# WEST SALE AND WURRUK INDUSTRIAL SUPPLY STRATEGY

APPENDICES REPORT

**NOVEMEBER 2017** WELLINGTON SHIRE COUNCIL

**Urban Enterprise** **Urban Planning / Land Economics / Tourism Planning / Industry Software**

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# APPENDIX A INFRASTRUCTURE REPORT

# INFRASTRUCTURE REPORT

## WEST SALE AND WURRUK LAND SUPPLY STRATEGY

AUGUST 2017

# Infrastructure Report

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August 2018

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## Project Details

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# 1 Introduction

This report supports the Strategy which is to provide a land use planning rationale to justify, rezone and facilitate the development of an appropriate area of land, in the short-medium term, within West Sale and Wurruk in accordance with the recommendations of the adopted 'Sale, Wurruk and Longford Structure Plan (2010)'.

The three sites nominated within the Structure Plan for potential future industrial growth are located:

- **Site 1**

To the west of the existing industrial zoned land in Wurruk; The site is within Wurruk and lies to the west of the existing industrial estate, between the Princes Highway (and railway line) to the south and the Thompson River to the north. It is approximately 42Ha in area and is currently within the Farming Zone. The site is partially affected by the Flood and Land Subject to Inundation Overlays to the north. Figure 1 outlines the area for Site 1.

Figure 1: Site 1

- **Site 2**

Site 2 lies to the north of the Princes Highway and to the east of the West Sale Aerodrome. Figure 2 outlines the Site 2 area.

The site is approximately 79Ha in area and is currently within the Farming Zone. Both the Airport Environs Overlay 1 & 2 apply to the land. The activities of the adjacent Aerodrome are a potential constraint on the land – particularly given that a process is currently underway to facilitate a 300m extension to the eastern end of the existing runway. Recent discussions between Urban Enterprise and

the Aerodrome Manager and Wellington Shire Council has indicated a land swap is required to facilitate an extension to the runway at the aerodrome. With this land swap the area adjustment is a definite 54.5ha with a potential 3.8ha another 2.0ha which is considered unlikely to be included. This land swap arrangement for Site 2 is detailed in Figure 3.

- **Site 3**

Site 3 lies to the east of the Fulham Correctional Centre and to the south of the Princes Highway. The land is approximately 104Ha in area and is currently within the Farming Zone. The land is affected by the Airport Environs Overlay 2. Figure 2 outlines the Site 3 area.


Figure 2: Site 2 and 3


Figure 3: Site 2 modified

This report focuses on:

Identifying the key infrastructure requirements (including associated financial costs) that are necessary to 'unlock' the potential for the development of the identified additional land in the short-medium term that will assist in delivering the land to the market.

The following areas will be subjects of interest focussed on in this report:

- Water supply.
- Sewerage.
- Local government development requirements.
- Stormwater and issues inherent from local flooding and catchment management.
- Electricity.
- Gas supply.
- Telecommunications.

# 2 Summary of Previous Studies

A number of previous studies including the development Sale, Wurruk and Longford Structure plan have been undertaken in recent times and provide the platform for the West Sale and Wurruk Industrial Land Supply Strategy. Below is a brief summary of the previous investigations relevant to infrastructure in the West Sale and Wurruk area:

- Sale, Wurruk and Longford Structure Plan including Issues and Options Paper (2010):

  The structure plan identified the areas in West Sale and Wurruk to facilitate industrial development. It is was acknowledged capacity issues associated with providing cost-effective service infrastructure (e.g. piped water and sewerage) was apparent.

- Wellington Shire Council: Economic Development Strategy (2016-2022)

  This report identified facilitating investment in infrastructure with the need to continue to invest in ports, rail and roads.

- Gippsland Regional Growth Plan (2014)

  This report is a broader scale assessment and identifies Sale as an area that contains infrastructure. However, to facilitate growth it requires mid to high levels of investment to deliver infrastructure to support future growth.

- Wellington Planning Scheme Policy and Zone Amendments – Industrial and Business Zones (October 2007)

  The report identified the West Sale Aerodrome and adjoining land as favourable sites suitable to accommodate future industrial land provision but acknowledged one of the major constraints to be the lack of infrastructure provision.

- Sale Industrial Land and Retail Assessment (May 2006)

  This report identifies the need for any future industrial land supply to have appropriate transport connectivity and available infrastructure to service development.

- Sale Industrial and Bulky Goods Zone Areas Review (October 2004)

  This report identifies that most industries require a range of services in order to operate effectively. While most industries have a standard requirement for services, it is important to acknowledge few industries are heavy users of various services and this is an important consideration when assessing existing infrastructure or new infrastructure.

# 3 Site infrastructure assessments

## 3.1 Water Supply

Gippsland Water is the authority responsible for the provision of water facilities. The advice provided by Gippsland Water (GW) is:

Gippsland Water (GW) have completed water modelling to determine the effect of the three candidate sites on the existing infrastructure and advise what upgrades are required to service the ultimate scenario. For the base case GW used 500 lots via a sole feed from the residential area known as "The Ridge" water main. This was to test the existing 225mm main within Wurruk. Beyond 500 lots in Wurruk a secondary interconnection main is needed along Settlement Road. A copy of the water modelling report is in Appendix 1 of this report which includes a plan detailing the three nominated sites and the future residential growth area included in the modelling.

The three identified areas, as well a future subdivision were assigned relevant diurnal patterns to simulate their usage: The diurnal pattern applied for the Industrial sectors were based on the existing pattern for the Wurruk/Sale Industrial sector and an additional 20%. The current residential pattern in the catchment was applied to the 500 lot subdivision.

An average peak demand was applied to each of the areas by assuming a peak day consumption rate of 1300 L/Lot/Day and 5 lots per hectare for the industrial areas.
The peak hour demands of the three industrial areas were:

- Site 1 = 6.1 L/s
- Site 2 = 10.1 L/s
- Site 3 = 20.2 L/s

The findings from modelling undertaken by Gippsland Water are:

- Site 1 can be serviced without any upgrades to the existing system, via an extension of the 150 mm main along Hunt Place. For modelling purposed a 180 OD HDPE 100 main was used.

- Site 2 and Site 1 + Site 2 can be serviced with the existing network if moderate headlosses are accepted, particular with the later scenario,

- Site 3 individually will require a minimum upsize to 300 mm to avoid moderate to high headlosses along the 225 mm distribution main (4.2 km section).

