn, Yangennanock Women's Group, Aboriginal Keeping Place, Hamilton.

Goulding, M 1988, *Aboriginal Occupation of the Melbourne Area, District 2: A Report to the Land Conservation Council*, Megan Goulding.

Long, A 2007, *North Dennington Trunk Sewer & Dales Road Water Storage Duplication, Warnambool.*,.

Lourandos, H 1980, "'Forces of Change: Aboriginal Technology and Population in South Western Victoria'",.

McAlister, R 2018, *Compliance with CHMP 15220: Proposed Sewer Connection: Ocean Beach Road, Sorrento*, Heritage Insight, Kensington.

Mitchell, J 2014, *Proposed Residential Subdivision at 17-19 Mortlake Road, Warrnambool*, Alpha Archaeology Pty Ltd, Kensington.

Mitchell, J 2020, *Proposed Sewer Pump Station at 391 Wollaston Road, Warrnambool*,.

Mitchell, J, McFarlane, E & Hill, J 2016, *Proposed Residential Subdivision at Lot 2 and CA 10B, corner of Wollaston Road and Warrnambool-Caramut Roads, Warrnambool*, Alpha Archaeology Pty Ltd, Maribyrnong.

O'Reilly, S 2012, *Woollaston Road Development Infrastructure Works: Pipeline, Warrnambool*, Urban Colours Arts Cultural Heritage Consultants, Lara.

O'Reilly, S & McAlister, R 2011, *Wollaston Road, Warrnambool: Housing Subdivision Cultural Heritage Management Plan*, Urban Colours Arts Cultural Heritage Consultants, Lara.

Paynter, N & Rhodes, D 2005, *An Archaeological Assessment Wollaston Road, Warrnambook*, Heritage Insight Pty Ltd, Richmond.

Presland, G (ed.) 1977, *Journals of George Augustus Robinson January - March 1840* Second Edition., Ministry for Conservation Publication, Melbourne.

Presland, G 1994, *Aboriginal Melbourne: The Lost Land of the Kulin People*, Penguin Books, Ringwood, Victoria.

Rhodes, D & Rawoteea, B 2007, *Cranbourne West Urban Growth Plan Indigenous Archaeology Specialist Report*, Heritage Insight Pty Ltd, Richmond.

Rowan, JN, Russell, LD & Ransom, SW 2000, *Land Systems of Victoria* 3rd edn DB Rees (ed), Centre for Land Protection Research, Department of Natural Resources and Environment, Epsom, Victoria.

Schell, P 1995, *An Archaeological Survey of the Hopkins River*, Report for the Framlingham Trust, Melbourne.

Stephens, M 2014, *The journal of William Thomas: assistant protector of the Aborigines of Port Phillip & Guardian of the Aborigines of Victoria 1839 to 1843 (Volume 3)*,.

Viridans Biological Databases 2012, *Just-a-Minute Victorian Animals*, Viridans Biological Databases.

Zola, N & Gott, B 1992, *Koorie Plants – Koorie People: Traditional Aboriginal Food, Fibre and Healing Plants of Victoria*, Koorie Heritage Trust, Melbourne.

Appendix 1: CHMP Notification

VICTORIA State Government | Premier and Cabinet

Notice of Intent to prepare a Cultural Heritage Management Plan for the purposes of the *Aboriginal Heritage Act 2006*

This form can be used by the Sponsor of a Cultural Heritage Management Plan to complete the notification provisions pursuant to s.54 of the *Aboriginal Heritage Act 2006* (the "Act").

For clarification on any of the following please contact Victorian Aboriginal Heritage Register (VAHR) enquiries on 1800-726-003.

SECTION 1 - Sponsor information

Sponsor:	Wollaston Developments Pty Ltd		
ABN/ACN:	638859622		
Contact Name:	Cameron Gull		
Postal Address	18-20 Peel Street, Ballarat North Vic 3350		
Business Number:	438 341 592	Mobile:	
Email Address:	cameron@gullco.com.au		

Sponsor's agent (if relevant)

Company:			
Contact Name:			
Postal Address			
Business Number:		Mobile:	
Email Address:			

SECTION 2 - Description of proposed activity and location

Project Name:	Proposed Residential Development: 147 Wollaston Road, Warrnambool
Municipal district:	Warrnambool City Council

Clearly identify the proposed activity for which the cultural heritage managment plan is to be prepared (ie. Mining, road construction, housing subivision)

Subdivision

SECTION 3 - Cultural Heritage Advisor

Name	Company	Email address
Renee McAlister	Heritage Insight Pty Ltd	reneemcalister@heritageinsight.com

SECTION 4 - Expected start and finish date for the cultural heritage management plan

Start Date: 03-Aug-2020 Finish Date: 13-Jan-2021

Submitted on: 03 Aug 2020

VICTORIA State Government | Premier and Cabinet

SECTION 5 - Why are you preparing this cultural heritage management plan?

☑ A cultural heritage management plan is required by the Aboriginal Heritage Regulations 2007

What is the high Impact Activity as it is listed in the regulations?

Subdivision

Is any part of the activity an area of cultural heritage sensitivity, as listed in the regulations? Yes

☐ Other Reasons (Voluntary)

☐ An Environment Effects Statement is required

☐ A Cultural Heritage Management Plan is required by the Minister for Aboriginal Affairs.

☐ An Impact Management Plan or Comprehensive Impact Statement is required for the activity

SECTION 6 - List the relevant registered Aboriginal parties (if any)

This section is to be completed where there are registered Aboriginal parties in relation to the management plan.

Eastern Maar Aboriginal Corporation RNTBC

SECTION 7A - List the relevant Aboriginal groups or Aboriginal people with whom the Sponsor intends to consult (if any)

*This section is to be completed only if the proposed activity in the management plan is to be carried out in an area where there is **no Registered Aboriginal Party.***

SECTION 7B - Describe the intended consultation process (if any)

*This section is to be completed only if the proposed activity in the management plan is to be carried out in an area where there is **no Registered Aboriginal Party.***

SECTION 8 – State who will be evaluating this plan (mandatory)

The plan is to be evaluated by:

☐ Joint - Registered Aboriginal Party AND The Secretary

☑ A Registered Aboriginal Party

If checked, list the relevant Registered Aboriginal Party Evaluating: Eastern Maar Aboriginal Corporation RNTBC

☐ The Secretary

☐ Victorian Aboriginal Heritage Council

SECTION 9 – Preliminary Aboriginal Heritage Tests (PAHTs)

List the Reference Number(s) of any PAHTs conducted in relation to the proposed activity:

SECTION 10 - Notification checklist

Submitted on: 03 Aug 2020

Premier and Cabinet

Ensure that any relevant registered Aboriginal party/ies is also notified. A copy of this notice with a map attached may be used for this purpose.
(A registered Aboriginal party is allowed up to 14 days to provide a written response to a notification specifying whether or not it intends to evaluate the management plan.)

In addition to notifying the Deputy Director and any relevant registerd Aboriginal party/ies, a Sponsor must also notify any owner and/or occupier of any land within the area to which the management plan relates. A copy of this notice with a map attached may be used for this purpose.

Ensure any municipal council, whose municipal district includes an area to which the cultural heritage management plan relates, is also notified. A copy of this notice, with a map attached, may also be used for this purpose.

Submitted on: 03 Aug 2020

Appendix 2: Aboriginal Places in the Geographic Region

Aboriginal Place No	Aboriginal Place Name	Component Place Number	Component Type
7321-0347	ROACHE 1	7321-0347-1	Artefact Scatter
7321-0348	ROACHE 2	7321-0348-1	Artefact Scatter
7321-0349	ROACHE 3	7321-0349-1	Artefact Scatter
7321-0350	ROACHE 4	7321-0350-1	Artefact Scatter
7321-0450	WOLLASTON ROAD 1	7321-0450-1	Artefact Scatter
7321-0451	WOLLASTON ROAD 2	7321-0451-1	Artefact Scatter
7321-0479	Wollaston Rd 1	7321-0479-1	Artefact Scatter
7321-0480	Wollaston Rd 2	7321-0480-1	Artefact Scatter
7321-0481	Wollaston Rd 3	7321-0481-1	Artefact Scatter
7321-0482	Wollaston Road 4 IA	7321-0482-1	Artefact Scatter
7321-0483	Wollaston Road 5 IA	7321-0483-1	Artefact Scatter
7321-0486	Wollaston Road 3 AS	7321-0486-1	Artefact Scatter
7321-0487	Wollaston Road 6 AS	7321-0487-1	Artefact Scatter
7321-0489	Wollaston Rd 4	7321-0489-2	Artefact Scatter
7321-0504	Woodford LDAD	7321-0504-2	Low Density Artefact Distribution
7321-0504	Woodford LDAD	7321-0504-3	Low Density Artefact Distribution

Appendix 3: Previous Reports in Geographic Region

Report No.	Report Type	Title	Author	Report Year
16869	CHMP Complex Assessment	Proposed Sewer Pump Station at 391 Wollaston Road, Warrnambool	Jodie Mitchell	
15752	CHMP Complex Assessment	Proposed Sewerage Line: Extending along road reserve at Shaw St and into 221 Wollaston Rd and 9 Goodall St, Warrnambool	Laurinda Dugay	
15446	CHMP Complex Assessment	Proposed Residential Subdivision: 159 Mortlake Road, Warrnambool	Renee McAlister	
15259	CHMP Complex Assessment	Bridge Road Rural Subdivision, Woodford, Victoria 3281	Jenny Fiddian and Keith Patton	
12906	CHMP Complex Assessment	Residential Subdivision, 123 Queens Road, Warrnambool, Victoria	Jennifer Chandler	
12329	CHMP Desktop Assessment	Woollaston Road Development Infrastructure Works: Pipeline, Warrnambool	Steven O'Reilly	
11662	CHMP Complex Assessment	Wollaston Road, Warrnambool: Housing subdivision	Steven O'Reilly and Renee McAlister	
11656	CHMP Complex Assessment	Proposed Residential Subdivision at Lot 2 and CA 10B, corner of Wollaston Road and Warrnambool-Caramut Roads, Warrnambool	Jodie Mitchel, Elizabeth McFarlane, Jeremy Hill	
4681	Salvage Excavation	Wollaston Road, Warrnambool: Housing Subdivision	Edward Kincraig East and Steven O'Reilly	
4070	Survey	NORTH DENNINGTON TRUNK SEWER & DALES ROAD WATER STORAGE DUPLICATION, WARNAMBOOL	LONG, A	2007
3396	Survey	AN ARCHAEOLOGICAL ASSESSMENT WOLLASTON ROAD, WARRNAMBOOL	PAYNTER, N & RHODES, D	2005
2984	Desktop or Paper or Due Diligence or Other	HISTORIC PLACES SPECIAL INVESTIGATION SOUTH WEST VICTORIA A STUDY OF ABORIGINAL CONTACT AND POST CONTACT HISTORY AND PLACES	CRITCHETT, J	1995
1945	Desktop or Paper or Due Diligence or Other	ARCHAEOLOGICAL STUDIES IN THE CENTRAL WESTERN DISTRICT OF VICTORIA SITE SURVEY AND CULTURAL RESOURCE MANAGEMENT	COUTTS.P.J.F	1985
1370	Desktop or Paper or Due Diligence or Other	COAST ACTION COAST CARE 1998/99 ABORIGINAL ARCHAEOLOGICAL DESKTOP STUDY	MARSHALL, B. & SCHELL, P.	1998
1260	Desktop or Paper or Due Diligence or Other	W.L. KOENIG COLLECTION: DOCUMENTATION OF STONE ARTEFACTS FROM A PRIVATE COLLECTION.	AMOROSI, L.	1998
652	Desktop or Paper or Due Diligence or Other	JOURNALS OF GEORGE AUGUSTUS ROBINSON MARCH-MAY 1841	PRESLAND, G.	1977
552	Desktop or Paper or Due Diligence or Other	JOURNALS OF G.A. ROBINSON: MAY TO AUGUST 1841	PRESLAND, G. (ED.)	1980
447	Desktop or Paper or Due Diligence or Other	IMPACT OF EUROPEAN SETTLEMENT ON ABORIGINAL SOCIETY IN WESTERN VICTORIA	COUTTS, P.J.F., WITTER, D.C. & PARSONS, D.M.	1977

Report No.	Report Type	Title	Author	Report Year
446	Survey	SUMMER FIELD PROGRAMME OF THE VICTORIA ARCHAEOLOGICAL SURVEY 1976-1977	COUTTS, P.J.F.	1977
431	Desktop or Paper or Due Diligence or Other	PROBLEMS IN CONSTRUCTING A PREHISTORIC REGIONAL SEQUENCE: HOLOCENE SOUTH-EAST AUSTRALIA	BIRD, C. & FRANKEL, D.	1991
410	Site Specific Investigation (not excavation)	PREVIOUSLY UNRECORDED ABORIGINAL STONE ALIGNMENTS IN VICTORIA	LANE, L. & FULLAGAR, R.L.K.	1980
393	Desktop or Paper or Due Diligence or Other	THE ARCHAEOLOGY OF THE DISCOVERY BAY AREA, VICTORIA	WITTER, D.C.	1977
332	Desktop or Paper or Due Diligence or Other	CHRONOLOGY AND EXPLANATION IN WESTERN VICTORIA AND SOUTH-EAST SOUTH AUSTRALIA	BIRD, C. & FRANKEL, D.	1991
265	Desktop or Paper or Due Diligence or Other	IMPACT OF EUROPEAN SETTLEMENT ON ABORIGINAL SOCIETY IN WESTERN VICTORIA	COUTTS, P.J.F., WITTER, D.C. & PARSONS, D.M.	1977
227	Survey	AN ARCHAEOLOGICAL SURVEY IN S.W. VICTORIA: A REPORT TO THE KERRUP-JMARA COUNCIL OF ELDERS	ELLENDER, I.	1989
187	Desktop or Paper or Due Diligence or Other	PREHISTORY OF THE BASALT PLAINS	MULVANEY, D.J.	1964
165	Test Excavation	THE MOUND PEOPLE OF WESTERN VICTORIA: A PRELIMINARY STATEMENT	COUTTS, P.J.F., WITTER, D.C., MCILWRAITH, M. ET AL	1977
156	Desktop or Paper or Due Diligence or Other	A CLOSER LOOK AT CULTURAL CONTACT: SOME EVIDENCE FROM "YAMBUCK", WESTERN DISTRICT, VICTORIA	CRITCHETT, J.	1984

Appendix 4: Glossary

Adze A flake with stepped retouch along lateral margins that can be hafted for use as a tool.

Anvil A flat object on which a core was placed to flake material from. Anvils often have a small pit/groove, usually in the centre of the object, as a result of this action.

Archaeology The study of cultural remains from past cultures and generations.

Artefact Scatter The material remains of past Aboriginal peoples' activities. Usually contain stone artefacts, but other material may also be present, including charcoal, animal bone, shell and ochre. An artefact scatter is usually represented by a single stone flake or a concentration of flaked stone pieces (or fragments).

Assemblage A collection of artefacts that are derived from the same site.

Backed Blade Stone artefact associated with the Australian small tool tradition. They are characterised by unidirectional or bidirectional retouch found along a lateral margin, thought to be blunt for hafting (Holdaway & Stern 2004, p.260).

Basalt A fine-grained rock occurring from lava flows.

Bifacially Flaked Flakes removed from two faces of an object such as a core.

Blade A flake that is twice as long as it is wide.

Bondi Point An asymmetrical blade with a point at one end with backing retouch. Part of the Australian Small Tool Tradition.

Burial Human Remains, normally found as concentrations of human bones or teeth, exposed by erosion or earthworks. They are sometimes associated with charcoal or ochre, although shell, animal bone and stone tools may also be present. Tend to be located in soft soils and sand, although can occur in rock shelters, caves and dead trees.

Burin A truncated flake formed by snapping or retouching along one lateral margin that then forms a platform from which small flakes are removed forming a triangular scar that acts as a working edge (Holdaway & Stern 2004, p.241–243).

Ceramic A term used to identify wares made from either clay or fusible stone such as stoneware, earthenware, porcelain or terracotta (Davies & Buckley 1987, p.186).

Chert A compact, fine-grained rock made of crypto-crystalline silica and can occur in a variety of colours, usually red, green or black.

Core A specimen of rock that has undergone a process of reduction through the removal of a number of flakes and as a result they have negative flake scars. Cores can contain a single platform, have two platforms or have had flakes removed in multiple directions.

Cortex The original surface of a mineral or rock subjected to weathering by the elements.

Cultural Material Any material remains which are produced by human activity.

Debitage Detached pieces of stone that are discarded during the reduction process.

Dry Stone Wall A wall formed of a number of courses of rock (usually basalt or limestone) with no bond or binding component. Walls are usually tapered, have two faces and can have hearting (packing), or plugging.

Earthenware A non-vitreous (porous) whiteware, usually used for domestic tablewares. Most earthenware is glazed and decorated, transfer printed or left plain (Davies & Buckley 1987, p.186).

Earth Feature Collective term used to refer to mounds, rings, hearths, postholes and ovens.

Earth Mound Mounds generally appear as raised areas of darker soil. They are commonly found in the volcanic plains of western Victoria or on higher ground near water bodies. Mounds often contain charcoal, burnt clay or stone heat retainers from cooking ovens, animal bones, shells, stone tools and sometimes, Aboriginal burials.

Earth Ring Banked circles of soil often associated with stone arrangements, which had a ceremonial purpose for Aboriginal people in the past.

Excavation A controlled means of soil disturbance (digging) allowing for detailed recording of the soil profile, features and artefacts exposed.

Flake A stone artefact that contains characteristics such as the presence of a platform, bulb of percussion and termination which reveal that the stone has been struck from a core and is the result of stone working (Holdaway & Stern 2004, p.5).

Flake Core A flake that has subsequently been used as a core and had other flakes removed from it.

Flaked Piece Small fragments of stone that have been removed from flakes resulting from tool maintenance or tool production (Holdaway & Stern 2004, p.17). Flaked pieces do not display the characteristics evident in a complete flake.

Flint Similar to chert with a pale cortex and conchoidal fracture. Usually occurring in limestone (Roberts 1998, p.65).

Footing The structural base/footprint from structures often built from bluestone, brick or wooden posts.

Geometric Microlith Part of the Australian small tool tradition. They are symmetrical in form, pointed at both ends and can be backed along a lateral margin (Holdaway & Stern 2004, p.262).