- Any of the remaining options including Site 3, requires the 225 mm distribution main to upgraded to a 375 or 450 mm. Furthermore the pumps at the Wurruk TWPS would need to be replaced in order to accommodate the increased flows and subsequent headlosses.

Basically the preliminary modelling and analysis indicates that Site 1 and Site 2 could be supported with minor pump station upgrades. Beyond that the 5km distribution main will need to be increased from 225mm to likely 375mm.

## 3.2 Sewer

Gippsland Water is the authority responsible for the provision of sewerage reticulation. The advice provided by Gippsland Water (GW) is:

**Sewer - Site 1 (about 30 developable hectares)**

The current Wurruk Estate has a SPS (sewer pump station) with capacity for the additional 30 hectares.

The current sewer main to the north of current estate (Riverside Drive) has a sewer main with an Upstream Invert Level of 9.91 metres.

To service all of the area, with a sewer main extension the IL at the west extent of Area 1 will need to be about 17 metres.

Therefore about 50% of this area can gravitate and the other 50% will need to have a new sewer pump station.

All of the costs for this infrastructure would be borne by the developer.

Depending on the loading from the new estate the existing 150mm main may need to be increase to 225mm.

Figure 4: Site 1 – Existing Sewer Infrastructure

**Sewer - Site 2 (about 50 developable hectares) – assessed individually**

There is no sewer in this area. The rising main from the Fulham Correctional Facility SPS runs up Hopkins Road and then along the Princes Hwy into Wurruk (roundabout before bridges). About 7600 metres in length.

The rising main is DN200 DICL PN35 RRJ.

The typical dry weather loading in GW region for light industrial is about 6500 litres/day/hectare. Therefore an average dry weather of 3.8 l/s for the 50 hectares.

With wet weather added – increase by factor of 6 (rule of thumb) – therefore about 22.8 l/s.

Potentially this 22.8 l/s could be injected in the rising main, at chainage 1600 metres, however this will significantly impact the flow rate of the Fulham Correctional SPS (FC SPS).

The frictional headloss of the FC SPS is currently about 35 metres (35 l/s). Adding an additional 22.8l/s at chainage 1600, will increase the frictional headloss by another 52 metres.

For this area to go either the FC SPS will need to be upgraded (pumps, electrics, detention storage) or the rising main increased to reduce the frictional headloss.

**Sewer – Site 3 (about 100 developable hectares) – assessed individually**

There is no sewer in this area. The rising main from the Fulham Correctional Facility SPS runs up Hopkins Road and then along the Princes Hwy into Wurruk (roundabout before bridges). About 7600 metres in length.

The rising main is DN200 DICL PN35 RRJ.

The typical dry weather loading in GW region for light industrial is about 6500 litres/day/hectare. Therefore an average dry weather of 7.6 l/s for the 100 hectares.
With wet weather added – increase by factor of 6 (rule of thumb) – therefore about 45.6 l/s.
The injection point would be at chainage 300m, and again will significantly affect the flow rate of FC SPS.

The frictional headloss of the FC SPS is currently about 35 metres. Adding an additional 45.6l/s at chainage 300, will increase the frictional headloss by another 143 metres (178 metre of friction).

For this area to go **BOTH** the FC SPS will need to be upgraded **AND** the rising main increased to reduce the frictional headloss.

**Old rising main from Fulham.**

Figure 5 details an abandoned GW rising main which has been identified by the water authority as a potential item of infrastructure that could potentially be utilised as a stormwater outlet. It may have a benefit to provide a slow release outlet for stormwater from future development in the area. The condition of the rising main is considered to be fair.