Glaze A coating put over wares fired in a kiln. Glazes can come in a variety of colours and can also be transparent.

Greenstone A metamorphic rock derived from basalt containing feldspar and quartz and is made green by chlorite and epidote. Often used for the manufacture of hand axes.

Grindstone A flat slab of rock with central depression used to grind, crush or pound seeds, ochre, or sharpen tools, etc. Grindstones are usually made on sedimentary rocks with an abrasive surface and can be used in conjunction with a muller.

Ground Edge Axes A sharpening process – flaking, pecking and polishing, usually along a single lateral margin. The axes are generally hafted with the worked edge forming the tool edge.

Ground Surface Visibility The extent to which the natural soil surface below the vegetation on the ground is visible.

Hammerstone A hard rock or mineral used to flake fragments of stone from a core (Holdaway & Stern 2004, p.4).

Hearth The remains of a fireplace containing charcoal and sometimes burnt earth, bone, stone artefacts or other organic material.

In situ An artefact or feature that remains in its original position, or where it was left.

Manuport A stone block that displays no attributes of being either a core or a flake.

Microblade Has the same characteristics as a blade but just of smaller proportions (Holdaway & Stern 2004, p.17).

Ochre Earth varying in colour from yellow to red, used as a pigment.

Organic Compounds formed from living organisms (plants or animals).

Oven Mound Usually circular or oval in shape and often situated close to a water source. They were used for cooking and contain a rich greasy organic mix of soil and organic material. An oven mound is likely to contain charcoal, burnt clay or stone heat retainers, stone tools, bones, shell and on occasion, burials (AAV Mini Poster 4).

Platform The surface from which the flake was struck off the core – natural, flaked or abraded (Holdaway & Stern 2004, p.120).

Point A flake that has two edges that form a point with retouch along one or both lateral margins (Holdaway & Stern 2004, p.16).

Porcelain A non-porous ceramic with a glass-like appearance. Can be translucent, can be used for tableware or more decorative features such as ornaments.

Post-Contact The period after contact between Aboriginal people and Europeans.

Pre-Contact The period before contact between Aboriginal people and Europeans.

Quarry Outcrop of stone or ochre that has been quarried by Aboriginal people in the past. Generally associated with a large amount of broken stone and flakes. The outcrop (cores) bear negative scars from flaking.

Quartz A mineral that commonly occurs in sedimentary, igneous and metamorphic rocks. Quartz can come in a number of forms including crystal, rose, and smoky.

Quartzite A metamorphic rock formed by the re-crystallization of quartz. Quartz is rich in sandstone and limestone (Roberts 1998, p.109).

Retouch A worked edge or modification of a flake formed by removing a number of small flakes along an edge. This can be done as a form of maintenance or to produce a tool.

Rock Art Paintings created on the rock surfaces of caves and rock shelters and engravings in limestone caves. Artwork includes stencils, prints and drawings. The paint consists of ochres, clays and charcoal mixed with fats.

Scarred Tree A tree which has had a slab of bark removed, exposing the sapwood on the trunk or branch of a tree. Aboriginal people used the bark to make shelters, containers (coolamons) and canoes.

Scraper A flake with at least one edge that has continuous retouch. Scraper types include steep-edged, end, side and nose scraper (Holdaway & Stern 2004, p.16).

Shell Midden A surface and/or subsurface deposit composed of shell and sometimes stone artefacts, charcoal and bone. Middens are normally found in association with coastlines, rivers, creeks and swamps –

wherever coastal, riverine or estuarine shellfish resources were available and exploited.

Silcrete A fine-grained rock derived from shale or siltstone mixed with silica.

Spit A horizontal unit of soil removed during excavation. Spits can be arbitrary (dug to a depth of 50, 100, 200, 300mm, etc.) or can be confined to a particular soil type or context. The excavation of spits allows for greater understanding, analysis and interpretation of the soil profile.

Stone Feature Includes cairns, rock wells, stone arrangements, fish traps, stone structures and grinding grooves. May be a natural feature, which was used or modified to be used by Aboriginal people in the past (rock well, stone arrangement), or a stone feature which has been deliberately constructed for a specific purpose (fish trap, stone structure, cairn), or is the result of a specific activity carried out by Aboriginal people in the past (grinding grooves).

Stoneware A vitreous (non-porous) ceramic, usually light brown in colour, used for drinking containers or used industrially. Often glazed or unglazed (salt glaze or slip applied) (Davies & Buckley 1987, p.186).

Stratification The position of sediments and rocks in sequence throughout time.

Subsurface Testing A method of excavation that involves ground disturbing works to identify the potential for cultural material. Subsurface testing may comprise hand excavation and/or machine excavation.

Survey An inspection of land either by foot or by car (windscreen survey) noting conditions on surface visibility, landforms and the presence of cultural material.

Termination The shape of the distal end of a flake (Holdaway & Stern 2004, p.129).

Terracotta A low-fired clay (ceramic), usually orange to red in colour and very porous. Often used for plumbing (drainage components) or garden ware.

Tool Modified flakes usually with retouch present along an edge (Holdaway & Stern 2004, p.33).

Transect An excavated stretch of ground that can be of varying lengths in a straight line.

Transfer Printed A design is traced and engraved onto a copper plate on which ink and oil is then applied. The design is pressed onto tissue paper and then placed on an object and the paper removed. The object is then fired and glazed. Transfer printed ceramics come in a variety of colours and patterns and were mass produced.

Trench An area confined by excavation usually in the form of a square (e.g., 2x2m) or rectangular (e.g., 1.5x1m).

References

AAV Mini Posters (1–7).

Davies, M & Buckley, K 1987, *Port Arthur Conservation & Development Project: Archaeological Procedures Manual*, Occasional Paper No.13. Department of Lands, Parks and Wildlife, Tasmania.

Holdaway, S & Stern, N 2004, *A Record in Stone: The Study of Australia's Flaked Stone Artefacts*, Museum Victoria and Aboriginal Studies Press, Melbourne.

Roberts, JL, 1998, *A Photographic Guide to Minerals, Rocks and Fossils*, New Holland, London.

Appendix 5: General Residential Zone – Schedule 1, Planning Scheme

VICTORIA PLANNING PROVISIONS

32.08 GENERAL RESIDENTIAL ZONE

31/07/2018
VC148

Shown on the planning scheme map as **GRZ**, **R1Z**, **R2Z** or **R3Z** with a number (if shown).

Purpose

To implement the Municipal Planning Strategy and the Planning Policy Framework.

To encourage development that respects 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.

32.08-1 Neighbourhood character objectives

27/03/2017
VC110

A schedule to this zone may contain neighbourhood character objectives to be achieved for the area.

32.08-2 Table of uses

08/08/2019
VC159

Section 1 - Permit not required

Use	Condition
Bed and breakfast	No more than 10 persons may be accommodated away from their normal place of residence. At least 1 car parking space must be provided for each 2 persons able to be accommodated away from their normal place of residence.
Community care accommodation	Must meet the requirements of Clause 52.22-2.
Dependent person's unit	Must be the only dependent person's unit on the lot.
Domestic animal husbandry (other than Domestic animal boarding)	Must be no more than 2 animals.
Dwelling (other than Bed and breakfast) **Home based business** **Informal outdoor recreation**	
Medical centre	The gross floor area of all buildings must not exceed 250 square metres. Must not require a permit under Clause 52.06-3. The site must adjoin, or have access to, a road in a Road Zone.
Place of worship	The gross floor area of all buildings must not exceed 250 square metres. The site must adjoin, or have access to, a road in a Road Zone.
Racing dog husbandry	Must be no more than 2 animals.
Railway	

Page 1 of 11

VICTORIA PLANNING PROVISIONS

Use	Condition
Residential aged care facility	
Rooming house	Must meet the requirements of Clause 52.23-2.
Tramway	
Any use listed in Clause 62.01	Must meet the requirements of Clause 62.01.

Section 2 - Permit required

Use	Condition
Accommodation (other than Community care accommodation, Dependent person's unit, Dwelling, Residential aged care facility and Rooming house) **Agriculture (other than Animal production, Animal training, Apiculture, Domestic animal husbandry, Horse husbandry and Racing dog husbandry)**	
Car park	Must be used in conjunction with another use in Section 1 or 2.
Car wash	The site must adjoin, or have access to, a road in a Road Zone.
Convenience restaurant	The site must adjoin, or have access to, a road in a Road Zone.
Convenience shop	
Domestic animal husbandry (other than Domestic animal boarding) – if the Section 1 condition is not met	Must be no more than 5 animals.
Food and drink premises (other than Convenience restaurant and Take away food premises) **Grazing animal production** **Leisure and recreation (other than Informal outdoor recreation and Motor racing track)** **Market** **Place of assembly (other than Amusement parlour, Carnival, Cinema based entertainment facility, Circus, Nightclub and Place of worship)** **Plant nursery**	
Service station	The site must either: ▪ Adjoin a commercial zone or industrial zone. ▪ Adjoin, or have access to, a road in a Road Zone. The site must not exceed either:

Page 2 of 11

VICTORIA PLANNING PROVISIONS

Use	Condition
	▪ 3000 square metres. ▪ 3600 square metres if it adjoins on two boundaries a road in a Road Zone.
Store	Must be in a building, not a dwelling, and used to store equipment, goods, or motor vehicles used in conjunction with the occupation of a resident of a dwelling on the lot.
Take away food premises	The site must adjoin, or have access to, a road in a Road Zone.
Utility installation (other than Minor utility installation and Telecommunications facility)	
Any other use not in Section 1 or 3	

Section 3 – Prohibited

Use
Amusement parlour
Animal production (other than Grazing animal production)
Animal training
Brothel
Cinema based entertainment facility
Domestic animal boarding
Horse husbandry
Industry (other than Car wash)
Motor racing track
Nightclub
Office (other than Medical centre)
Retail premises (other than Convenience shop, Food and drink premises, Market, and Plant nursery)
Saleyard
Stone extraction
Transport terminal
Warehouse (other than Store)

32.08-3
31/07/2018
VC148

Subdivision

Permit requirement

A permit is required to subdivide land.

An application to subdivide land that would create a vacant lot less than 400 square metres capable of development for a dwelling or residential building, must ensure that each vacant lot created less than 400 square metres contains at least 25 percent as garden area. This does not apply to a lot created by an application to subdivide land where that lot is created in accordance with:

Page 3 of 11

- An approved precinct structure plan or an equivalent strategic plan;
- An incorporated plan or approved development plan; or
- A permit for development.

An application to subdivide land, other than an application to subdivide land into lots each containing an existing dwelling or car parking space, must meet the requirements of Clause 56 and:

- Must meet all of the objectives included in the clauses specified in the following table.
- Should meet all of the standards included in the clauses specified in the following table.

Class of subdivision	Objectives and standards to be met
60 or more lots	All except Clause 56.03-5.
16 – 59 lots	All except Clauses 56.03-1 to 56.03-3, 56.03-5, 56.06-1 and 56.06-3.
3 – 15 lots	All except Clauses 56.02-1, 56.03-1 to 56.03-4, 56.05-2, 56.06-1, 56.06-3 and 56.06-6.
2 lots	Clauses 56.03-5, 56.04-2, 56.04-3, 56.04-5, 56.06-8 to 56.09-2.

VicSmart applications

Subject to Clause 71.06, an application under this clause for a development specified in Column 1 is a class of VicSmart application and must be assessed against the provision specified in Column 2.

Class of application	Information requirements and decision guidelines
Subdivide land to realign the common boundary between 2 lots where: ▪ The area of either lot is reduced by less than 15 percent. ▪ The general direction of the common boundary does not change.	Clause 59.01
Subdivide land into lots each containing an existing building or car parking space where: ▪ The buildings or car parking spaces have been constructed in accordance with the provisions of this scheme or a permit issued under this scheme. ▪ An occupancy permit or a certificate of final inspection has been issued under the Building Regulations in relation to the buildings within 5 years prior to the application for a permit for subdivision.	Clause 59.02
Subdivide land into 2 lots if: ▪ The construction of a building or the construction or carrying out of works on the land: – Has been approved under this scheme or by a permit issued under this scheme and the permit has not expired. – Has started lawfully. ▪ The subdivision does not create a vacant lot.	Clause 59.02

32.08-4 Construction or extension of a dwelling or residential building

15/05/2018
VC143

Minimum garden area requirement

An application to construct or extend a dwelling or residential building on a lot must provide a minimum garden area as set out in the following table:

Lot size	Minimum percentage of a lot set aside as garden area
400 - 500 sqm	25%
Above 500 - 650 sqm	30%
Above 650 sqm	35%

This does not apply to:

- An application to construct or extend a dwelling or residential building if specified in a schedule to this zone as exempt from the minimum garden area requirement;
- An application to construct or extend a dwelling or residential building on a lot if:
  - The lot is designated as a medium density housing site in an approved precinct structure plan or an approved equivalent strategic plan;
  - The lot is designated as a medium density housing site in an incorporated plan or approved development plan; or
- An application to alter or extend an existing building that did not comply with the minimum garden area requirement of Clause 32.08-4 on the approval date of Amendment VC110.

32.08-5 Construction and extension of one dwelling on a lot

31/07/2018
VC148

Permit requirement

A permit is required to construct or extend one dwelling on:

- A lot of less than 300 square metres.
- A lot of between 300 square metres and 500 square metres if specified in a schedule to this zone.

A permit is required to construct or extend a front fence within 3 metres of a street if:

- The fence is associated with one dwelling on:
  - A lot of less than 300 square metres, or
  - A lot of between 300 and 500 square metres if specified in a schedule to this zone, and
- The fence exceeds the maximum height specified in Clause 54.06-2.

A development must meet the requirements of Clause 54.

No permit required

No permit is required to:

- Construct or carry out works normal to a dwelling.
- Construct or extend an out-building (other than a garage or carport) on a lot provided the gross floor area of the out-building does not exceed 10 square metres and the maximum building height is not more than 3 metres above ground level.
- Make structural changes to a dwelling provided the size of the dwelling is not increased or the number of dwellings is not increased.

VicSmart applications

Subject to Clause 71.06, an application under this clause for a development specified in Column 1 is a class of VicSmart application and must be assessed against the provision specified in Column 2.

Class of application	Information requirements and decision guidelines
Construct an outbuilding or extend a dwelling if the development: Meets the minimum garden area requirement of Clause 32.08-4. ▪ Does not exceed a building height of 5 metres. ▪ Is not visible from the street (other than a lane) or a public park. ▪ Meets the requirements in the following standards of Clause 54: – A10 Side and rear setbacks. – A11 Walls on boundaries. – A12 Daylight to existing windows. – A13 North-facing windows. – A14 Overshadowing open space. – A15 Overlooking. For the purposes of this class of VicSmart application, the Clause 54 standards specified above are mandatory. If a schedule to the zone specifies a requirement of a standard different from a requirement set out in the Clause 54 standard, the requirement in the schedule to the zone applies and must be met.	Clause 59.14
Construct or extend a front fence within 3 metres of a street if the fence is associated with one dwelling.	Clause 59.03

32.08-6
31/07/2018
VC148

Construction and extension of two or more dwellings on a lot, dwellings on common property and residential buildings

Permit requirement

A permit is required to:

- Construct a dwelling if there is at least one dwelling existing on the lot.
- Construct two or more dwellings on a lot.
- Extend a dwelling if there are two or more dwellings on the lot.
- Construct or extend a dwelling if it is on common property.
- Construct or extend a residential building.

A permit is required to construct or extend a front fence within 3 metres of a street if:

- The fence is associated with 2 or more dwellings on a lot or a residential building, and
- The fence exceeds the maximum height specified in Clause 55.06-2.

A development must meet the requirements of Clause 55. This does not apply to a development of five or more storeys, excluding a basement.

An apartment development of five or more storeys, excluding a basement, must meet the requirements of Clause 58.

A permit is not required to construct one dependent person's unit on a lot.

VicSmart applications

Subject to Clause 71.06, an application under this clause for a development specified in Column 1 is a class of VicSmart application and must be assessed against the provision specified in Column 2.

Class of application	Information requirements and decision guidelines
Construct or extend a front fence within 3 metres of a street if the fence is associated with 2 or more dwellings on a lot or a residential building.	Clause 59.03

Transitional provisions

Clause 55 of this scheme, as in force immediately before the approval date of Amendment VC136, continues to apply to:

- An application for a planning permit lodged before that date.
- An application for an amendment of a permit under section 72 of the Act, if the original permit application was lodged before that date.

Clause 58 does not apply to:

- An application for a planning permit lodged before the approval date of Amendment VC136.
- An application for an amendment of a permit under section 72 of the Act, if the original permit application was lodged before the approval date of Amendment VC136.

32.08-7 Requirements of Clause 54 and Clause 55

27/03/2017
VC110

A schedule to this zone may specify the requirements of:

- Standards A3, A5, A6, A10, A11, A17 and A20 of Clause 54 of this scheme.
- Standards B6, B8, B9, B13, B17, B18, B28 and B32 of Clause 55 of this scheme.

If a requirement is not specified in a schedule to this zone, the requirement set out in the relevant standard of Clause 54 or Clause 55 applies.

32.08-8 Residential aged care facility

26/10/2018
VC152

Permit requirements

A permit is required to construct a building or construct or carry out works for a residential aged care facility.

A development must meet the requirements of Clause 53.17 - Residential aged care facility.

32.08-9 Buildings and works associated with a Section 2 use

26/10/2018
VC152

A permit is required to construct a building or construct or carry out works for a use in Section 2 of Clause 32.08-2.

VicSmart applications

Subject to Clause 71.06, an application under this clause for a development specified in Column 1 is a class of VicSmart application and must be assessed against the provision specified in Column 2.

Class of application	Information requirements and decision guidelines
Construct a building or construct or carry out works with an estimated cost of up to $100,000 where: ▪ The building or works is not associated with a dwelling. ▪ The requirements in the following standards of Clause 54 are met, where the land adjoins land in a residential zone used for residential purposes: – A10 Side and rear setbacks. – A11 Walls on boundaries. – A12 Daylight to existing windows. – A13 North-facing windows. – A14 Overshadowing open space. – A15 Overlooking. For the purposes of this class of VicSmart application, the Clause 54 standards specified above are mandatory. If a schedule to the zone specifies a requirement of a standard different from a requirement set out in the Clause 54 standard, the requirement in the schedule to the zone applies and must be met.	Clause 59.04

32.08-10
26/10/2018
VC152

Maximum building height requirement for a dwelling or residential building

A building must not be constructed for use as a dwelling or a residential building that:

- exceeds the maximum building height specified in a schedule to this zone; or
- contains more than the maximum number of storeys specified in a schedule to this zone.

If no maximum building height or maximum number of storeys is specified in a schedule to this zone:

- the building height must not exceed 11 metres; and
- the building must contain no more than 3 storeys at any point.

A building may exceed the applicable maximum building height or contain more than the applicable maximum number of storeys if:

- It replaces an immediately pre-existing building and the new building does not exceed the building height or contain a greater number of storeys than the pre-existing building.
- There are existing buildings on both abutting allotments that face the same street and the new building does not exceed the building height or contain a greater number of storeys than the lower of the existing buildings on the abutting allotments.

- It is on a corner lot abutted by lots with existing buildings and the new building does not exceed the building height or contain a greater number of storeys than the lower of the existing buildings on the abutting allotments.
- It is constructed pursuant to a valid building permit that was in effect prior to the introduction of this provision.

An extension to an existing building may exceed the applicable maximum building height or contain more than the applicable maximum number of storeys if it does not exceed the building height of the existing building or contain a greater number of storeys than the existing building.

A building may exceed the maximum building height by up to 1 metre if the slope of the natural ground level, measured at any cross section of the site of the building wider than 8 metres, is greater than 2.5 degrees.

A basement is not a storey for the purposes of calculating the number of storeys contained in a building.

The maximum building height and maximum number of storeys requirements in this zone or a schedule to this zone apply whether or not a planning permit is required for the construction of a building.

Building height if land is subject to inundation

If the land is in a Special Building Overlay, Land Subject to Inundation Overlay or is land liable to inundation the maximum building height specified in the zone or schedule to the zone is the vertical distance from the minimum floor level determined by the relevant drainage authority or floodplain management authority to the roof or parapet at any point.

32.08-11 **Application requirements**

26/10/2018
VC152

An application must be accompanied by the following information, as appropriate:

- For a residential development of four storeys or less, the neighbourhood and site description and design response as required in Clause 54 and Clause 55.
- For an apartment development of five or more storeys, an urban context report and design response as required in Clause 58.01.
- For an application for subdivision, a site and context description and design response as required in Clause 56.
- Plans drawn to scale and dimensioned which 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.
- The likely effects, if any, on adjoining land, including noise levels, traffic, the hours of delivery and despatch of good and materials, hours of operation and light spill, solar access and glare.
- Any other application requirements specified in a schedule to this zone.

If in the opinion of the responsible authority an application requirement is not relevant to the evaluation of an application, the responsible authority may waive or reduce the requirement.

32.08-12 Exemption from notice and review

26/10/2018
VC152

Subdivision

An application to subdivide land into lots each containing an existing dwelling or car parking space is exempt from the notice requirements of section 52(1)(a), (b) and (d), the decision requirements of section 64(1), (2) and (3) and the review rights of section 82(1) of the Act.

32.08-13 Decision guidelines

26/10/2018
VC152

Before deciding on an application, in addition to the decision guidelines in Clause 65, the responsible authority must consider, as appropriate:

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 facilities 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.

Dwellings and residential buildings

- For the construction and extension of one dwelling on a lot, the objectives, standards and decision guidelines of Clause 54.
- For the construction and extension of two or more dwellings on a lot, dwellings on common property and residential buildings, the objectives, standards and decision guidelines of Clause 55. This does not apply to an apartment development of five or more storeys, excluding a basement.
- For the construction and extension of an apartment development of five or more storeys, excluding a basement, the objectives, standards and decisions guidelines of Clause 58.

Non-residential use and development

- Whether the use or development is compatible with residential use.
- Whether the use generally serves local community needs.
- The scale and intensity of the use and development.
- The design, height, setback and appearance of the proposed buildings and works.
- The proposed landscaping.
- The provision of car and bicycle parking and associated accessways.
- Any proposed loading and refuse collection facilities.
- The safety, efficiency and amenity effects of traffic to be generated by the proposal.

32.08-14 Signs

26/10/2018
VC152

Sign requirements are at Clause 52.05. This zone is in Category 3.

32.08-15 **Transitional provisions**

26/10/2018
VC152

The minimum garden area requirements of Clause 32.08-4 and the maximum building height and number of storeys requirements of Clause 32.08-9 introduced by Amendment VC110 do not apply to:

- A planning permit application for the construction or extension of a dwelling or residential building lodged before the approval date of Amendment VC110.
- Where a planning permit is not required for the construction or extension of a dwelling or residential building:
  - A building permit issued for the construction or extension of a dwelling or residential building before the approval date of Amendment VC110.
  - A building surveyor has been appointed to issue a building permit for the construction or extension of a dwelling or residential building before the approval date of Amendment VC110. A building permit must be issued within 12 months of the approval date of Amendment VC110.
  - A building surveyor is satisfied, and certifies in writing, that substantial progress was made on the design of the construction or extension of a dwelling or residential building before the approval date of Amendment VC110. A building permit must be issued within 12 months of the approval date of Amendment VC110.

The minimum garden area requirement of Clause 32.08-3 introduced by Amendment VC110 does not apply to a planning permit application to subdivide land for a dwelling or a residential building lodged before the approval date of Amendment VC110.

MOYNE PLANNING SCHEME

13/06/2014 C59

SCHEDULE 1 TO CLAUSE 32.08 GENERAL RESIDENTIAL ZONE

Shown on the planning scheme map as **GRZ1**.

MOYNE GENERAL RESIDENTIAL AREAS

1.0 Permit requirement for the construction or extension of one dwelling on a lot

13/06/2014 C59

Is a permit required to construct or extend one dwelling on a lot of between 300 square metres and 500 square metres?
None specified

2.0 Requirements of Clause 54 and Clause 55

13/06/2014 C59

	Standard	Requirement
Minimum street setback	A3 and B6	None specified
Site coverage	A5 and B8	None specified
Permeability	A6 and B9	None specified
Landscaping	B13	None specified
Side and rear setbacks	A10 and B17	None specified
Walls on boundaries	A11 and B18	None specified
Private open space	A17	None specified
	B28	None specified
Front fence height	A20 and B32	None specified

3.0 Maximum building height requirement for a dwelling or residential building

13/06/2014 C59

None specified.

4.0 Application requirements

13/06/2014 C59

None specified.

5.0 Decision guidelines

13/06/2014 C59

None specified.

Page 1 of 1

Bushfire Development Report

for the development of a
staged subdivision at
147 Wollaston Road
Warrnambool VIC 3280

Report prepared for
Wollaston Road Developments Pty Ltd

November 2022

WWW.TERRAMATRIX.COM.AU

Terramatrix project code: WollastonRoadDevelopmentsPtyLtd-2022-01 DD_BPA-Warrnambool
Cover image: Looking north over the site.

Accountability

Stage	Date completed	Name	Title
Desktop assessment	2022-07-04	John Eastwood	Senior Analyst
Analysis & report preparation	2022-07-06	John Eastwood	Senior Analyst
Peer review	2022-07-07	Jon Boura	Managing Director
Update	2022-07-22	John Eastwood	Senior Analyst

Version Control

Version	Date issued	Comments	Issued by
1.0	2022-07-07	Bushfire Development Report (BDR) to client	John Eastwood
2.0	2022-11-02	Update to new features	John Eastwood

Terramatrix Pty. Ltd.
ACN 129 163 373
ABN 44 129 163 373
PO Box 1391
Collingwood VIC 3066
P: 03 9417 2626
www.terramatrix.com.au

Contents

1 Introduction

This Bushfire Development Report (BDR) has been prepared for Wollaston Road Developments Pty Ltd, to assess how the proposed development of a possible retirement village and residential subdivision at 147 Wollaston Road, Warrnambool VIC 3280 can respond to the bushfire risk and the applicable Victorian planning and building controls that relate to bushfire, in particular the objective and applicable strategies of the Planning Policy Framework (PPF) at Clause 13.02-1S *Bushfire planning* in the Victoria Planning Provisions (Warrnambool Planning Scheme, 2018a).

This report will inform the development plan to subdivide the north-eastern part of the land for subsequent residential development and develop a retirement village in the north-western part. The site is currently vacant and is in a designated Bushfire Prone Area (BPA). BPAs are those areas subject to or likely to be subject to bushfires, as determined by the Minister for Planning.

Higher hazard land within a BPA, which may be subject to extreme bushfire behaviour, is covered by the Bushfire Management Overlay (BMO). The nearest areas covered by the BMO are approximately 3.7kms to the east and south-west.

This report assesses the bushfire hazard and identifies how the proposed development can appropriately mitigate any bushfire risk and respond to and comply with the applicable bushfire planning and building controls. These are:

- Clause 13.02-1S *Bushfire Planning*, which is the State planning policy for bushfire. The development proposal needs to show that it meets the objective and applicable strategies of the policy.
- The Building Act 1993 and associated Building Regulations 2018, which require bushfire protection standards in designated BPAs, for class 1, 2 and 3 buildings, 'Specific Use Bushfire Protected Buildings' and associated class 10a buildings or decks.

This report has been prepared in accordance with guidance for the assessment of, and response to, bushfire risk, provided in:

- *Bushfire State Planning Policy Amendment VC140*, Planning Advisory Note 68 (DELWP, 2018);
- *Local planning for bushfire protection*, Planning Practice Note 64 (DELWP, 2015a);
- *Planning Permit Applications Bushfire Management Overlay* Technical Guide (DELWP, 2017);
- *Design guidelines for settlement planning at the bushfire interface* (DELWP, 2020a); and
- AS 3959-2018 *Construction of buildings in bushfire prone areas* (Standards Australia, 2020).

2 Overview of site

The site comprises a large vacant lot north of the progressively developing urban areas of Warrnambool in the City of Warrnambool local government area (see Figure 1). The site is in the south-eastern corner of the North of Merri River Structure Plan (Mesh, 2011).

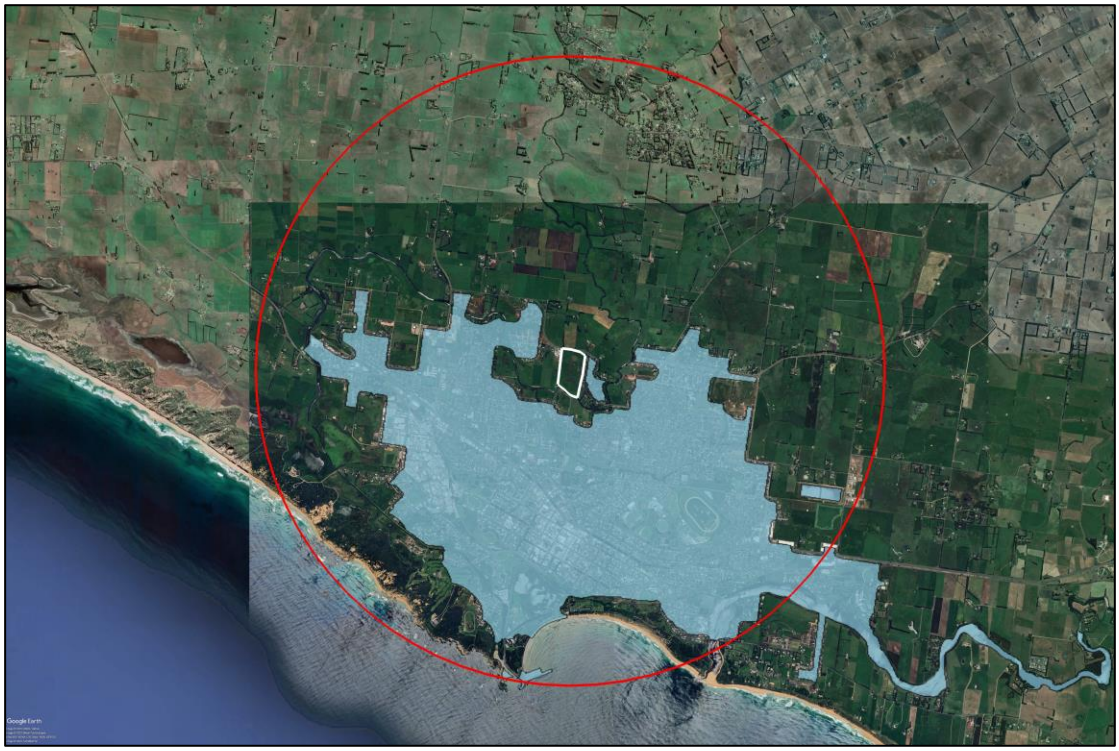


Figure 1 – 147 Wollaston Road area (site shown in white outline, 5km buffer in red outline) non-BPA land is shown in teal shading (2022 Google Earth).

2.1 Proposed development

The development proposal is for the staged multi-lot subdivision of the eastern part of the site with subsequent residential development, and the development of a retirement village in the western part. The site is in the currently undeveloped pastoral area to the north Warrnambool, to the south of Wollaston Road and north of Merri River. The southern part of the site is affected by the Urban Floodway Zone (and Schedule) (UFZ) and will comprise open space (see Figure 2) to be managed by Council in the future.

The proposed subdivision layout and road network will provide a single access/egress point to Wollaston Road, with the possibility of a future accessway across Merri River to the south (see Figure 2).

Figure 2 – 147 Wollaston Road master plan (Beveridge Williams, 2022).

3 Bushfire planning and building controls

This section identifies the applicable planning and building controls that relate to bushfire.

3.1 Clause 13.01-1S Natural hazards and climate change

The objective of this Clause is to minimise the impacts of natural hazards and adapt to the impacts of climate change through risk-based planning. Specified strategies to achieve the objective are:

- '*Consider the risks associated with climate change in planning and management decision making processes.*
- *Identify at risk areas using the best available data and climate change science.*
- *Integrate strategic land use planning with emergency management decision making.*
- *Direct population growth and development to low risk locations.*
- *Develop adaptation response strategies for existing settlements in risk areas to accommodate change over time.*
- *Ensure planning controls allow for risk mitigation or risk adaptation strategies to be implemented.*
- *Site and design development to minimise risk to life, property, the natural environment and community infrastructure from natural hazards*' (Warrnambool Planning Scheme, 2018b).

Especially in southern and eastern Australia, since the 1950's there has been an increase in the length of the fire weather season and a greater number of higher risk days associated with climate change (CSIRO/BOM, 2020). The Australasian Fire and Emergency Service Authorities Council (AFAC) identify that a failure of building codes and land use planning to adequately adapt to climate change is a significant risk (AFAC, 2018).

This Clause supports the adoption of a precautionary approach to the identification and mitigation of bushfire risk.

3.2 Clause 13.02-1S Bushfire Planning

Clause 13.02-1S has the objective '*To strengthen the resilience of settlements and communities to bushfire through risk based planning that prioritises the protection of human life*' (Warrnambool Planning Scheme, 2018a). The policy must be applied to all planning and decision making under the Planning and Environment Act 1987, relating to land which is:

- Within a designated BPA;
- Subject to a BMO; or
- Proposed to be used or developed in a way that may create a bushfire hazard.

Clause 13.02-1S requires priority to be given to the protection of human life by:

- *'Prioritising the protection of human life over all other policy considerations.*
- *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.*

- *Reducing the vulnerability of communities to bushfire through consideration of bushfire risk in decision-making at all stages of the planning process'* (Warrnambool Planning Scheme, 2018a).

Key strategies are stipulated in Clause 13.02-1S, which require that strategic planning documents, planning scheme amendments and development plan approvals properly assess bushfire risk and include appropriate bushfire protection measures. This also applies to planning permit applications for:

- Subdivisions of more than 10 lots;
- Accommodation;
- Childcare centre;
- Education centre;
- Emergency services facility;
- Hospital;
- Indoor recreation facility;
- Major sports and recreation facility;
- Place of assembly; and
- Any application for development that will result in people congregating in large numbers.

Development should not be approved 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*' (Warrnambool Planning Scheme, 2018a).

This study assesses the bushfire hazard and identifies the bushfire protection measures that will be required for future development of the site. It is considered that development can appropriately prioritise the protection of human life and meet the objectives of Clause 13.02-1S by ensuring compliance with the applicable bushfire planning and building controls.

A response to the applicable strategies of Clause 13.02-1S is provided in Section 7 of this report.

3.3 Clause 71.02-3 Integrated Decision Making

Clause 71.02-3 states that planning and responsible authorities should endeavour to integrate policies and balance conflicting objectives in favour of net community benefit and sustainable development. However, in bushfire affected areas, the protection of human life must be prioritised over all other policy considerations (Warrnambool Planning Scheme, 2018c).

3.4 Bushfire Prone Area (BPA)

The site is in a BPA (see Figure 3). BPAs are those areas subject to or likely to be subject to bushfire, as determined by the Minister for Planning. Those areas of highest bushfire risk within the BPA are designated as BMO areas, which does not apply to the site or any land for 3.5km.

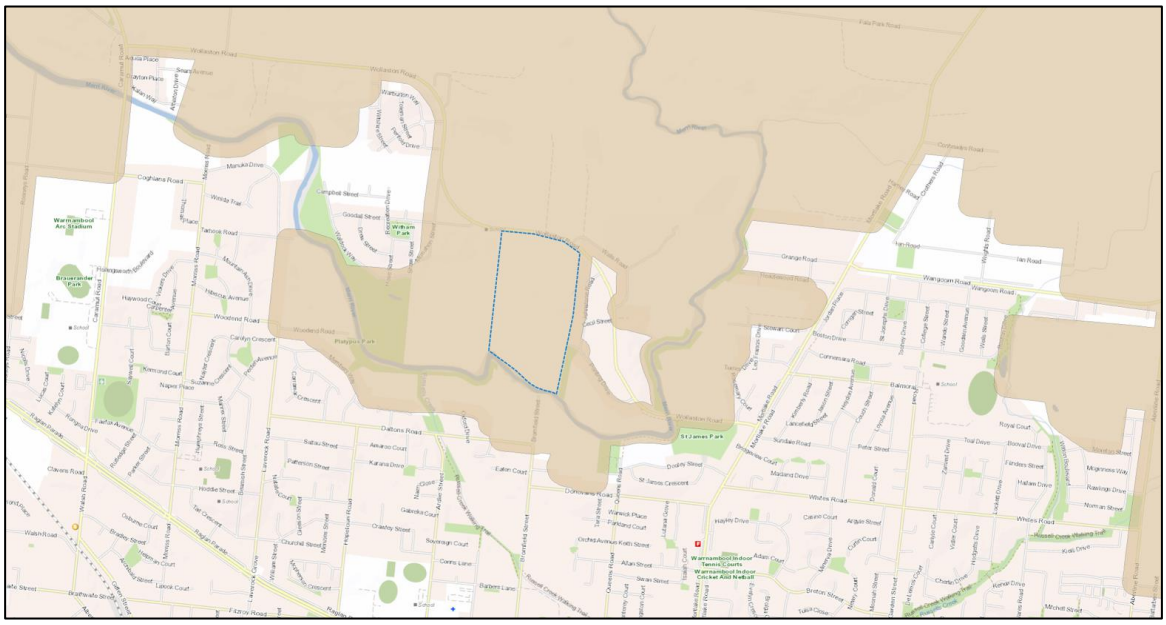


Figure 3 - BPA (brown shading) coverage of the site (highlighted in blue outline) and surrounds.