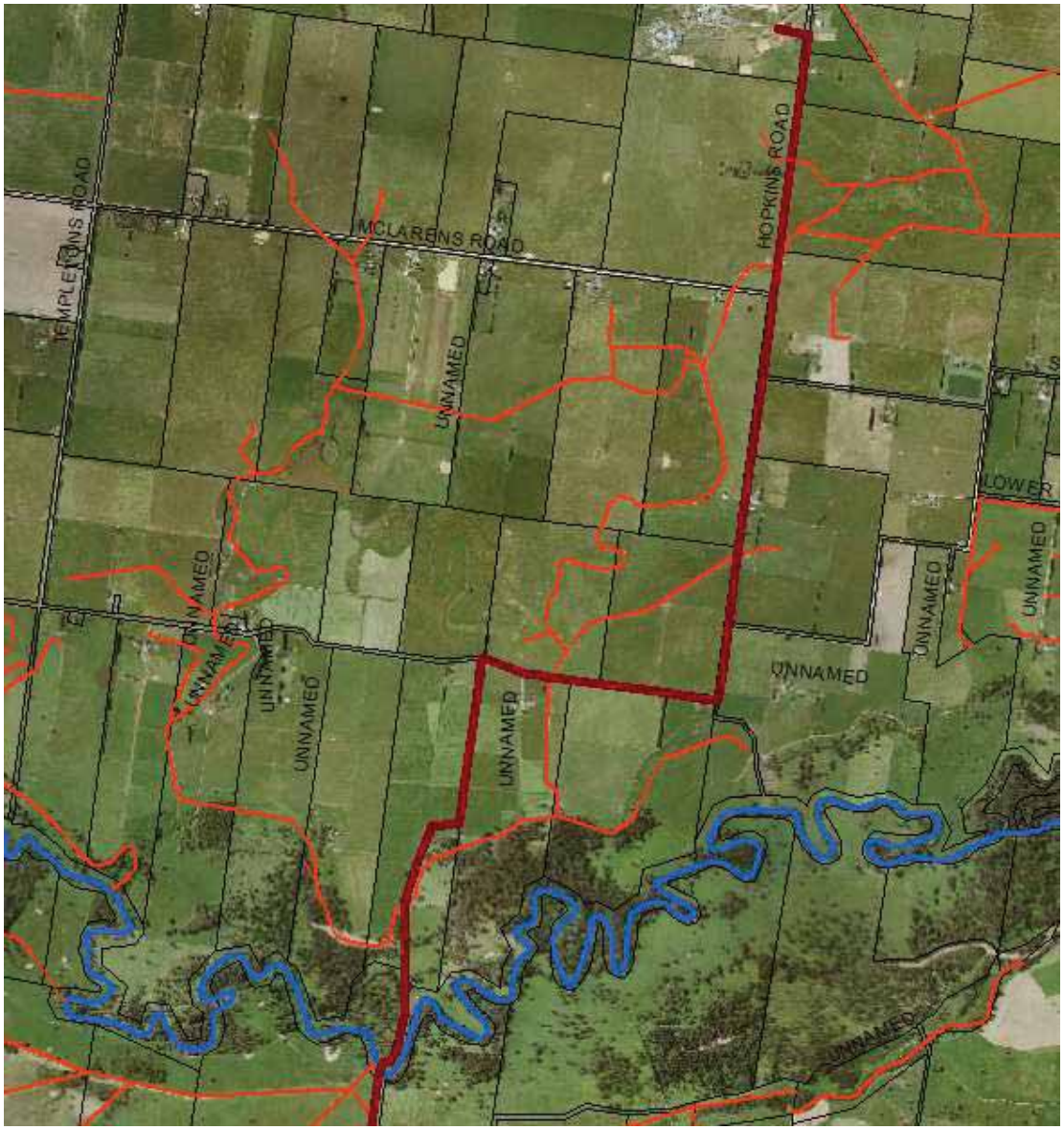



Figure 5: Old 150mm diameter rising main from Fulham

## 3.3 Stormwater

### Wellington Shire Council

The existing local drainage is maintained by Wellington Shire Council (WSC). Advice from Wellington Shire Council engineering department is:

The typical IDM industrial street cross section drawing of. Table 2 Urban Road / Street characteristics in the IDM (refer Figure 6 below) would enable for appropriate overland flow paths for stormwater.

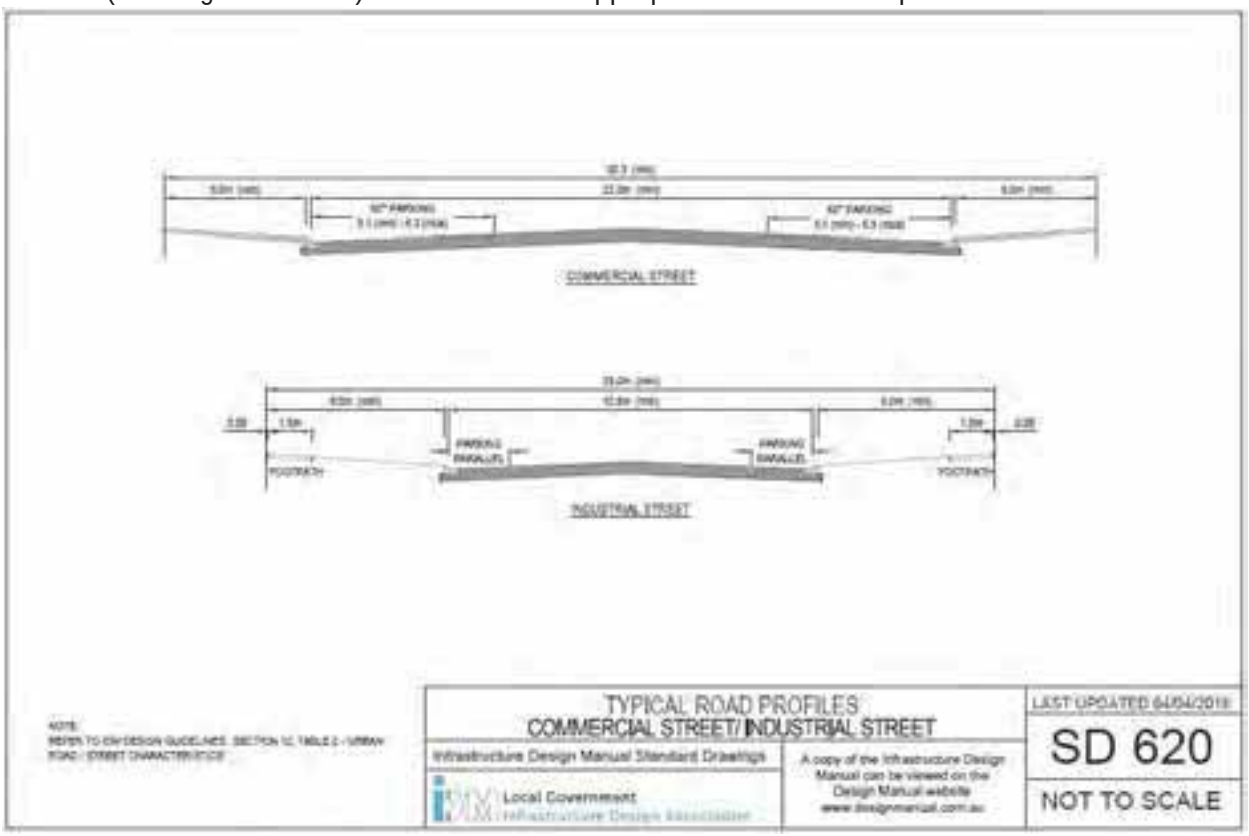



Figure 6: Typical industrial street cross section

Drainage will follow the same approach as a typical low density residential zone development. Industrial subdivisions drainage must cater for the 10% AEP event with 1% event typically as overland flow. Outfalls for the candidate areas are described below:

- **Site 1**

Subject to West Gippsland Catchment Management Authority (WGCMA) approval/conditions but likely to the Thompson River to the north of the site. Overland flow to river will be okay with treatment;

- **Site 2**

There is an existing drain along the eastern extent airfield which eventually drains down to the Central Gippsland No. 4 drain as highlighted in Figure 7. Overland flow is expected to be okay with typical levels of retention though it will require further detailed investigation. There is a current project to extend the runway which Wellington Shire Council will be required to re-arrange the final drainage in this area but it will ultimately drain to the same No. 4 drain.

Figure 7: Central Gippsland Drain No.4

- **Site 3**

There is a nominated drain which is part of the Kilmany drainage system as per Figure 8. The site can discharge into this drain however the final stormwater strategy may need to take into account for a higher level of retention as any water not lost through evaporation and transpiration may ultimately drain to the private levee near the outlet to the Latrobe River. Any future development needs to account for any additional overflow from the land which would need to be managed by water harvesting or retention before ever hitting the levee bank which is approximately 7km away from the site.


Figure 8: Kilmany Drain

**West Gippsland Catchment Management Authority**

West Gippsland Catchment Management Authority (WGCMA) are a government organisation responsible for managing the land and water resources in West Gippsland. Advice from the West Gippsland Catchment Management Authority (CMA) includes:

Figure 9 highlights the designated waterways and known flood extents in the Wurruk area.