In a BPA, the Building Act 1993 and associated Building Regulations 2018, through application of the National Construction Code (NCC), require bushfire protection standards for class 1, 2 and 3[1] buildings, 'Specific Use Bushfire Protected Buildings'[2] and associated class 10A buildings[3] or decks. The applicable performance requirement in the NCC is:

> *'A building that is constructed in a designated bushfire prone area must, to the degree necessary, be designed and constructed to reduce the risk of ignition from a bushfire, appropriate to the —*
>
> *(a) potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire; and*
>
> *(b) intensity of the bushfire attack on the building'* (ABCB, 2020).

Compliance with *AS 3959-2018 Construction of buildings in bushfire prone areas* is 'deemed-to-satisfy' the performance requirement (ABCB, 2020). For Class 1 buildings and associated Class10a buildings or decks, the *NASH Standard – Steel Framed Construction in Bushfire Areas* is also deemed to satisfy the requirement (NASH, 2021).

The Victorian building regulations require that applicable buildings be constructed to a minimum Bushfire Attack Level (BAL)-12.5, or higher, as determined by a site assessment or planning scheme requirement. A BAL is a means of measuring the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact. There are six BALs defined in AS 3959-2018, which range from BAL-LOW, which has no bushfire construction requirements, to BAL-FZ (Flame Zone) where flame contact with a building is expected (see Appendix A).

[1] Class 1, 2 and 3 buildings are defined in the Building Code of Australia (BCA), and are generally those used for residential accommodation, including houses and other dwellings, apartments, hotels and other buildings with a similar function or use.

[2] Specific Use Bushfire Protected Buildings are defined in the Victorian *Building Regulations 2018,* they generally comprise 'vulnerable' uses and include schools, kindergartens, childcare facilities, aged care facilities and hospitals.

[3] Class 10a buildings are defined in the BCA as non-habitable buildings including sheds, carports, and private garages.

Larger developments and certain vulnerable uses in a BPA (see Section 3.2) are also required by Clause 13.02-1S *Bushfire planning* to:

- *'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'* (Warrnambool Planning Scheme, 2018a).

DELWP review and excise areas from the BPA approximately every 6 months, particularly in growth areas where the hazard is removed as urban development occurs. Land becomes eligible for excision if it satisfies statewide hazard mapping criteria, including that the land needs to be:

- At least 300m from areas of classified vegetation (except grassland) larger than 4ha in size; and
- At least 150m from areas of classified vegetation (except grassland) 2 to 4ha in size; and
- At least 60m from areas of unmanaged grassland more than 2ha in size (DELWP, 2015b).

For isolated areas of vegetation greater than 1ha but less than 2ha, the shape of the area and connectivity to any other hazardous vegetation is a further consideration (DELWP, 2015b).

There are no obstacles to future development of the site complying with the applicable strategies at Clause 13.02-1S and the building regulations invoked by the BPA coverage (see Sections 6 and 7). Following development, parts of the site will be eligible for excision from the BPA.

3.5 Other controls

3.5.1 Zoning

The site is in the General Residential Zone and Schedule 1 (GRZ1) and Urban Floodway Zone and Schedule (UFZ). Neither zoning or Schedule has bushfire planning implications for the site, although the UFZ does mean that a large undeveloped area within the site will remain – this area will become open space and be managed by Council.

3.5.2 Overlays

The site is covered by the Development Plan Overlay and Schedule 10 (DPO10), which calls for the preparation of a Development Plan. The site is also covered by the Development Contributions Plan Overlay - Schedule 1 (DCPO1) and the Environmental Significance Overlay and Schedule 2 (ESO2), neither of which have bushfire planning implications for the site. The Floodway Overlay and Schedule (FO) over the southern part of the site will see the retention of an undeveloped area within the site, which will form the future open space to be managed by Council. Parts of the open space will need to be managed in a low threat state to provide setbacks for dwellings built to a BAL-12.5 construction standard.

4 North of Merri River Structure Plan

The site is in the North of Merri River Structure Plan (Mesh, 2011). The structure plan does not identify bushfire as an issue and no bushfire protection measures are stipulated. The arrangement of different land uses proposed for the precinct, as shown in the structure plan, is shown here at Figure 4. The site and the land to the north is identified as 'Standard density residential'.

The structure plan identifies a road through the site (shown as black line on Figure 4) that will be provided for in the development plan on an alternative alignment (see Figure 2).

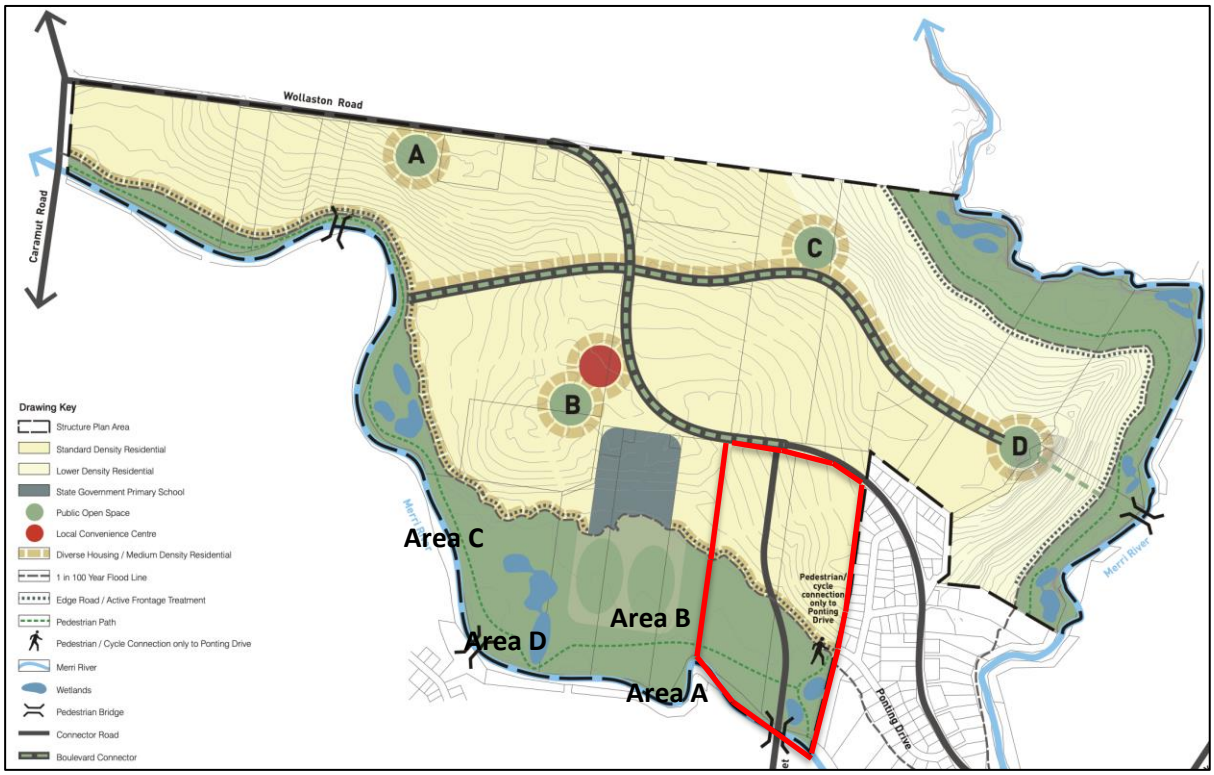


Figure 4 – Site and surrounds as shown in North of Merri River Structure Plan (Mesh, 2011), with approximate site boundary highlighted in red.

4.1 Regional bushfire risk assessments and plans

Regional Bushfire Planning Assessment (RBPA) Barwon South-west Region

As part of the response to the 2009 Victorian Bushfires Royal Commission, Regional Bushfire Planning Assessments (RBPAs) were undertaken across six regions that covered the whole of Victoria. The RBPAs provide information about 'identified areas' where a range of land use planning matters intersect with a bushfire hazard to influence the level of risk to life and property from bushfire. The RBPAs state that '*This information should be addressed as part of strategic land use and settlement planning at the regional, municipal and local levels'* (DPCD, 2012).

The *Regional Bushfire Planning Assessment – Barwon South-west Region* covers the City of Warrnambool LGA. It does not identify any bushfire matters of concern in or around the site, although the Merri River environs are identified:
'*The watercourse contains patches of riparian vegetation surrounded by grassland environments. Surrounding developed and undeveloped lots are in or in proximity to vegetated bushfire hazard areas'* (DPCD, 2012).

The vegetation in the Merri River environs is not considered to be a significant bushfire risk to the site and can be addressed through the management of vegetation within the site and appropriate BAL construction standards. The southern part of the site will form open space which will be managed by Council, including areas required to be managed in a low threat state to provide setbacks for the nearby dwellings built to a BAL-12.5 construction standard. This is consistent with the DELWP settlement interface guidelines recommending low threat public open space on the bushfire interface (DELWP, 2020).

Warrnambool Municipal Fire Management Plan (MFMP)

The Warrnambool MFMP addresses a range of risk environments, including fires in residential, commercial and industrial environments, bushfires and hazardous material environments across the Warrnambool municipality and lists a wide range of programs to address these risks (Warrnambool City Council, 2015).

The MFMP does not identify a requirement for specific bushfire protection actions in the Wollaston Road area.

Safer Together – Strategic Bushfire Management Planning

The Safer Together program is an approach to reducing the risk of bushfire in Victoria. Strategic bushfire management planning is jointly delivered by Forest Fire Management Victoria (FFMVic), Country Fire Authority (CFA), Emergency Management Victoria (EMV) and local government in consultation with communities (DELWP, 2020).

Fuel management focused strategies have been developed for six regions, with region-specific strategies applied in response to the identified bushfire risk (see Figure 5 and Figure 6). The 147 Wollaston Road site is in the easternmost part of the Barwon South-West – Far South-West region.

The Warrnambool area is not in a Bushfire Risk Engagement Area (which are areas in which managing bushfire fuels is most effective in reducing risk). The low risk of the site (see Figure 5), and that no need has been identified for fuel management in the surrounding landscape (see Figure 6), contribute to the proposed development of the site being appropriate.

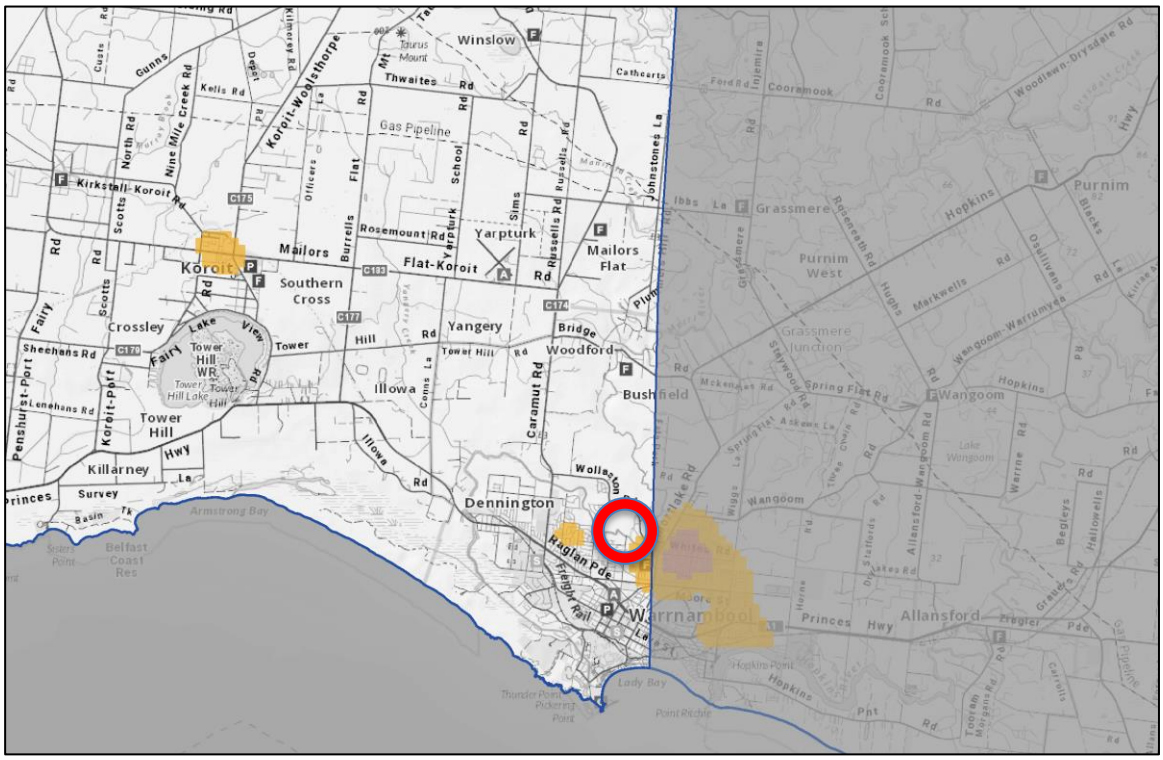


Figure 5 – Risk of house loss (orange is low-intermediate risk, purple the highest risk) (FFMV, 2021) with the site indicated by red circle.

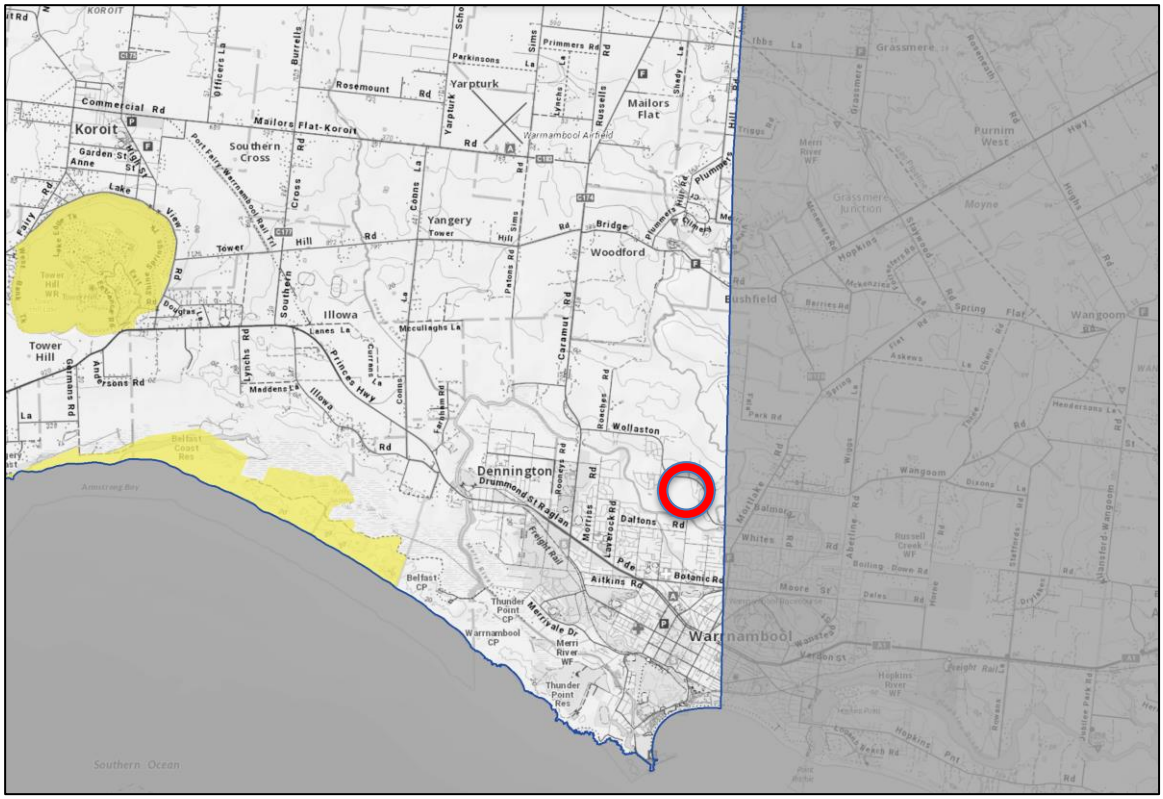


Figure 6 – FFMV fuel management strategy in the Warrnambool area (see Table 1) with the site indicated by red circle.

Table 1 – Legend to Figure 6.

Fire Management Zone	Legend colour	Aim
Asset Protection Zone (APZ)		To provide the highest level of localised protection to human life, property, critical infrastructure, the economy and high value community assets. Reduces radiant heat and ember attack through planned burning, mowing slashing or vegetation removal.
Bushfire Moderation Zone (BMZ)		To develop fuel- reduced areas of sufficient width and continuity to reduce the speed and intensity of bushfires. BMZ also aims to provide areas which assist in making bushfire suppression safer and more effective and in improving access and egress. Reduces speed and intensity of bushfires. Supports APZs and protects nearby assets, particularly from ember spotting.
Landscape Management Zone (LMZ)		Management objectives are varied and include fuel reduction and ecological outcomes. Hazard reduction may be undertaken to supplement APZ and BMZ activities, only where deemed necessary by a risk-based approach. Treatments may be undertaken for the active management of ecosystem function and for the management of flora and fauna species. Burning (or absence of burning) will be used to ecosystem resilience across the landscape. Planned burning will be used to reduce overall fuel and bushfire hazard, ecological resilience and particular landscape values.
Planned Burn Exclusion Zone (PBEZ)		Exclusion of planned burning from areas intolerant to fire.