Unique to this area is a flood levee known as the Kilmany Levee Bank. Although this area is unique as any significant stormwater flow that drains to this area needs to be pumped past the levee bank, it is acknowledge that pumping of stormwater is very infrequent. The actual flow from the catchment that reaches the levee bank is very minimal as most water is either stored in existing farm dams, waterways and lost through evaporation and transpiration. The cost of pumping the stormwater falls to the land holders who own land behind the levee.

It is likely that part of Site 2 and all of Site 3 would drain to this point. Without further detailed hydrological and hydraulic analysis which is not included in this study, it is difficult to determine the actual size of sub catchment within site 2 that drains to the Kilmany drain. However, the land in the region is reasonably flat and therefore future development can be engineered to ensure a significant portion of the catchment drains to the north and discharges into the Central Gippsland Drain No.4.

In Figure 9 WGCMA have highlighted the drainage path from Site 2 and Site 3 to the Kilmany Levee which is shown as a red line.

If stormwater does drain to this location it will need to be managed to meet best practice stormwater quality targets as well as ensure that the quantity is managed. This will potentially require additional on site storage compared to traditional best practice stormwater treatment.

Based on the above requirements TGM have calculated that to manage stormwater runoff to pre development rates and volumes requires drainage reserves to be set aside to enable stormwater detention. The encumbered land for:

- Site 2 is 4.06ha
- Site 3 is 8.48ha

Which equates to approximately 8 % of the land area. The above is based on a rudimentary calculation and does not include any detailed assessment to calculate flood hydrographs and assess streamflow routing. Hence the area required to set aside for stormwater detention may possibly be of a greater percentage that those above. The above also assumes an average storage depth of 0.5m. If the storage depth can be increased this can reduce the actual area required for detention.

As noted in section 3.2 Gippsland Water have advised of a redundant rising main that heads to the La Trobe River from Fulham correctional facility via Hopkins Road. This a 150mm diameter pipe which would have capacity to discharge a small amount of stormwater. It would have minimal benefit to reduce the on site detention. To provide a more appropriate sized drainage outlet along this route a nominal size 900mm diameter pipe is recommended. The distance to the La Trobe River is 400m so the cost to deliver this this drainage outfall is approximately $3.0 million.

It is noted that Site 1 does not require the same level of stormwater detention as there is a great ability to discharge the stormwater to the Thompson River. However, Site 1 is subject to flooding from the Thompson River and therefore is affected by a flood extents. The area that is encumbered by a flood extents can be utilised so locate a stormwater treatment system including any additional flood storage. Final approvals would be subject to WGCMA assessment.

Figure 9: Designated Waterway and Kilmany Drain

## 3.4 Electricity

The advice from Ausnet, the electrical authority responsible for electricity infrastructure, is that it appears the current infrastructure is sufficient to support additional loading of 1–2 MVA in the shorter term.
As shown in Figure 10 AusNet Services has two rural style 22kV line known as MFA23 and SLE14 distribution feeders.

- These feeders presently have the capability to support 1-2MVA in the location shown.
- This should be suitable for the first stages of development.
- This may not be capable of supporting the ultimate demand of these sites. This will depend significantly on the electrical demand of customers within the estate.
- Augmentation two the lines can be undertaken and this will increase the availability of power. This can be determined once development is undertaken.
  Normal supply policy contribution and cost will be incurred to reticulate the site.


Figure 10: Electricity – Existing Infrastructure

## 3.5 Gas

APA Group are responsible for managing the gas supply network in Sale. The advice received from APA includes:

- The subject sites are adjacent to existing gas reticulation infrastructure but not of a capacity to support any major industrial loads. The current infrastructure has been installed to suit the supply required for Fulham and the Aerodrome.
- APA Networks do not automatically reticulate industrial estates, supply is determined from customer connection requests – generally made through a retailer.
- To supply any major load, either duplication of the existing supply main or upstream augmentation maybe required.

## 3.6 Telecommunications

The agent for the roll out of the telecommunication services will be the responsibility of the National Broadband Network (NBN).

The Dial before you Dig information indicates NBN assets are located within this region. According to the NBN website it is also noted that the Wurruk region is NBN ready and new and existing developments can connect to the NBN service through a NBN provided.

There is no expectation for any backhaul charges.

# 4 Site Infrastructure Comparison

Based on the infrastructure assessments the below table assesses a comparison between each site in terms of what infrastructure upgrades are necessary and what the potential costs are required for upgrade to these area to meet the future development. The below table is based on a light industry demand.

| | Site 1 | | Site 2 | | Site 3 | |
|---|---|---|---|---|---|---|
| Infrastructure Item | Description of Upgrade | Cost ($ mil) | Description of Upgrade | Cost ($ mil) | Description of Upgrade | Cost ($ mil) |
| Water | Can be serviced without any upgrades to the existing system, via an extension of the 150 mm main along Hunt Place | $0 | Site 2 and Site 1 + Site 2 can be serviced with the existing network | $0 | Site 3 individually will require a minimum upsize to 300 mm to avoid moderate to high headlosses along the 225 mm distribution main (4.2 km section) (@$500/m) | $2.1 mil |
| Sewer | New sewer pump station for 50% of site. | $0.75 | Fulham Correction SPS to be upgraded | $1.5 | The Fulham Correction SPS will need to be upgraded ($2.1mil) **AND** the rising main upgraded (7.6km). (4.2km @ $500/m) | $4.2 |
| Stormwater | Wetland/ Detention System | $1.0 | Wetland/ Detention System | $2.0 | Wetland/ Detention System ($2.5mil) and 900mm dia outfall (4.0km @$750/m) | $5.5 |
| Electricity | | $0 | | $0 | | $0 |
| Gas | Upgrade gas main to site | $0.18 | Upgrade gas main to site | $1.35 | Upgrade gas main to site | $1.50 |
| Telecommun-ications | | $0 | | $0 | | $0 |
| TOTAL | | $1.93 | | $4.85 | | $13.30 |

Figure 11: Infrastructure comparison

# 5 Summary

The three nominated sites in West Sale and Wurruk have been assessed to determine whether existing infrastructure can support future industrial development and where necessary, what investments are necessary and what constraints exists. The assessment was based on assessing existing data and reports, and consultation with key authorities and stakeholders.

Based on previous studies it was identified the areas had a reasonable level of infrastructure in the area but there was a definite need for investment to facilitate future growth.