5 Bushfire hazard assessment

One of the bushfire hazard identification and assessment strategies in Clause 13.02-1S is to use the best available science to identify the hazard posed by vegetation, topographic and climatic conditions. The basis for the hazard assessment should be:

- *'Landscape conditions - meaning the conditions in the landscape within 20 kilometres and potentially up to 75 kilometres from a site;*
- *Local conditions - meaning conditions in the area within approximately 1 kilometre from a site;*
- *Neighbourhood conditions - meaning conditions in the area within 400 metres of a site; and,*
- *The site for the development'* (Warrnambool Planning Scheme, 2018a).

This section includes a bushfire assessment at:

- The wider landscape scale, for at least 20km around the site (see Figure 1 and Map 1);
- The local landscape scale extending up to 1km from the site and the neighbourhood scale up to 400m around the site boundary, to identify any risk arising around the site beyond the site assessment zone (see Map 2); and
- The site scale, for 100m around the site and future residential areas, to determine likely future BALs (see Map 3).

The BPA coverage invokes AS 3959-2018, which requires a site assessment of the vegetation and topography up to 100m around a building, for the purposes of determining the applicable BAL construction standard for that building (Standards Australia, 2020).

5.1 Landscape assessment

5.1.1 Landscape – to 20km

The development site at 147 Wollaston Road is located north of Merri River on the northern side of Warrnambool, approximately 4.5km from the coast.

The landscape is characterised by three main land types:

- To the south and, at some distance to the east and west of the site, areas of existing urban development comprise a largely low threat zone, with part of the immediately adjacent property to the west currently comprising unmanaged vegetation;
- Beyond the urban area to the south-west, a thin band of coastal scrub is covered by the BMO; and
- The majority of the 20km landscape assessment zone comprises flat pastoral land with limited treed vegetation to the north, east and west of Warrnambool beyond the immediate urban areas.

The designated BPA covers roughly 90% of the 20km landscape assessment zone (excluding the ocean), with the exception of the urban areas of Warrnambool. The BMO covers the coastal scrub mentioned above and a large but isolated area of bushland near Purnim, around 18km to the north-east.

There is a limited fire history within 20km, mostly well to the east of Warrnambool (see Map 1). However, the potential for a grassfire impacting the site will remain until the surrounding landscape is developed as urban area.

In Victoria, the most likely scenarios for a large landscape fire are an approach from those directions typically associated with the direction of the wind on severe, or higher, fire danger days i.e. approach of bushfire from the north, north-west, west or south-west (Long, 2006).

The site has an exposure to extensive areas of grass to the north beyond Wollaston Road, and to the south in the Merri River corridor. Consequently, the site could be affected by a potentially fast-moving grassfire, with possible impact by smoke, ember attack (although likely to be less than that generated by a fire in woodland or forest) and radiant heat. The presence of Wollaston Road and provision of adequate setbacks and separation from the hazard will mitigate the threat of flame contact and radiant heat.

The site has access to the nearby lower threat areas immediately to the east and to Warrnambool to the south via Wollaston Road.

5.2 Local and neighbourhood conditions

5.2.1 Local – to 1km

Within the 1km local assessment zone, the landscape is dominated by the pastoral areas of nearby farmland, with the fringe of the 1km local assessment zone comprising low threat areas of the nearby urban areas in all directions except the north. The predominant bushfire hazard are the areas of Grassland around the site.

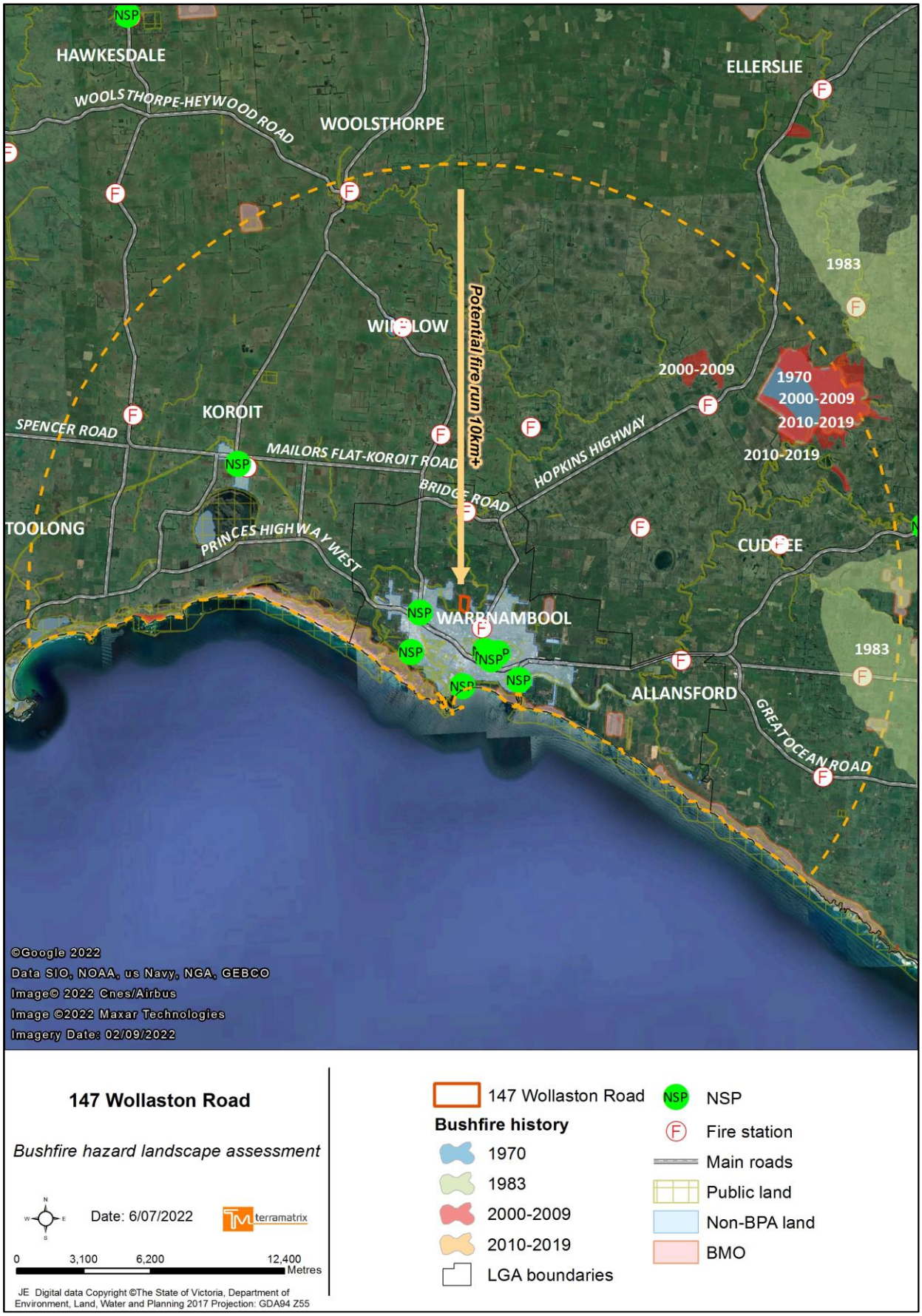
5.2.2 Neighbourhood – to 400m

Within 400m, the neighbourhood scale bushfire risk to the site is largely consistent with that for 1km, however land undergoing urban development comprises a smaller proportion of the assessment zone.

5.2.3 Landscape risk

To assist in assessing landscape risk, four 'broader landscape types', representing different landscape risk levels, are described in the DELWP technical guide *Planning Applications Bushfire Management Overlay*. These are intended to streamline decision-making and support more consistent decisions based on the landscape risk (DELWP, 2017).

The four types range from low risk landscapes where there is little hazardous vegetation beyond 150m of a site and extreme bushfire behaviour is not credible, to extreme risk landscapes with limited or no evacuation options, and where fire behaviour could exceed BMO/AS 3959 assumptions (see Table 2).



Map 1 – Bushfire hazard landscape assessment.

The development site and surrounding landscape accords with Landscape Type 2 although this risk is generated by Grassland rather than higher fuel load vegetation types and largely restricted to approach from the north. The risk to the site is likely to be reduced in the medium term as adjacent and nearby properties in the North of Merri River Structure Plan are developed and hazardous vegetation removed.

Table 2 - Landscape risk typologies (from DELWP, 2017).

Broader Landscape Type 1	Broader Landscape Type 2	Broader Landscape Type 3	Broader Landscape Type 4
• *There is little vegetation beyond 150 metres of the site (except grasslands and low-threat vegetation).* • *Extreme bushfire behaviour is not possible.* • *The type and extent of vegetation is unlikely to result in neighbourhood-scale destruction of property.* • *Immediate access is available to a place that provides shelter from bushfire.*	• *The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site.* • *Bushfire can only approach from one aspect and the site is located in a suburban, township or urban area managed in a minimum fuel condition.* • *Access is readily available to a place that provides shelter from bushfire. This will often be the surrounding developed area.*	• *The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site.* • *Bushfire can approach from more than one aspect.* • *The site is located in an area that is not managed in a minimum fuel condition.* • *Access to an appropriate place that provides shelter from bushfire is not certain.*	• *The broader landscape presents an extreme risk.* • *Fires have hours or days to grow and develop before impacting.* • *Evacuation options are limited or not available.*
I N C R E A S I N G R I S K →			

Map 2 – Local and neighbourhood hazard assessment.

5.3 Vegetation

Vegetation within a 100m assessment zone around the site has been classified in accordance with the AS 3959-2018 methodology through a desktop assessment. Classified vegetation is vegetation that is deemed hazardous from a bushfire perspective.

The classification system is not directly analogous to Ecological Vegetation Classes (EVCs) but uses a generalised description of vegetation based on the AUSLIG (Australian Natural Resources Atlas: No. 7 - Native Vegetation) classification system. The classification is largely based on the structural characteristics of the vegetation at maturity, but the key determinant should be the likely fire behaviour that it will generate.

5.3.1 Woodland

A small area of treed vegetation to the north-west best accords with the Woodland group of AS 3959-2018. Woodland vegetation comprises areas with trees up to 30m tall, 10% – 30% foliage cover dominated by eucalypts (and/or callitris) with a prominent grassy understorey, may contain isolated shrubs (Standards Australia, 2020).

5.3.2 Grassland

Vegetation on adjacent land to the north and south-west matches the AS 3959-2018 classification of Grassland, which is defined as all forms of vegetation (except Tussock Moorlands) including situations with shrubs and trees, if overstorey foliage cover is less than 10%. Includes pasture and cropland (Standards Australia, 2020).

Grassland vegetation is considered hazardous and therefore classifiable when it is not managed in a minimal fuel condition. Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack (e.g. short-cropped grass, to a nominal height of 100 mm) (Standards Australia, 2020). Grassland areas should be assumed to be unmanaged and classifiable unless there is 'reasonable assurance' that they will be managed in perpetuity, in a low threat state, e.g. no more than approx. 100mm high.

5.3.3 Excluded vegetation and non-vegetated areas

Areas of low threat vegetation and non-vegetated areas can be excluded from classification in accordance with Section 2.2.3.2 of AS 3959-2018, if they meet one or more of the following criteria:

a) 'Vegetation of any type that is more than 100m from the site.
b) Single areas of vegetation less than 1 ha in area and not within 100m of other areas of vegetation being classified vegetation.
c) Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site, or each other, or of other areas of vegetation being classified vegetation.

d) *Strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified vegetation.*
e) *Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.*
f) *Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition, mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks'* (Standards Australia, 2020).

For the purposes of this report, it is assumed that all vegetation on the site, including the open space to the south, will be managed in a low threat state (i.e. as non-classified vegetation), therefore Map 3 does not show any classified vegetation on the site. Low-threat areas excluded from classification include the managed curtilage of the surrounding properties. Non-vegetated areas include the roads, driveways and structures within the site assessment zone (see Map 3).

5.4 Topography

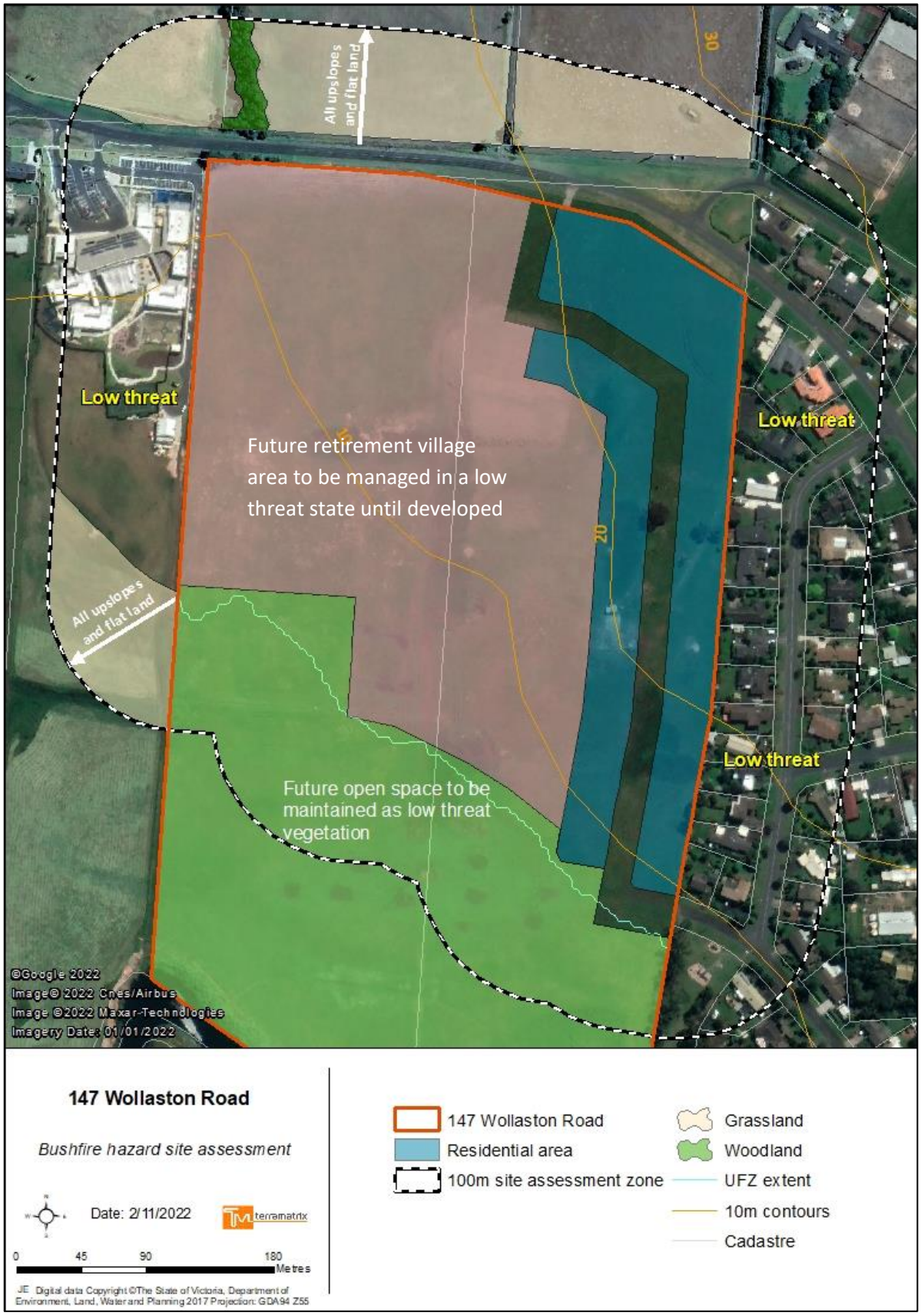
AS 3959-2018 requires that the 'effective slope' be identified to determine the BAL and applicable vegetation setback distances. This is the slope of the land under the classified vegetation[4] that will most significantly influence the bushfire attack on a building. Two broad types apply:

- Flat and/or Upslope - land that is flat or on which a bushfire will be burning downhill in relation to the development. Fires burning downhill (i.e. on an upslope) will generally be moving more slowly with a reduced intensity.
- Downslope - land under the classified vegetation on which a bushfire will be burning uphill in relation to the development. As the rate of spread of a bushfire burning on a downslope (i.e. burning uphill towards a development) is significantly influenced by increases in slope, downslopes are grouped into five classes in 5˚ increments from 0˚ up to 20˚.

The site is in a predominantly flat or undulating or only gently sloping landscape, without significant changes in elevation that would appreciably influence bushfire behaviour. The land to the north rises away from the site in the 'All upslopes and flat land' slope category of AS 3959-2018. The land to the south-west is on the flat area associated with the Merri River and has been assessed as being in the 'All upslopes and flat land' slope category, however the limited information regarding this area means that this slope should be verified through a site assessment.

For the purposes of determining BALs and vegetation setback distances for future development in all affected areas, the applicable slope class is 'All upslopes and flat land'.

[4] The slope of the land between the classified vegetation and the building is called the site slope, which in the Method 1 procedure of AS 3959, is assumed to be the same as the effective slope.



Map 3 – 147 Wollaston Road Bushfire hazard site assessment.

5.5 Future Urban Structure

147 Wollaston Road is located on the southern edge of the of the North of Merri River Structure Plan (Mesh, 2011) (see Figure 4), in an area indicated as future residential development to be created to the north of the existing urban areas of Warrnambool.

The North of Merri River Structure Plan provides a broad picture of the planned expansion of Warrnambool to the north, including the road network, open space, activity centres and community facilities, neighbourhoods and density and the utilities and drainage. The structure plan indicates that in the medium to long term, the land to the north of the site will also comprise low threat residential areas for a distance of 700m, with a comprehensive local road network providing access to the existing urban areas of Warrnambool.

The North of Merri River Structure Plan shows minor reserves and local parks throughout the residential and commercial zones (Mesh, 2011). The Merri River corridor will form the primary open areas close to the site, with potential active open space sports fields proposed to the west.

6 Planning and design response

This section identifies how future development can respond to the bushfire risk, including the requirements of Clause 13.02-1S, published DELWP and CFA guidance and the building regulations applicable to construction in a BPA.

6.1 BAL construction standard

To satisfy the applicable strategies of Clause 13.02-1S, future dwellings and other buildings requiring a BAL (see Section 3.4), should be sufficiently setback from classified vegetation to enable an appropriate construction standard.

Building setbacks are measured from the edge of the classified vegetation to the external wall of a building, excluding eaves, roof overhangs and some other building appurtenances[5] (Standards Australia, 2020) (see Figure 7).

[5] The setback distance is measured from the edge of the classified vegetation to the external wall of the building, or for parts of the building that do not have external walls (including carports, verandas, decks, landings, steps and ramps), to the supporting posts or columns. The following parts of a building are excluded:

a) Eaves and roof overhangs.
b) Rainwater and domestic fuel tanks.
c) Chimneys, pipes, cooling or heating appliances or other services.
d) Unroofed pergolas.
e) Sun blinds (Standards Australia, 2020).

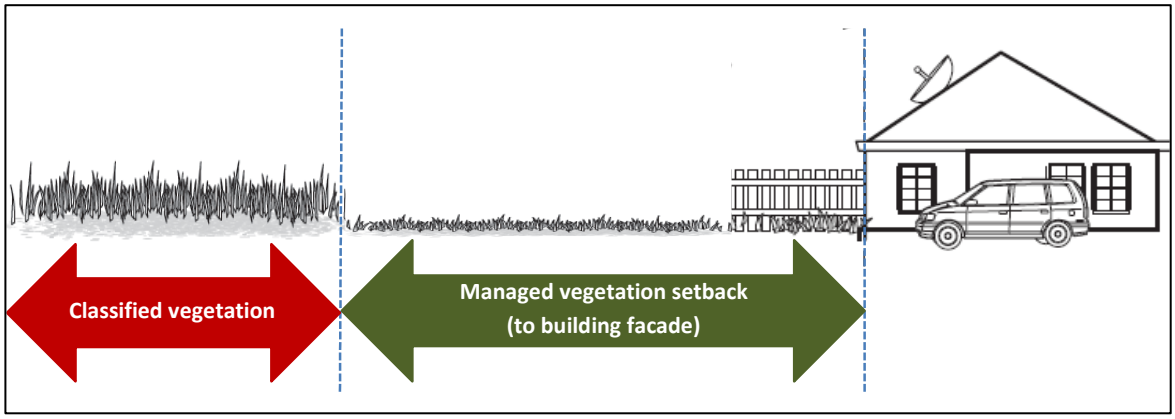


Figure 7 - Example of building-classified vegetation setback (adapted from CFA, 2013).

6.1.1 Building setbacks

The site is exposed to classified Grassland to the north and south-west. Much of this bushfire hazard is a short to medium term issue, with the progressive removal of the hazard as the structure plan is realised. The setbacks required in response to Grassland for BAL-12.5, based on the hazard assessment in Section 5 and determined using the simple Method 1 procedure of AS 3959-2018, are shown in Table 3 below.

Table 3 - Building setbacks for BAL-12.5.

BAL construction standard	Vegetation type	Effective slope	Low threat setback distance (m)
BAL-12.5	Grassland	All upslopes and flat land	19m

As no rezoning or other planning scheme amendment is proposed and the development proposal is consistent with the North of Merri River Structure Plan, the settlement planning strategies of Clause 13.02-1S arguably do not apply and the development of the site is not limited to a BAL-12.5 construction standard for future buildings. BAL-12.5 setbacks are, however, achievable across the site.

Map 3 shows the setbacks required in response to classified Grassland outside of the site. These setbacks are based on assumptions about vegetation retention and management, i.e.:

- All classified vegetation external to the site (see Map 3) will be retained in the short to medium term and will need to be responded to during the design and layout of the subdivision, i.e. buildings will not be able to be constructed within 19m of classified Grassland beyond the site boundary;
- All dwellings and other buildings requiring a BAL will need to have a 19m low threat setback in all directions at the time of building permit application to achieve a BAL-12.5 rating; and
- The vegetation within the open space will be landscaped to create a low threat vegetation (see Map 4 and Section 6.1.2).

The site can respond to the bushfire hazard with an appropriate layout and through the management of vegetation within the future retirement village and open space areas.

6.1.2 Open space and landscaping

Parts of the future open space to the south of the residential development area will comprise low threat vegetation. However, vegetated areas have the potential to create classified vegetation within the site, potentially close to the residential development area.

The supplied plans indicate areas of vegetation within the open space. If this vegetation does not meet the AS 3959-2108 exclusion criteria, it may create a bushfire hazard that requires a higher BAL response from nearby dwellings. Consequently, it is recommended that the layout and landscaping of the open space within 100m of the interface with the future residential areas meet the AS 3959-2018 exclusion criteria.

The exclusion criteria are:

(a) 'Vegetation of any type that is more than 100m from the site.

(b) Single areas of vegetation less than 1 ha in area and not within 100m of other areas of vegetation being classified vegetation.

(c) Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site, or each other, or of other areas of vegetation being classified vegetation.

(d) Strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified vegetation.

(e) Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.

(f) Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition6, mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks' (Standards Australia, 2020).

As the open space extends more than 100m from the residential development area, vegetation beyond that distance will not constitute a bushfire hazard to the proposed development. Within 100m, the application of exclusion criteria *(c), (d), (e)* and *(f)* will avoid the creation of a bushfire hazard within the site. Information that may assist in achieving this is included below. This area will be managed by Council and must be managed in a low threat state to provide a Minimum of 19m setback from the bushfire hazard for the adjacent dwellings built to a BAL-12.5 construction standard

[6] Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, recognisable as short-cropped grass for example, to a nominal height of 100mm (Standards Australia, 2020).

(see Map 4). Note that this requirement will also apply to the retirement residential area when developed (not shown on Map 4).

A useful guide to creating low threat landscaping is the CFA publication *Landscaping for Bushfire* available (along with other information) at <https://www.cfa.vic.gov.au/plan-prepare/how-to-prepare-your-property/landscaping>, and which can be used in combination with the 'Firewise' plant selection guide available at <https://www.cfa.vic.gov.au/plan-prepare/how-to-prepare-your-property/landscaping/plant-selection-key/plant-selection-key>.

Within the residential area, landscaping should also consider:

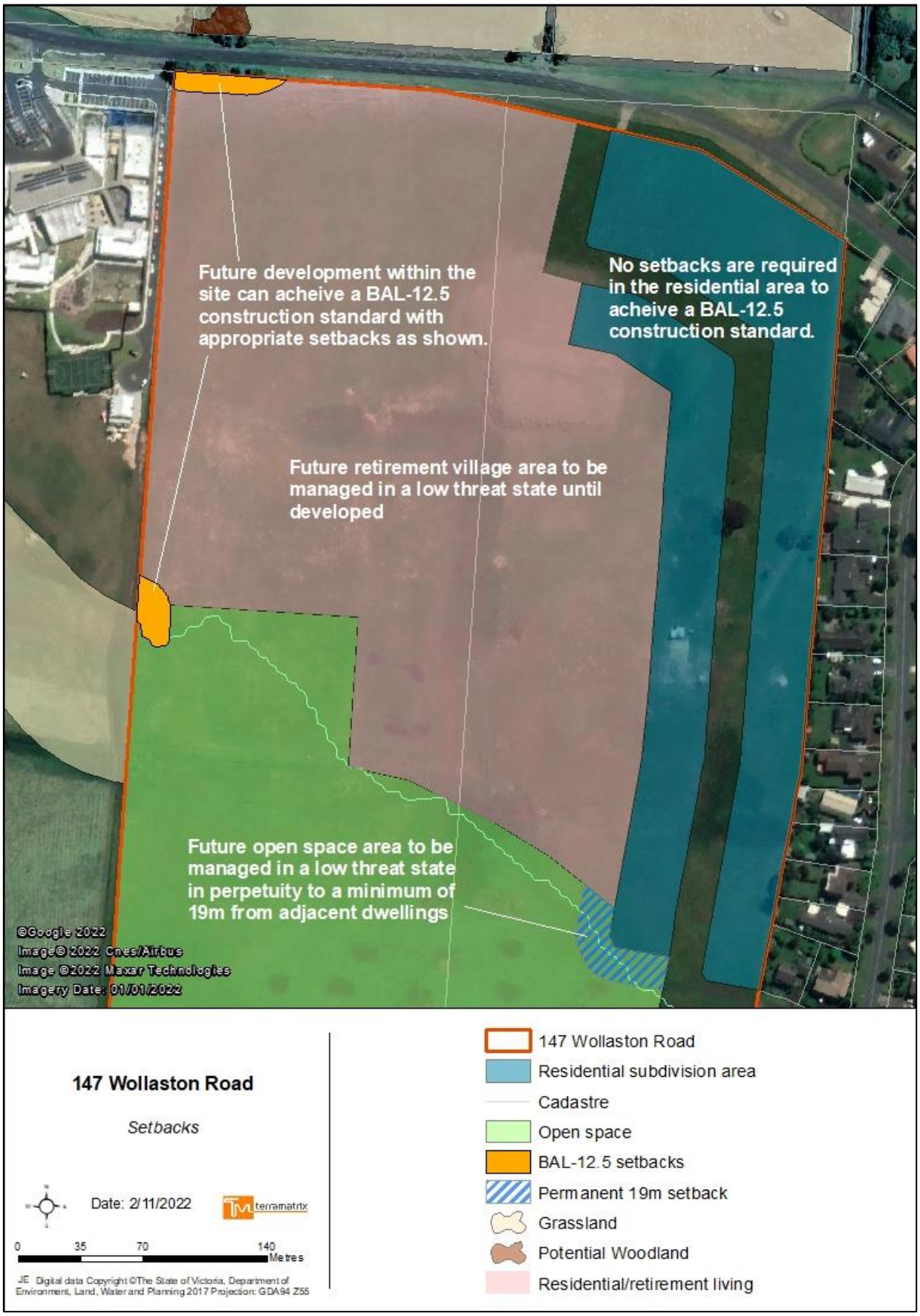
- Avoiding plantings that are in direct contact with buildings;
- Creating breaks in the horizontal and vertical continuity of plantings using non- combustible features such as crushed rock paths or lawn; and
- Using non-combustible mulches such as crushed glass, rock or granitic sand.

Suggested vegetation management standards within and for 100m around the residential development area are:

- Grass should be short cropped and maintained during the declared fire danger
- period.
- All leaves and vegetation debris should be removed at regular intervals during the
- declared fire danger period.
- Flammable objects and materials should not be located within 6m of the building.
- Plants greater than 30 centimetres in height should not be placed within 3m of a
- window or other glazed feature of the building.
- Individual and clumps of shrubs should not exceed 5 sq. metres in area and be
- separated from each other by 5 metres.
- Only low shrubs up to approx. 0.5 metres height at maturity should be planted under
- trees.
- There should be a clearance of approx. 2 metres between the lowest tree branches
- and ground level/understorey shrubs.

6.1.3 Roads and fire hydrants

All roads within the site should meet the guidelines detailed in the CFA publication *Requirements for water supplies and access for subdivisions in Residential 1 and 2 and Township Zones* (CFA, 2006). This publication also provides guidance regarding the provision of a reliable water supply for fire fighting via a conventional reticulated hydrant system, in accordance with the hydrant objective for residential subdivision at Clause 56.09-3 of the Warrnambool Planning Scheme.



Map 4 –Setbacks.

7 Clause 13.02-1S Bushfire planning

The applicable strategies at Clause 13.02-1S are detailed in the following sub-sections, and a summary response is provided about how the proposed development can respond to the strategies.

7.1.1 Protection of human life strategies

Priority must be given to the protection of human life.

Prioritising the protection of human life over all other policy considerations

The site is in a moderate bushfire risk location. The risk will lessen as development in and around the site occurs. Accordingly, the protection of human life can be prioritised by adopting the measures recommended in this report and through application of the existing planning and building regulations for construction in a BPA. There is access to the existing lower threat areas of Warrnambool, and the progressive excision of developed areas from the BPA (and eventually the site itself) will improve access to lower threat areas.

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.

As identified in Section 5.1, the site is in a moderate bushfire risk landscape. Therefore, if future buildings are setback sufficiently from any hazardous vegetation such that they achieve an appropriate BAL, the risk can be deemed to be acceptably mitigated.

The nearest *lowest* risk locations are the developed areas of Warrnambool near the site, and over the Merri River to the south, that are not in the BPA.

As development occurs within the site and on adjacent and nearby land, reliably low threat areas within the site will become eligible for excision from the BPA if they satisfy the exclusion criteria.

Reducing the vulnerability of communities to bushfire through consideration of bushfire risk in decision-making at all stages of the planning process

This report provides the basis for incorporating bushfire risk into decision making associated with planning development in the site.

The CFA (and FRV) consider that community resilience to bushfire will be strengthened (and hence, presumably, vulnerability to bushfire will be reduced) when a strategic planning proposal demonstrates that Clause 13.02-1S strategies have been applied, and

where a proposal takes advantage of existing settlement patterns so that new development will not expose the community to increased risk from bushfire.

The CFA provide principles to respond to Clause 13.02-1S including that settlement planning decisions should;

- *'Direct development to locations of lower bushfire risk.*
- *Carefully consider development in locations where there is significant bushfire risk that cannot be avoided.*
- *Avoid development in locations of extreme bushfire risk.*
- *Avoid development in areas where planned bushfire protection measures may be incompatible with other environmental objectives'* (CFA, 2015).

It is considered that development of the site can appropriately implement the strategies in Clause 13.02-1S that aim to prioritise protection of human life and will, therefore, meet the CFA strategic planning principles for bushfire.

7.1.2 Bushfire hazard identification and assessment strategies

The bushfire hazard must be identified, and an appropriate risk assessment be undertaken.

Applying the best available science to identify vegetation, topographic and climatic conditions that create a bushfire hazard.

This report identifies the hazard in accordance with the commonly accepted methodologies of AS 3959-2018 and, as appropriate, additional guidance provided in *Planning Practice Note 64 Local planning for bushfire protection* (DEWLP, 2015a), *Planning Advisory Note 68 Bushfire State Planning Policy Amendment VC140* (DEWLP, 2018a) and *Planning Permit Applications Bushfire Management Overlay Technical Guide*[7] (DELWP, 2017).

The type and extent of (hazardous) vegetation within, and up to 400m around, the site has been identified and classified into AS 3959-2018 vegetation groups. Classification was based on the anticipated long-term state of the vegetation, EVC mapping, aerial imagery, desktop assessment, published guidance on vegetation assessment for bushfire purposes and experience with the fuel hazard posed by the vegetation types that occur within the region.

GIS analysis of publicly available contour data for the area was undertaken to determine slopes, extending to 100m around the site (see Map 3).

[7] Although the site is not affected by the BMO, DELWP's BMO technical guide provides useful descriptors and guidance for assessing the bushfire risk at the landscape scale, as discussed in Section 5.1.

In relation to climatic conditions and fire weather, the AS 3959-2018 default FFDI 100/GFDI 130 benchmark used in the Victorian planning and building system, has been applied.

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.

The extent of BPA coverage has been considered (see Section 3.4) and is shown Map 1 and Map 2. This is based on the most recent BPA mapping for the area, which was gazetted 18th March 2022.

Applying the Bushfire Management Overlay in planning schemes to areas where the extent of vegetation can create an extreme bushfire hazard.

As identified in Section 5, no part of the site is covered by the BMO. This is considered appropriate and reflects relatively state-wide BMO mapping introduced into the Warrnambool Planning Scheme by amendment GC13, which was gazetted on 3rd October 2017.

Considering and assessing the bushfire hazard on the basis of:

- ***Landscape conditions - meaning the conditions in the landscape within 20 kilometres and potentially up to 75 kilometres from a site;***
- ***Local conditions - meaning conditions in the area within approximately 1 kilometre from a site;***
- ***Neighbourhood conditions - meaning conditions in the area within 400 metres of a site; and***
- ***The site for the development.***

The hazard has been assessed and described at the landscape, site, neighbourhood and local scales (see Section 5 and Maps 1, 2, and 3).

At the site scale, the assessment follows the AS 3959-2018 methodology applied in a BPA - by means of a desktop assessment - of classifying vegetation and topography within 100m of a building and, for this study, extending 100m around the site (see Map 3). At the local and neighbourhood scales, the site has been assessed at the 1km and 400m scales (see Map 2).

At the broader landscape scale a 20km radius around the site has been applied (see Section 5.1 and Map 1) in accordance with guidance about assessing risk for planning scheme amendments in Planning Advisory Note 68 (DEWLP, 2018a) and Planning Practice Note 64 (DELWP, 2015a).

Consulting with emergency management agencies and the relevant fire authority early in the process to receive their recommendations and implement appropriate bushfire protection measures.

Terramatrix is unaware of any consultation with fire authorities. It is anticipated Warrnambool City Council will refer this Bushfire Development Report to the CFA for their comments and recommendations.

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.

DELWP advisory and practice notes, Clause 13.02-1S, and the building regulations invoked by the BPA coverage, specify the general requirements and standards for assessing the risk, and the bushfire hazard landscape assessment has been considered. The guidance and requirements have been applied in this report as appropriate and bushfire protection measures have been identified commensurate with the risk.

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.

If the objectives and applicable strategies of Clause 13.02-1S are successfully implemented, as discussed in this report, and the building and planning regulations for construction in a BPA are complied with, then the risk can be deemed to be acceptably mitigated such that development can proceed.

The CFA specify that areas where development should not proceed could include:

- *'Isolated settlements where the size and/or configuration of the settlements will be insufficient to modify fire behaviour and provide protection from a bushfire.*
- *Where bushfire protection measures will not reduce the risk to an acceptable level.*
- *Where evacuation (access) is severely restricted.*
- *Where the extent and potential impact of required bushfire protection measures may be incompatible with other environmental objectives or issues, e.g. vegetation protection, land subject to erosion or landslip'* (CFA, 2015).

None of these criteria or characteristics are applicable to the site.

7.1.3 Settlement planning strategies

As the proposed development does not require a planning scheme amendment and is consistent with the existing zoning, North of Merri River Structure Plan and the settlement objectives and strategies in

the Planning Policy Framework (see Section 3.2), it is considered that the settlement planning strategies are not applicable. They are listed below but not responded to.

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 AS 3959-2009 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009).

Ensuring the availability of, and safe access to, areas assessed as a BAL-LOW rating under AS 3959-2009 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009) where human life can be better protected from the effects of bushfire.

Ensuring the bushfire risk to existing and future residents, property and community infrastructure will not increase as a result of future land use and development.