The study has determined that Site 1 has the least investment required while Site 3 requires the highest investment. It is important to acknowledge the land areas are not equal so it is disproportionate. If the areas were of equal size the actual costs would change. However, it is clear that site 2 and 3, regardless of their size do have infrastructure constraints, namely sewer and stormwater.

It was established that Site 3 is heavily constrained with site stormwater management in that any increase in stormwater outflow from future development impacts downstream landowners who are required to manage existing stormwater from upstream properties. Changes to the stormwater conditions adversely impacts these landowners. Site 2 also has a sub catchment area subject to the same conditions to site 3. Hence, to manage stormwater for Site 2 and 3 land from these areas are to be made available for on-site detention.

Site 1 is subject to having access to the existing industrial area to the east and has been assumed in this report. Therefore direct access to this industrial area is necessary to ensure development of Site 1, otherwise, the infrastructure investment will be more significant.

Finally, this report has assessed the land use for industrial growth primarily on light industry demand. Should there be an industrial business that require a heavy demand on infrastructure it would result in the need for larger infrastructure upgrades to those identified in this report. However, given the assessment is based on the same industrial demand for each of the candidate sites it is a relative comparison and it would be expected similar differences but on larger cost scales.

# 1 Appendix 1 (Gippsland Water - Water Modelling Report)

# West Sale & Wurruk Industrial Modelling Results

## Objective:

Determine the effect  the three candidate areas identified in the West Sale & Wurruk Industrial Land Management Strategy would have on the existing water infrastructure in the area, and determine what upgrades are required to service the ultimate scenario (3 areas).

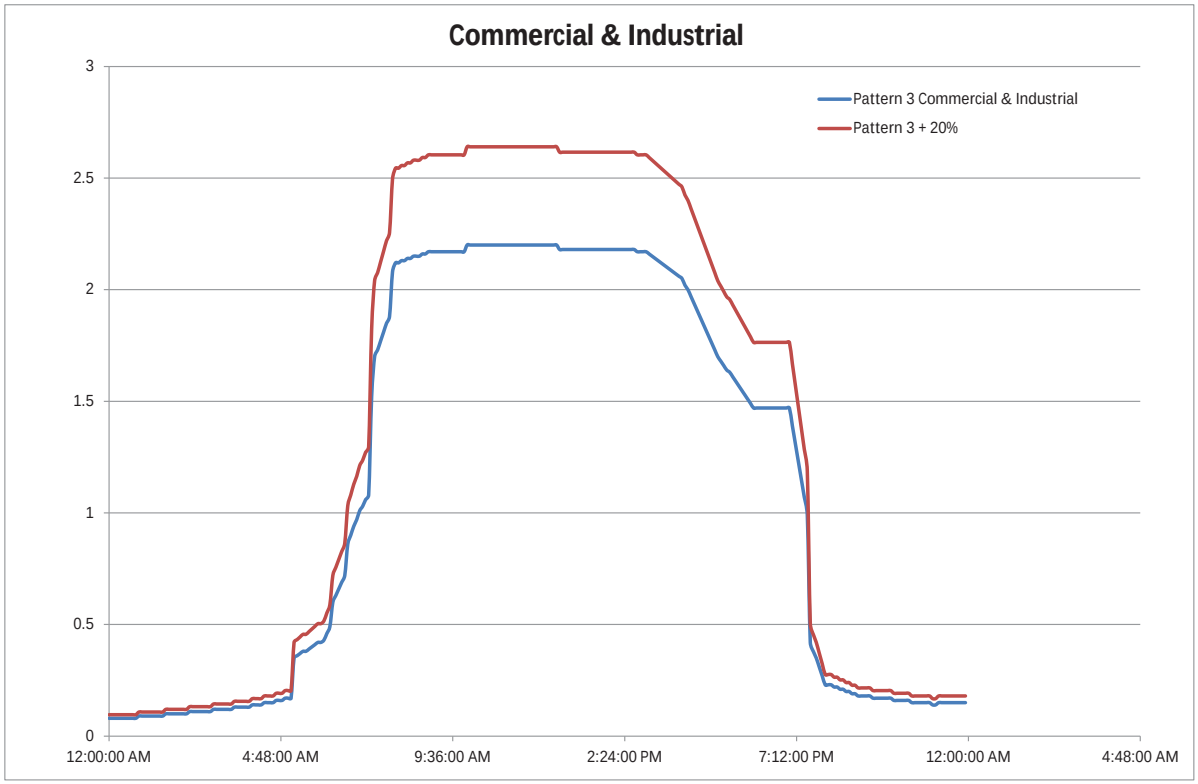

## Procedure:

The three identified areas, as well a future subdivision were assigned relevant diurnal patterns to simulate their usage: The diurnal pattern applied for the Industrial sectors were based on the existing pattern for the Wurruk/Sale Industrial sector and an additional 20%. The current residential pattern in the catchment was applied to the 500 lot subdivision.

An average peak demand was applied to each of the areas by assuming a peak day consumption rate of 1300 L/Lot/Day and 5 lots per hectare for the industrial areas.

The peak hour demands of the three industrial areas were:

- Area 1 =  6.1 L/s
- Area 2 = 10.1 L/s
- Area 3 = 20.2 L/s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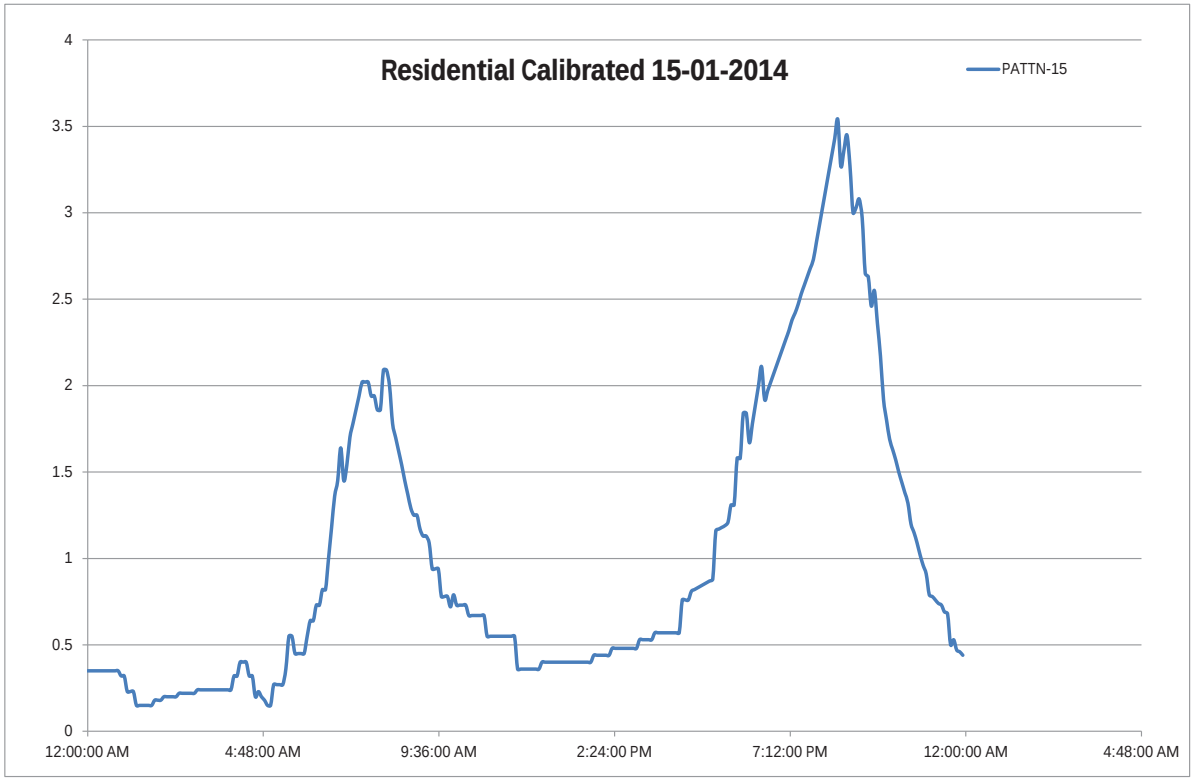
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## Results

| Scenario | Pressure Affects | Headloss Affects | Infrastructure Upgrades Required |
|---|---|---|---|
| Base Case | Minimum Pressure = **17.98 m** at the westerly most point at the corner of Mortimer Drive and Hawker Place. | Negligible headloss along 225 mm distribution main, with 2-3m headloss/100m along 150 mm main to Wurruk Correctional Facility. | Nothing Required |
| AREA 1 | Minimum Pressure = **17.75 m** at the westerly most point at the corner of Mortimer Drive and Hawker Place. | Negligible headloss along 225 mm distribution main, with 2-3m headloss/1000 m along 150 mm main to Wurruk Correctional Facility. | Nothing Required |
| AREA 2 | Minimum Pressure = **18.65 m** at the westerly most point at the corner of Mortimer Drive and Hawker Place. | 1-2 m headloss/1000 m along 4.2 km section of 225 mm main.<br>2-3 m headloss along new 150 mm main to service Area 2.<br>4-5 m headloss/1000 m along Wurruk Correctional Facility main. | 4.2 km of 300 mm main is required to replace the existing 225 mm distribution main to minimise headloss. The main should be larger than 300 mm (i.e. 375 mm) if Area 3 is also planned. |
| AREA 3 | Minimum Pressure = **18.53 m** at the westerly most point at the corner of Mortimer Drive and Hawker Place. | 2-3 m headloss/1000 m along 5.0 km section of 225 mm main.<br>4-5 m headloss/1000 m along Wurruk Correctional Facility main. | 4.2 km of 300 mm main is required to replace the existing 225 mm distribution main to minimise headloss. The main should be larger than 300 mm (i.e. 375 mm) if Area 3 is also planned. |
| AREA 1 + AREA 2 | Minimum Pressure = **18.63 m** at the westerly most point at the corner of Mortimer Drive and Hawker Place. | 1-2 m headloss/1000 m along 4.2 km section of 225 mm main.<br>2-3 m headloss along new 150 mm main to service Area 2.<br>4-5 m headloss/1000 m along Wurruk Correctional Facility main. | No upgrades are required if GW are willing to accept moderate headloss during peak periods along the 4.2 km section of the 225 mm main. |
| AREA 1 + AREA 2 + AREA 3 | All pressures west of Sale Heyfield Road are well below customer charter. The Wurruk Booster Pump Station is unable to produce the required head to over the headloss and the increased demand of the industrial areas. | 4-5 m headloss/1000 m along 4.2 km section of 225 mm main.<br>2-3 m headloss along new 150 mm main to service Area 2.<br>4-5 m headloss/1000 m along Wurruk Correctional Facility main. | 4.2 km of >300 mm main is required to replace the existing 225 mm distribution main to minimise headloss and bring pressures to customer charter levels.<br>Furthermore the Wurruk TWPS cannot produce the head required to overcome the substantial headloss. A larger main is likely to reduce the headloss in the main, thus potentially eliminating the need for a pump upgrade. |
| AREA 1 + AREA 2 + AREA 3 (With 300 mm Upgrade) | Pressures are better with 300 mm main; however areas west of Hopkins Road still remain below charter. | 1-2 m headloss/1000 m along 4.2 km section of 225 mm main.<br>2-3 m headloss along new 150 mm main to service Area 2. | This scenario shows that a 300 mm main is not sufficient and hence a 375 or 450 mm is required if both Areas 2 and 3 are proposed.<br><br>Pressures issues still remain and hence with this ultimate scenario, a pump capable of producing around 100m head would be required. |

| | | | |
|---|---|---|---|
| AREA 2 + AREA 3 | All pressures west of Sale Heyfield Road are well below customer charter. The Wurruk Booster Pump Station is unable to produce the required head to over the headloss and the increased demand of the industrial areas. | 4-5 m headloss/1000 m along 4.2 km section of 225 mm main.<br>2-3 m headloss along new 150 mm main to service Area 2.<br>4-5 m headloss/1000 m along Wurruk Correctional Facility main. | 4.2 km of >300 mm main is required to replace the existing 225 mm distribution main to minimise headloss and bring pressures to customer charter levels.<br>Furthermore the Wurruk TWPS cannot produce the head required to overcome the substantial headloss. A larger main is likely to reduce the headloss in the main, thus potentially eliminating the need for a pump upgrade. |
| AREA 2 + AREA 3 (With 300 mm Upgrade) | Pressures are better with 300 mm main; however areas west of Lyon Crescent still remain below charter. | 1-2 m headloss/1000 m along 4.2 km section of 225 mm main.<br>2-3 m headloss along new 150 mm main to service Area 2. | This scenario shows that a 300 mm main is not sufficient and hence a 375 or 450 mm is required if both Areas 2 and 3 are proposed.<br><br>Pressures issues still remain and hence with this ultimate scenario, a pump capable of producing around 100m head would be required |
| AREA 1 + AREA 3 | Minimum Pressure = **18.57 m** at the westerly most point at the corner of Mortimer Drive and Hawker Place. | 2-3 m headloss/1000 m along 5.0 km section of 225 mm main.<br>4-5 m headloss/1000 m along Wurruk Correctional Facility main. | The 5.0 km section of 225 mm main would need to be upgraded to a minimum of 300 mm to ensure moderate-high headlosses are not experienced during peak periods. |