Achieving no net increase in risk to existing and future residents, property and community infrastructure, through the implementation of bushfire protection measures and where possible reduce bushfire risk overall.

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.

Assessing alternative low risk locations for settlement growth on a regional, municipal, settlement, local and neighbourhood basis.

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 than a BAL-12.5 rating under AS 3959-2009'

7.1.4 Areas of high biodiversity conservation value

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

Terramatrix is not aware of any significant biodiversity impacts associated with the development proposal. The site has a history of pastoral use and contains no remnant native vegetation.

7.1.5 Use and development control in a Bushfire Prone Area

Clause 13.02-1S requires that '*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 uses and development:*

- *Subdivisions of more than 10 lots.*
- *Accommodation.*
- *Childcare centre.*
- *Education centre.*
- *Emergency services facility.*
- *Hospital.*
- *Indoor recreation facility.*
- *Major sports and recreation facility.*
- *Place of assembly.*
- *Any application for development that will result in people congregating in large numbers'* (Warrnambool Planning Scheme, 2018a).

It further states that:
'When assessing a planning permit application for the above uses and development:

- *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'* (Warrnambool Planning Scheme, 2018a).

Future development applications should be able to respond to this strategy and achieve acceptable safety if:

- Appropriate setbacks for future development from classified vegetation are achieved to enable appropriate BAL construction, with BAL-12.5 achievable across the site;
- Adequate access and egress for emergency management vehicles is provided by a residential road network; and
- A reliable water supply for firefighting is provided, via a conventional reticulated hydrant system, in accordance with the hydrant objective for residential subdivision at Clause 56.09-3.

8 Conclusion

This report has assessed the bushfire hazard in and around the 147 Wollaston Road site in accordance with Clause 13.02-1S in the Warrnambool Planning Scheme, and the AS 3959-2018 methodology - by means of a desktop assessment - as invoked by the Victorian building and planning regulations, and additional guidance provided in *Planning Practice Note 64 Local planning for bushfire protection* (DEWLP, 2015a) and *Planning Advisory Note 68 Bushfire State Planning Policy Amendment VC140* (DEWLP, 2018).

All areas of the site are currently in a designated BPA. Following development, some of the site will be eligible for excision from the BPA. The landscape is of moderate bushfire risk (Landscape Type 2), which will lessen as development on the subject site and neighbouring land proceeds.

The type and extent of (hazardous) vegetation within, and up to 100m around the site, has been identified and classified into AS 3959-2018 vegetation groups, based on DELWP extant EVC mapping, aerial imagery and publicly available spatial data. The classification is based on the current state of the vegetation outside of the site and identifies that the hazard is exposure to Grassland to the north and south-west, with a small area of Woodland to the north-west.

The terrain of the site and the surrounding landscape is benign from a bushfire perspective, being predominantly flat or gently rising away from the site. For the purposes of determining BALs and vegetation setback distances for future buildings, the applicable slope class is 'All upslopes and flat land'.

Bushfire behaviour can reasonably be expected to be within AS 3959-2018 presumptions and design parameters. Accordingly, it is considered that the risk can be mitigated to an acceptable level, and that future development of the site is appropriate, if dwellings (and any other buildings that require a BAL) are separated from hazardous vegetation to allow an appropriate BAL, in accordance with the building regulations.

A reliable water supply for firefighting can be provided via a conventional reticulated hydrant system in accordance with the hydrant objective for residential subdivision.

The risk to existing residents of Warrnambool will be reduced by the development of additional urban residential areas and associated low threat or non-vegetated land. This will eventually create BAL-LOW areas with the potential to be excised from the BPA if they are sufficiently distant from hazardous vegetation.

9 Appendix A - BALs explained

Bushfire Attack Level (BAL)	Risk Level	Construction elements are expected to be exposed to…	Comment
BAL-Low	VERY LOW: There is insufficient risk to warrant any specific construction requirements but there is still some risk.	No specification.	At 4kW/m^2 pain to humans after 10 to 20 seconds exposure. Critical conditions at 10kW/m^2 and pain to humans after 3 seconds. Considered to be life threatening within 1 minute exposure in protective equipment.
BAL-12.5	LOW: There is risk of ember attack.	A radiant heat flux not greater than 12.5 kW/m^2	At 12.5kW/m^2 standard float glass could fail and some timbers can ignite with prolonged exposure and piloted ignition.
BAL-19	MODERATE: There is a risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to radiant heat.	A radiant heat flux not greater than 19 kW/m^2	At 19kW/m^2 screened float glass could fail.
BAL-29	HIGH: There is an increased risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to an increased level of radiant heat.	A radiant heat flux not greater than 29 kW/m^2	At 29kW/m^2 ignition of most timbers without piloted ignition after 3 minutes exposure. Toughened glass could fail.
BAL-40	VERY HIGH: There is a much increased risk of ember attack and burning debris ignited by windborne embers, a likelihood of exposure to a high level of radiant heat and some likelihood of direct exposure to flames from the fire front.	A radiant heat flux not greater than 40 kW/m^2	At 42kW/m^2 ignition of cotton fabric after 5 seconds exposure (without piloted ignition).
BAL- FZ (i.e. Flame Zone)	EXTREME: There is an extremely high risk of ember attack and a likelihood of exposure to an extreme level of radiant heat and direct exposure to flames from the fire front.	A radiant heat flux greater than 40 kW/m^2	At 45kW/m^2 ignition of timber in 20 seconds (without piloted ignition).

Source: derived from AS 3959-2018 (Standards Australia, 2020).

10 References

ABCB (2020) *Building Code of Australia, Volumes 1 and 2 of the National Construction Code (NCC),* Australian Building Codes Board (ABCB). Available at <http://abcb.gov.au/ncc-online/>.

AFAC (2018) *Discussion paper on Climate Change and the Emergency Management Sector*. Australasian Fire and Emergency Service Authorities Council, Melbourne.

Beveridge Williams (2022) *Master plan V08*. Beveridge Williams Pty Ltd, Melbourne.

CFA (2015) *FSG LUP 008 Land Use Planning* CFA Land Use Planning Fire Services Guideline. Country Fire Authority, East Burwood. Available at <http://www.cfa.vic.gov.au/plan-prepare/strategic-planning/>.

CSIRO/BOM (2020) *State of the Climate 2020* CSIRO and Bureau of Meteorology (BOM), Commonwealth of Australia. Available at <https://www.csiro.au/en/Showcase/state-of-the-climate>.

DELWP (2015a) *Local planning for bushfire protection,* Planning Practice Note 64. Department of Environment, Land, Water and Planning, Melbourne. Available at <https://www.planning.vic.gov.au/publications/planning-practice-notes>.

DELWP (2015b) *Bushfire Prone Area Mapping Criteria*. Department of Environment, Land, Water and Planning, Melbourne. Available at <https://www.planning.vic.gov.au/policy-and-strategy/bushfire-protection/building-in-bushfire-prone-areas>.

DELWP (2017) *Planning Permit Applications Bushfire Management Overlay* Technical Guide. Department of Environment, Land, Water and Planning, Melbourne. Available at <https://www.planning.vic.gov.au/bushfire-protection/bushfire-management-overlay/technical-information>.

DELWP (2018) *Bushfire State Planning Policy Amendment VC140,* Planning Advisory Note 68, Department of Environment, Land, Water and Planning, Melbourne. Available at <https://www.planning.vic.gov.au/publications/planning-advisory-notes>.

DELWP (2020) *Design guidelines for settlement planning at the bushfire interface*. Department of Environment, Land, Water and Planning, Melbourne. Available at: <https://www.planning.vic.gov.au/__data/assets/pdf_file/0041/447998/Design-guidelines-for-settlement-planning-at-the-bushfire-interface.pdf>

DPCD (2012) *Regional Bushfire Panning Assessments – Barwon South-west Region*. Department of Planning and Community Development, Melbourne.

Long M (2006) A climatology of extreme fire weather days in Victoria. *Australian Meteorological Magazine*, **55**, 3-18.

Mesh (2011) *North of Merri River Structure Plan*. Mesh Pty Ltd. Available at <https://www.warrnambool.vic.gov.au/sites/warrnambool.vic.gov.au/files/documents/property/infrastructure%20and%20planning/strategies%20and%20plans/growth%20area/North%20of%20the%20Merri%20River%20Structure%20Plan%202011.pdf>.

NASH (2021) *NS 300 NASH Standard – Steel Framed Construction in Bushfire Areas 2021*. National Association of Steel-framed Housing Inc, Hartwell, Victoria.

Standards Australia (2020) *AS 3959-2018 Construction of buildings in bushfire-prone areas*. Incorporating Amendment No.2, Standards Australia, North Sydney, New South Wales.

Warrnambool City Council (2015) *Integrated Municipal Fire Management Plan for the Warrnambool City Municipal District V1.4 2012-2015*. Available at <https://www.warrnambool.vic.gov.au/sites/warrnambool.vic.gov.au/files/documents/council/about/strategic%20plans/MFMP%2003.03.2015.pdf>.

Warrnambool Planning Scheme (2018a) *Clause 13.02-1S Bushfire planning*. Available at <https://planning-schemes.app.planning.vic.gov.au/Warrnambool/ordinance/13.02>.

Warrnambool Planning Scheme (2018b) *Clause 13.01-1S Natural hazards and climate change*. Available at <https://planning-schemes.app.planning.vic.gov.au/Warrnambool/ordinance/13.01>.

Warrnambool Planning Scheme (2018c) *Clause 71.02-3 Integrated decision making*. Available at <https://planning-schemes.app.planning.vic.gov.au/Warrnambool/ordinance/71.02>.

147 Wollaston Road
Warrnambool

Vegetation Assessment

A report to
The Gull Group

Prepared by

***Mark Trengove* Ecological Services**

November 2021

Contents

Document History

Document Version	Date	Prepared by	Checked by
Draft	October 27 2021	Phil Hunter	Mark Trengove
Final	November 4 2021	Phil Hunter	Mark Trengove

***Mark Trengove* Ecological Services**
PO Box 1502 Geelong 3220
mtrengove@pipeline.com.au
ph 0428 298087

1 INTRODUCTION

1.1 Project Background

An area of land located at 147 Wollaston Rd Warrnambool is proposed to be subdivided. This report was commissioned by The Gull Group. to assess the quantity and significance of any native vegetation that might be present in the subject site.

Under Clause 52.17 of the Planning Scheme, the State has gazetted the Native Vegetation Removal Regulations. The Regulations 'introduce a risk-based approach to assessing applications to remove native vegetation'. (Department of Environment, Land, Water and Planning [DELWP] website i).

Refer to Section 4.2 for further discussion.

1.2 Objectives

The objectives of this investigation are to:

- Describe the flora values of the land.
- Evaluate the conservation significance of the land.
- Assess any potential impacts of the proposed development.
- Assess the implications of relevant government policy and legislation (Commonwealth EPBC Act, State Clause 52.17).

1.3 Study Area

The study area is comprised of approximately 24.61 ha of land, located at 147 Wollaston Rd Warrnambool, within the City of Warrnambool.

The site is within the Victorian Volcanic Plain bioregion and is located within the Glenelg Hopkins Catchment Management Authority region (DELWP website iv). The land is zoned General Residential Zone (GRZ) (DELWP website v).

The site is comprised of agricultural land which is currently being grazed by cattle. The vegetation within the study area is substantially exotic, with a very small amount of native vegetation occurring in a drainage line towards the south end of the site.

An old dairy, cattle yard, tanks and five mature planted trees exist at the eastern part of the property. A large rock heap (approx. 60 m x 60m) occurs at the northern end (refer Plate 2).

The site is gently undulating, with higher topography in the north-eastern area. A shallow dam exists in the south-eastern portion of the property (Plate 3). The Merri River is located adjacent to the southern perimeter.

The location of the study area is shown in Figure 1.

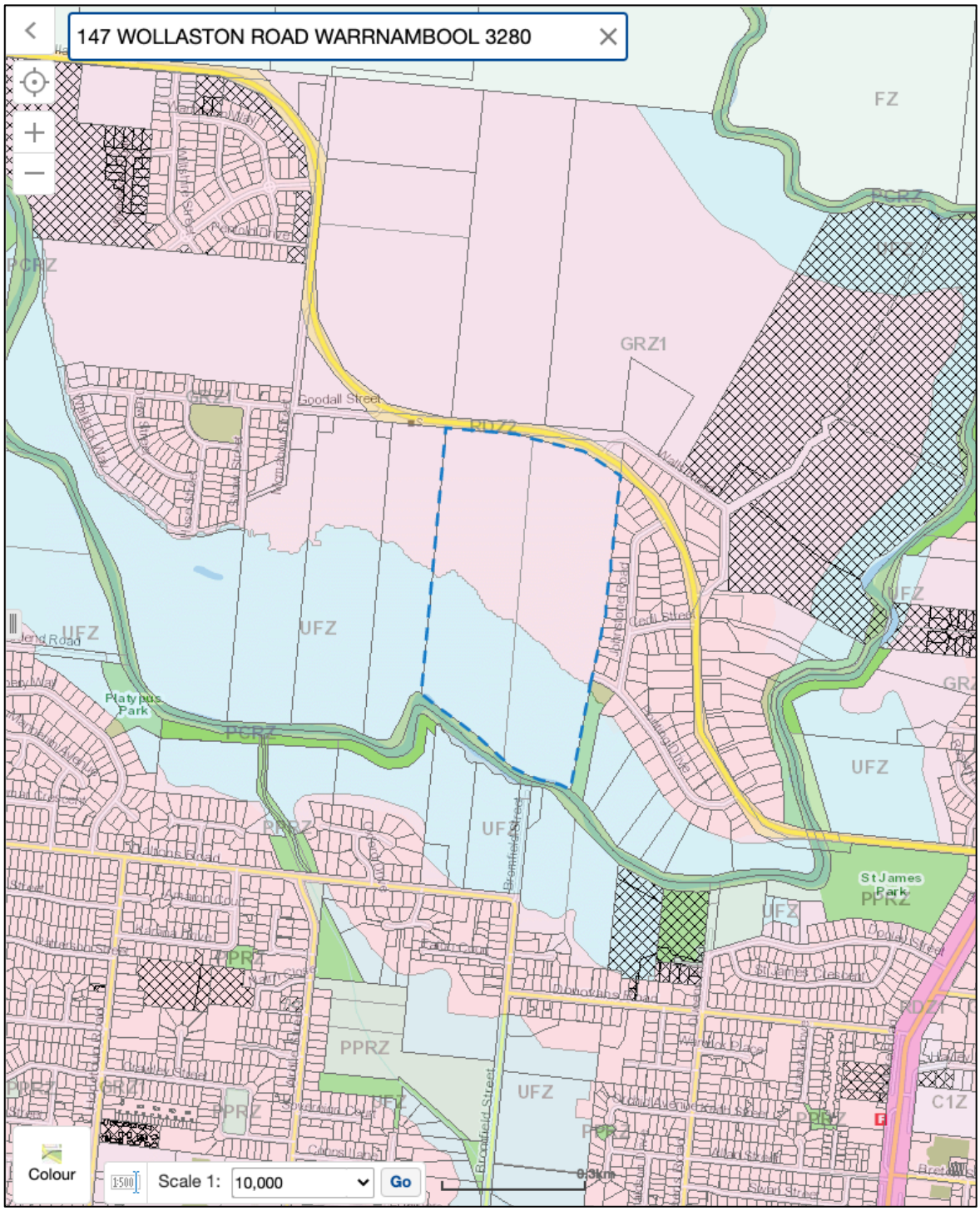


Figure 1. 147 Wollaston Rd Warrnambool (DELWP website v).

1.4 Proposed Development

The proposal is a residential subdivision within the property.

2 METHODS

2.1 Taxonomy

Scientific names for plants follow the Vicflora (RBG website). Common names for plants follow the Flora of Victoria Vols 2-4 (Walsh and Entwisle 1994-1999).

2.2 Literature and Database Review

Relevant literature and databases, including data from the NVIM tool (DELWP website iv), the Victorian Biodiversity Atlas (DELWP website iii), and the Commonwealth Department of Agriculture, Water and the Environment (EPBC website) was reviewed.

2.3 Field Survey

The site was inspected on foot on the 11th of October 2021. The entire site was traversed. Records were taken of all indigenous vascular plant species and dominant exotic vascular plant species. Native vegetation communities were mapped. Observations were made of the existing habitat values.

2.4 Limitations

The assessment was conducted during spring, a time of year that is suitable for the detection of most flora species likely to occur on site. The site was being grazed by cattle at the time of the survey, but no native species were affected. Plant growth following significant rainfall over the previous months provided good conditions for botanical assessment.

Due to the degraded condition of the study area vegetation and growth of vegetation following recent rain events, the site inspection is considered sufficient to assess the ecological values of the site. The survey includes only vascular flora. Fauna surveys were not undertaken.

There are not considered to be any significant limitations to the findings of this study.

2.5 Defining Significance

A number of criteria are applied in order to assess the significance of flora species and vegetation communities. The definition of the criteria is detailed in Appendix 1.

2.6 Defining and Assessing Vegetation

Native vegetation in Victoria has been defined by DELWP as belonging to two categories. These are:

Patch native vegetation

Patch native vegetation is either:

- any area of vegetation where at least 25 per cent of the total perennial understorey plant cover is native
- any area with three or more native canopy trees where the canopy foliage cover is overlapping.
- Current wetlands as mapped by DELWP.

Scattered tree native vegetation

Scattered tree native vegetation is:

- a native canopy tree that does not form part of a patch.

Habitat Hectares

Habitat hectare (Vegetation Quality Assessment v1.3) is a site-based measure that combines extent and condition of native vegetation. The current condition of native vegetation is assessed against a benchmark for its Ecological Vegetation Class (EVC). EVCs are classifications of native vegetation types. The benchmark for an EVC describes the attributes of the vegetation type in its mature natural state, which reflects the pre-settlement circumstances. The condition score of native vegetation at a site can be determined through undertaking a habitat hectare assessment.
The habitat hectare value of an area of native vegetation is calculated by multiplying the current condition of the vegetation (condition score) by the extent of native vegetation.

(DELWP website ii).

3 RESULTS

3.1 Ecological Vegetation Class

Ecological Vegetation Classes (EVCs) are the primary level of classification of vegetation communities within Victoria. An EVC contains one or more plant (floristic) communities and represents a grouping of vegetation communities with broadly similar ecological attributes. Classification of EVCs in this report follows Oates and Taranto (2001).