## Conclusion

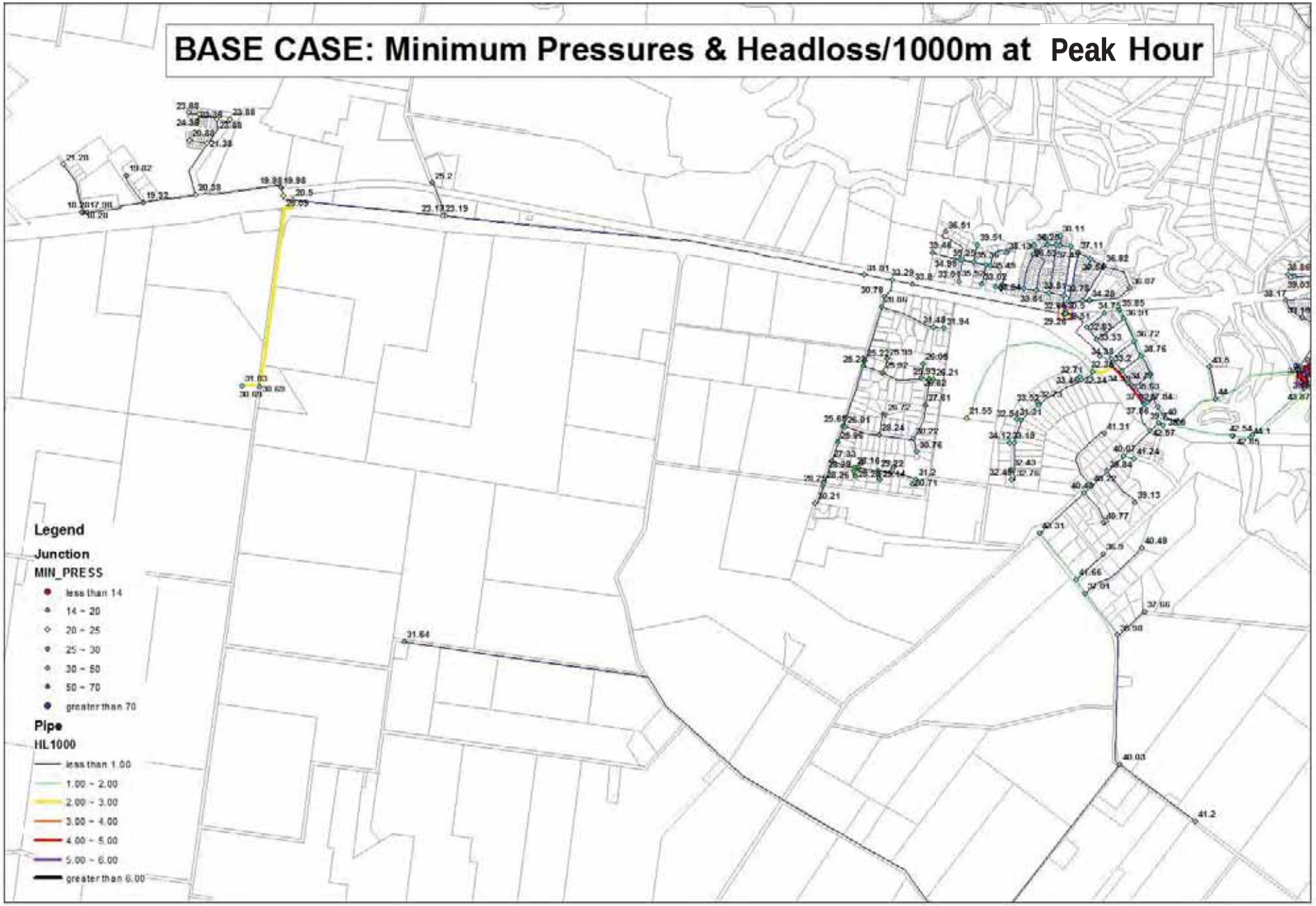
- Area 1 can be serviced without any upgrades to the existing system, via an extension of the 150 mm main along Hunt Place. For modelling purposed a 180 OD HDPE 100 main was used.

- Area 2 and Area 1 + Area 2 can be serviced with the existing network if moderate headlosses are accepted, particular with the later scenario,