The pre-1750 EVC mapping of the study area undertaken by DELWP (DELWP website iv) indicates that the study area was comprised of EVC 55 Plains Grassy Woodland in the northern part of the property and EVC 53 Swamp Scrub at the southern part. These EVC's are currently listed as 'Endangered' in the Victorian Volcanic Plain Bioregion (DELWP website vi).

'Endangered' is defined as an EVC where less than 10% of the pre-European extent remains within the bioregion (DELWP website vi).

Native vegetation is so poorly represented on site, that it does not typify either of these pre-1750 EVC's.

Refer to Figure 2 for DELWP EVC mapping.

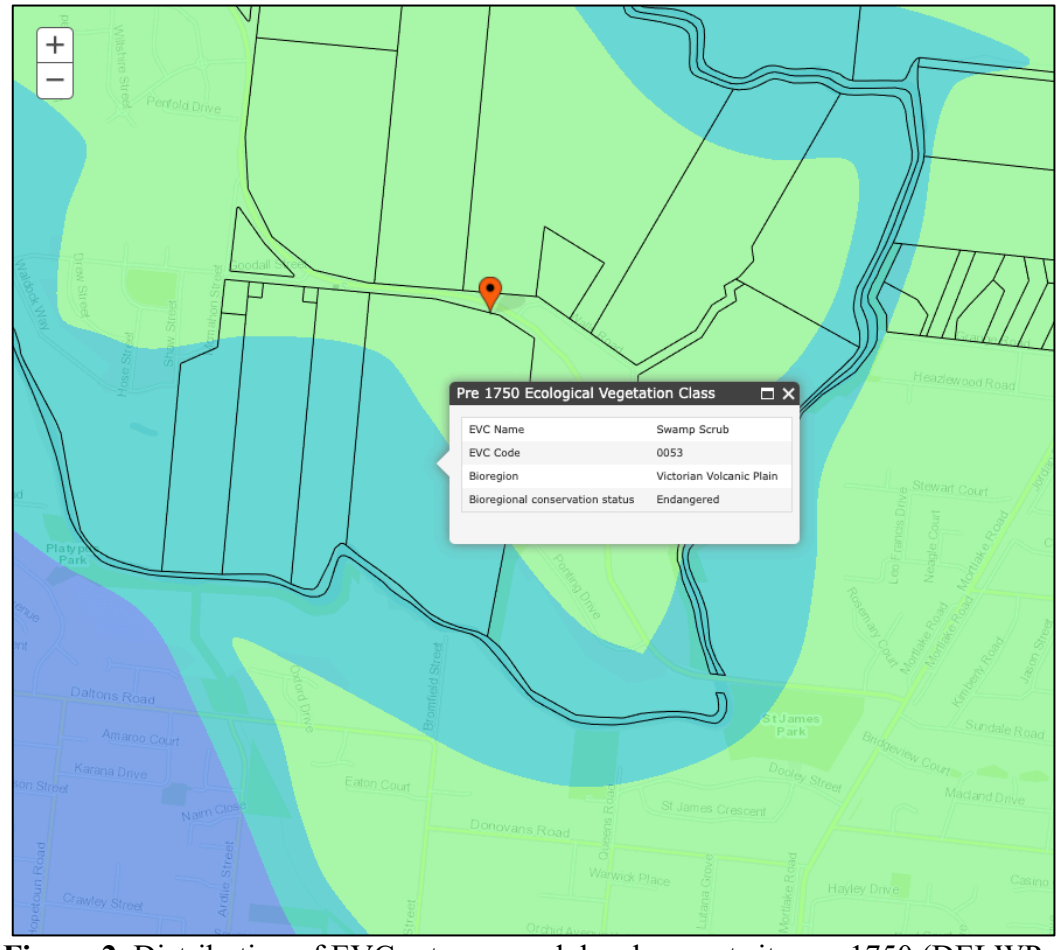


Figure 2. Distribution of EVCs at proposed development site pre-1750 (DELWP website iv).

3.2 Flora

Two native vascular plant species were recorded from the study area. Refer to Table 1 for a list of native and exotic vascular plant species recorded from this assessment. Planted species are marked with an asterisk *.

3.3 Vegetation Condition

The vegetation of the proposed impact areas is dominated by exotic pasture grasses and weeds such as Rye-grass, Yorkshire Fog, Toowoomba Canary-grass, White Clover, Ox-tongue, Cat's ear, and Dock (Plates 1 - 3).

Two native plant species: Rush (*Juncus sp.)* and Lesser Loosestrife were recorded in the study area (Plate 4). These species occur as a very minor component of the vegetation, existing randomly in a few small clumps (<1m2 each) in a low-lying area towards the southern boundary.

Four large Red Flowering Gums and a Red Ironbark (each approximately 50 years old) occur on higher ground near the eastern boundary (Plate 5).

Evidence of recent tree clearing (presumably large Cypress trees) was also noted in several areas near the dairy (ie. Plate 6).

Botanical Name	Common Name	Status
Arctotheca calendula	Capeweed	Exotic
Cerastium glomeratum	Sticky Mouse-ear Chickweed	Exotic
Corymbia ficifolia*	**Red Flowering Gum**	**Native***
Eucalyptus sideroxylon*	**Red Ironbark**	**Native***
Helminthotheca echioides	Ox-tongue	Exotic
Holcus lanatus	Yorkshire Fog	Exotic
Hypochaeris radicata	Cat's-ear	Exotic
Juncus sp.	**Rush**	**Native**
Lolium sp.	Rye Grass	Exotic
Lythrum hyssopifolia	**Lesser Loosestrife**	**Native**
Phalaris aquatica	Toowoomba Canary-grass	Exotic
Rumex crispus	Curled Dock	Exotic
Rumex pulcher	Fiddle Dock	Exotic
Stellaria media	Chickweed	Exotic
Trifolium repens	White Clover	Exotic
Urtica urens	Small Nettle	Exotic

Table 1 Naturalised Vascular Plant Species recorded this survey

3.4 Significant Flora

No National, State or Regionally significant plant species were recorded. The two recorded native plant species are of local conservation significance. Refer to Appendix 1 for the rational for assessing significance.

4 LEGISLATION AND GOVERNMENT POLICY

4.1 Commonwealth

4.1.1 Environment Protection and Biodiversity Conservation Act (1999)

The Environment Protection and Biodiversity Conservation (EPBC) Act (1999) was established to 'promote the conservation of biodiversity by providing strong protection for listed species and communities in the Commonwealth and for protected areas, Ramsar sites, Commonwealth Reserves, conservation zones and World Heritage sites, etc'.

The EPBC Act applies to developments and associated activities that have the potential to significantly impact on matters protected under the Act. Under the Act, unless exempt, actions require approval from the Australian Government Minister for Environment and Heritage if they are likely to significantly impact on a 'matter of national environmental significance'. There are currently seven matters of national environmental significance (NES):

- World Heritage properties;
- National Heritage properties;
- nationally listed threatened species and ecological communities;
- listed migratory species;
- Ramsar wetlands of international significance;
- Commonwealth marine areas; and
- nuclear actions (including uranium mining).

Any person proposing to take an action that may, or will, have a significant impact on a matter of national environmental significance must refer the action to the Australian Government Minister for Environment and Water Resources for determination as to whether the action is a 'controlled action' or is not approved.

Grassy Eucalypt Woodland of the Victorian Volcanic Plain is considered 'critically endangered' under the Act, ie. EVC 55 (EPBC Website i). However, the site does not meet the thresholds required to adequately represent this community (EPBC Website ii).
EVC 53 Swamp Scrub is not referred to under the Act.

4.1.2 Implications

There are no implications for the current proposal under the EPBC Act.

4.2 State

4.2.1 Native Vegetation Permitted Clearing Regulations

Under Particular Provision (Native Vegetation Clause 52.17) the State has gazetted the Native Vegetation Permitted Clearing Regulations. The Regulations 'introduce a risk-based approach to assessing applications to remove native vegetation' (DELWP website i).

The purpose of Clause 52.17 is 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). This includes:

1. Avoid the removal, destruction or lopping of native vegetation.

2. Minimise 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.

To manage the removal, destruction or lopping of native vegetation to minimise land and water degradation. (DELWP website i).

Under the Regulations, any areas of patch or scattered tree native vegetation that are proposed to be removed are subject to protection/and or recruitment offsets, depending upon the characteristics of the site.

When native vegetation removal is permitted, an offset must be secured which achieves a no net loss outcome for biodiversity. To achieve this the offset makes a contribution to Victoria's biodiversity that is equivalent to the contribution made by the native vegetation that was removed. The type and amount of offset required depends on the native vegetation being removed and the contribution it makes to Victoria's biodiversity.

Implications for the current proposal are discussed as follows. Refer to Figure 3 for Location mapping (DELWP data).

4.2.2 Implications

The results show that Lesser Loosestrife and a Rush species occur in a few very small clumps (<1m2 each) within the site, with no more than one of these species present in each clump. They are considered too small and degraded to identify as 'patch vegetation.'
A large basaltic rock pile (approx. 60m x 60m) was present near the northern boundary (plate 2). No non-vascular flora was recorded.
The study area is consequently assessed to be comprised of degraded vegetation (i.e. non-patch or scattered tree native vegetation).

The proposal requires the removal of no 'patch' or 'scattered tree' native vegetation.

Consequently, there are no implications for the removal of native vegetation under the regulations.

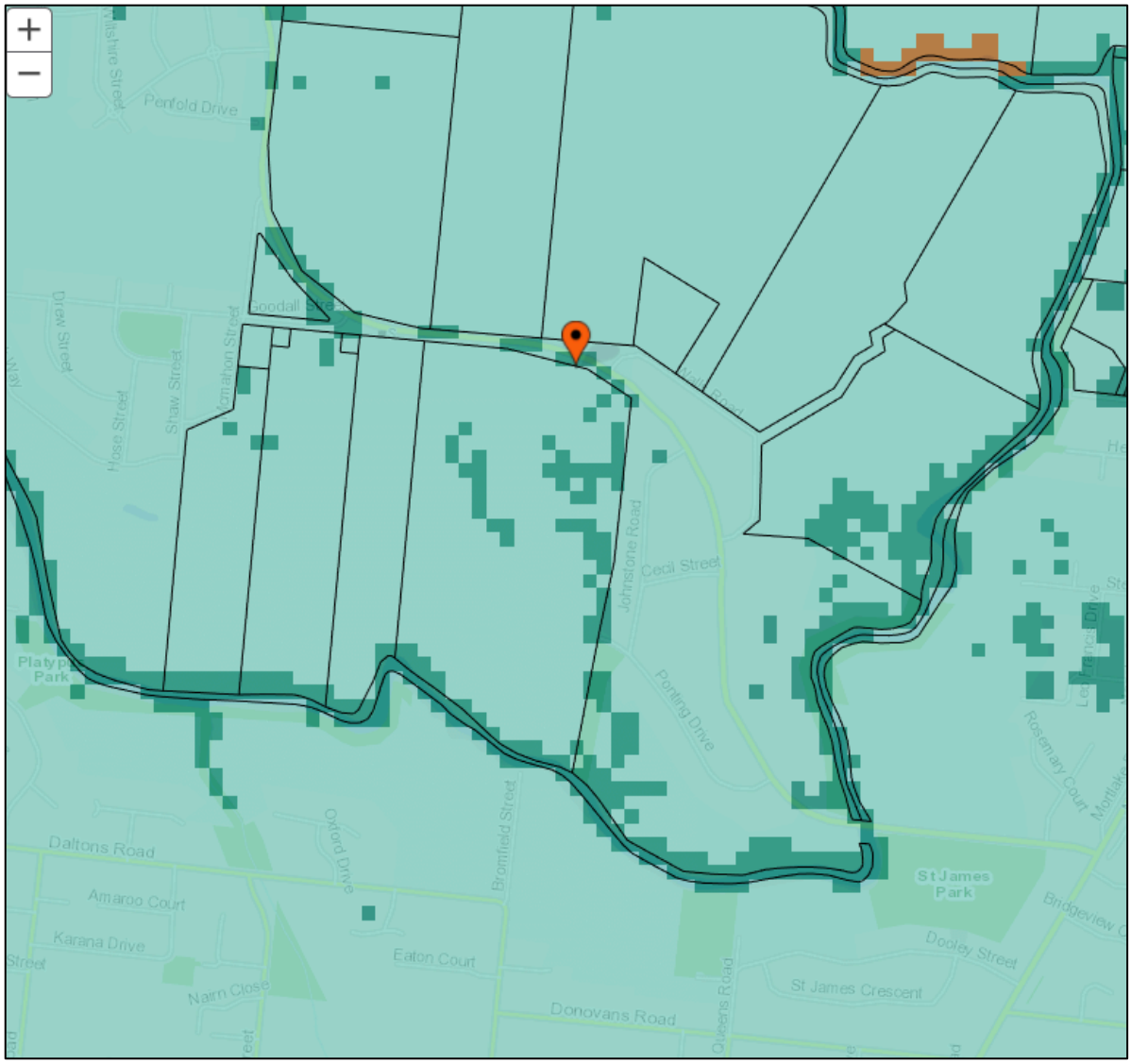


Figure 3. Distribution of vegetation according to 'Location' at proposed development site. Green equates to 'Location 1' (i.e., lowest risk), dark green equates to 'Location 2' (i.e., medium risk) (DELWP website iv).

The study area is located within Locations 1 and 2.

5 CONCLUSIONS

Description
The land at 147 Wollaston Rd Warrnambool that is the subject of this report has been subjected to past disturbance and contains vegetation that is degraded and comprised of predominately exotic plant species. Two native plant species: Lesser Loosestrife and a Rush species were recorded in the study area. These species occur in a few very small clumps (<1m2 each) and represent a minor component of the vegetation. These fragments are not considered 'patch vegetation.

Implications
No patch or scattered tree native vegetation is proposed to be impacted upon.

No State, National or Regionally significant plant species were recorded within the study area.

The proposal is assessed to have no implications under the Commonwealth EPBC Act.

Referral to DELWP is not required under the Native Vegetation Removal Regulations as no patch or scattered tree native vegetation is proposed to be removed.

Limitations
There are not considered to be any significant limitations to the findings of this study.

Appendix 1 - ASSESSING CONSERVATION SIGNIFICANCE

Conservation significance is assessed at a range of scales, including national, state, regional and local. Criteria used for determining the conservation significance of flora at national to local scales are presented below for botanical conservation significance.

Botanical Significance

National botanical significance applies to an area when it supports one or more of the following attributes:

a population of at least one nationally threatened plant species listed by Briggs and Leigh (1996) or plant species listed on the schedules to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

A nationally threatened ecological community listed on the schedules of the *Environment Protection and Biodiversity Conservation Act 1999*.

State botanical significance applies to an area when it supports one or more of the following attributes:

A population of at least one plant species threatened in Victoria, as listed by Gullan et al. (1990), NRE (2000a) or more recently in the unpublished records of the Flora Information System (NRE), or on the schedules to the Victorian *Flora and Fauna Guarantee Act 1988*.

An ecological community considered threatened in Victoria through its listing on the schedules of the *Flora and Fauna Guarantee Act 1988*.

Regional botanical significance applies to an area that supports one or more of the following attributes:

Supports a population of one or more regionally depleted species defined in a valid regional assessment of biodiversity (eg. Regional Native Vegetation Plan, Environment Conservation Council Report or Comprehensive Regional Assessment documents).

An ecological vegetation class that is considered endangered or vulnerable in a particular bioregion (based on Conn 1993 and the Regional Native Vegetation Plan), in which case the area is of **High Regional** significance.

An ecological vegetation class that is considered depleted in a particular bioregion (based on Conn 1993 and the Regional Native Vegetation Plan), in which case it is of **Regional** significance.

Local botanical significance applies to all remnant native vegetation that does not meet the above criteria. In much of Victoria native vegetation has been so depleted by past clearing and disturbance that all remaining vegetation must be considered to be of at least local conservation significance.

6 REFERENCES

Corangamite Catchment Management Authority (2005) 'Corangamite Native Vegetation Plan' CCMA Website.

DELWP Website i.
https://www.environment.vic.gov.au/__data/assets/pdf_file/0019/90523/Key-Changes-Overview.pdf

DELWP Website ii.
https://www.environment.vic.gov.au/native-vegetation/native-vegetation

DELWP Website iii.
http://www.depi.vic.gov.au/environment-and-wildlife/biodiversity/victorian-biodiversity-atlas

DELWP Website iv.
https://nvim.delwp.vic.gov.au/Biodiversity/RiskPathway#/

DELWP Website v.
https://mapshare.vic.gov.au/vicplan/

DELWP Website vi.
https://www.environment.vic.gov.au/biodiversity/bioregions-and-evc-benchmarks

Department of Environment, Land, Water and Planning (DELWP) (2017), *Guidelines for the removal, destruction or lopping of native* vegetation.

EPBC Website i
https://www.environment.gov.au/epbc/about/epbc-act-lists

EPBC Website ii.
http://www.environment.gov.au/system/files/resources/e97c2d51-08f2-45e0-9d2f-f0d277c836fa/files/grasslands-victoria.pdf

Oates, A. & Taranto, M. (2001): 'Vegetation mapping of the Port Phillip & Westernport region' Arthur Rylah Institute for Environmental Research, DNRE, Victoria.

Parkes, D., Newell, G. & Cheal, D. (2003): 'Assessing the quality of native vegetation: The habitat hectares approach. Parks, Flora & Fauna Division, DNRE, Victoria.

Royal Botanic Gardens Vicflora Website
https://vicflora.rbg.vic.gov.au

Walsh, N G & Entwisle, T (1994-1999): 'Flora of Victoria Vol 2-4' Inkata Press, Melbourne.

Plates 1-6 Site Photographs

Plate 1. Typical site condition showing dominance of exotic pasture grasses and weeds (view looking south from northern boundary).

Plate 2. Typical site condition showing dominance of exotic pasture grasses and weeds, and rocky heap (view looking south from northern section).

Plate 3. Typical site condition showing dominance of exotic pasture grasses and weeds, and dry dam (view looking east from southern section).

Plate 4. Small clumps of Rush *Juncus sp.* near the southern boundary.

Plate 5. From left: Red Ironbark and Red Flowering Gums near eastern boundary.

Plate 6. Evidence of recent tree clearing (looking south from northern section).