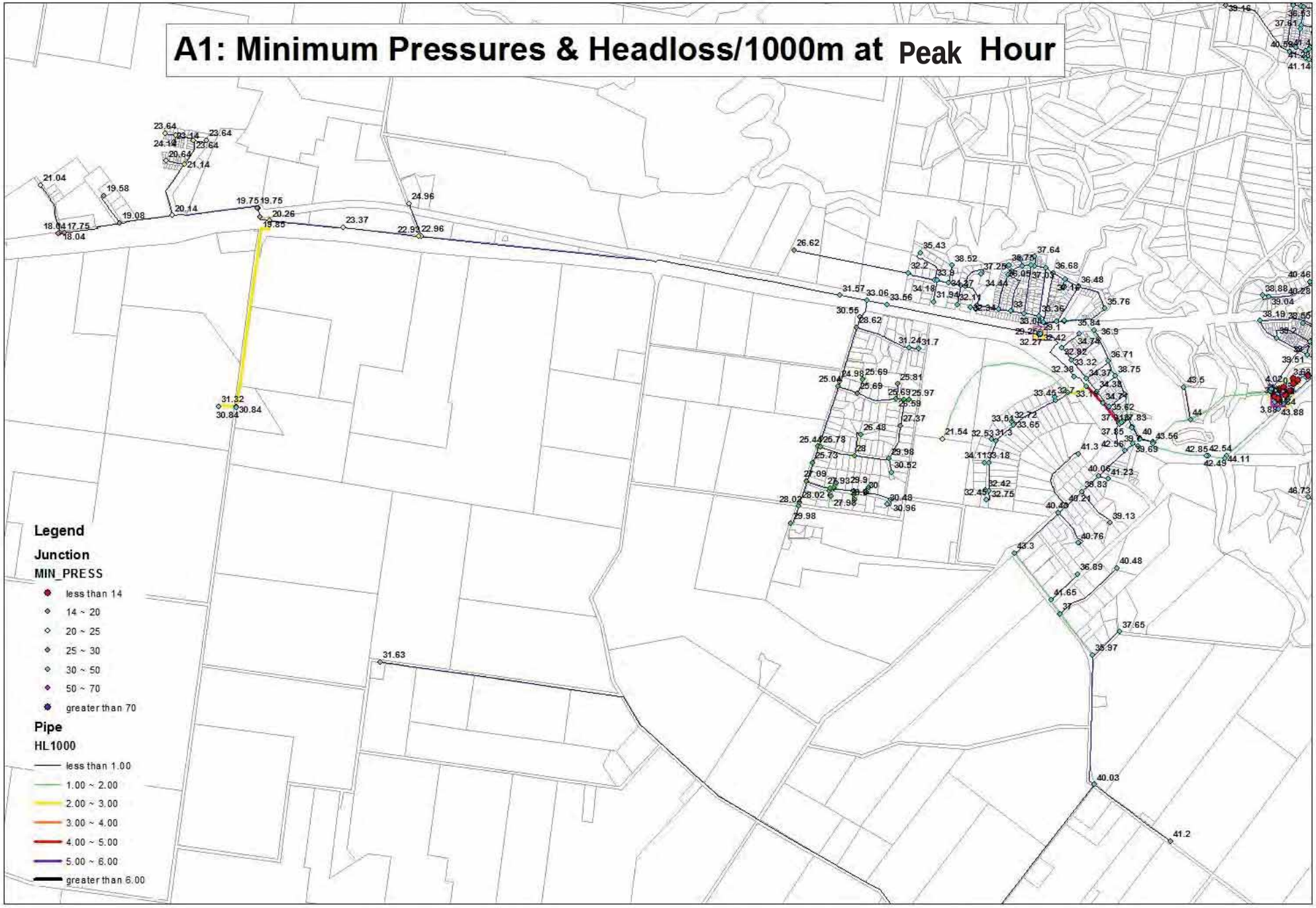
- Area 3 individually will require a minimum upsize to 300 mm to avoid moderate to high headlosses along the 225 mm distribution main (4.2 km section).

- Any of the remaining options including Area 3, requires the 225 mm distribution main to upgraded to a 375 or 450 mm. Furthermore the pumps at the Wurruk TWPS would need to be replaced in order to accommodate the increased flows and subsequent headlosses.

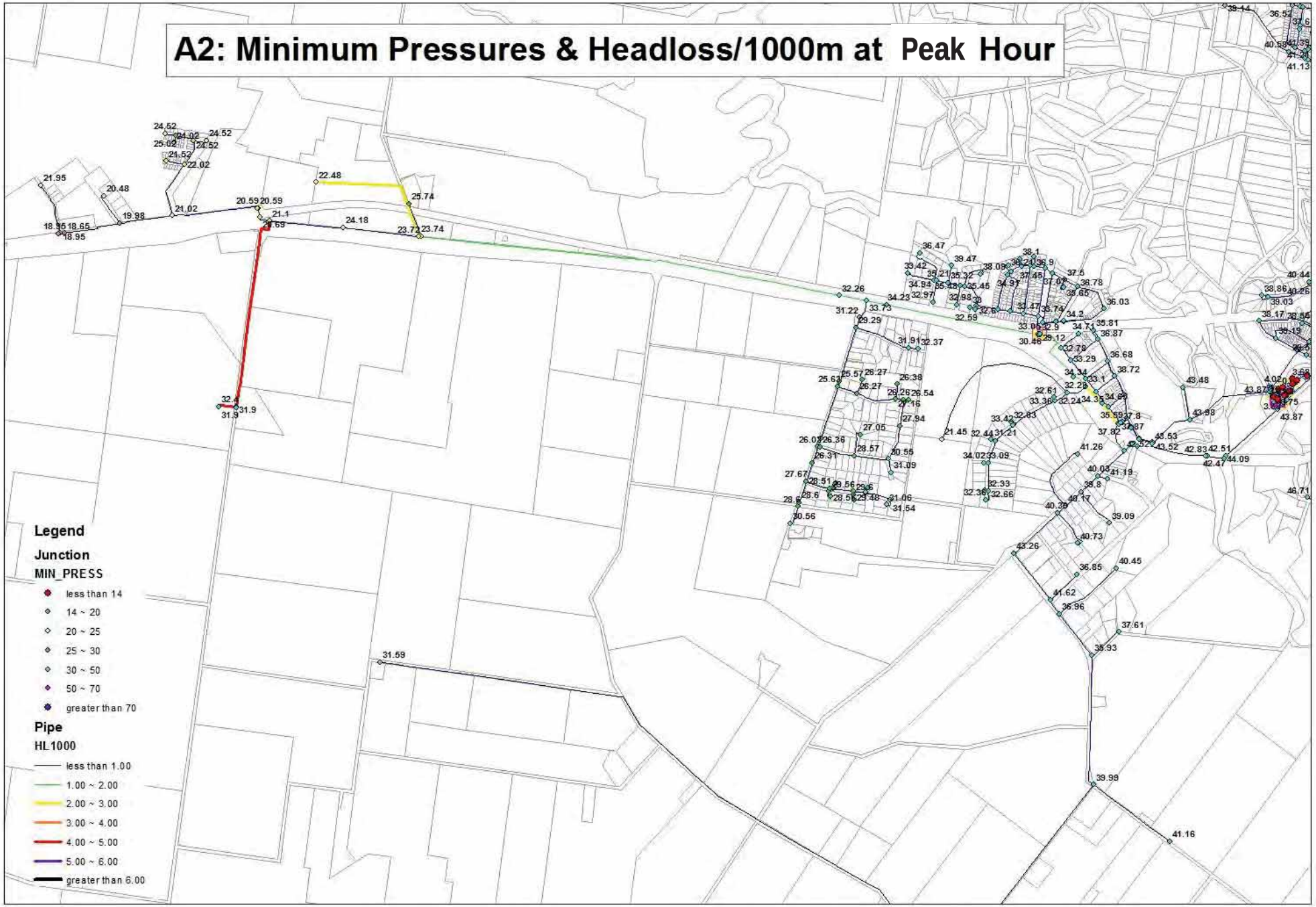
# BASE CASE: Minimum Pressures & Headloss/1000m at Peak Hour



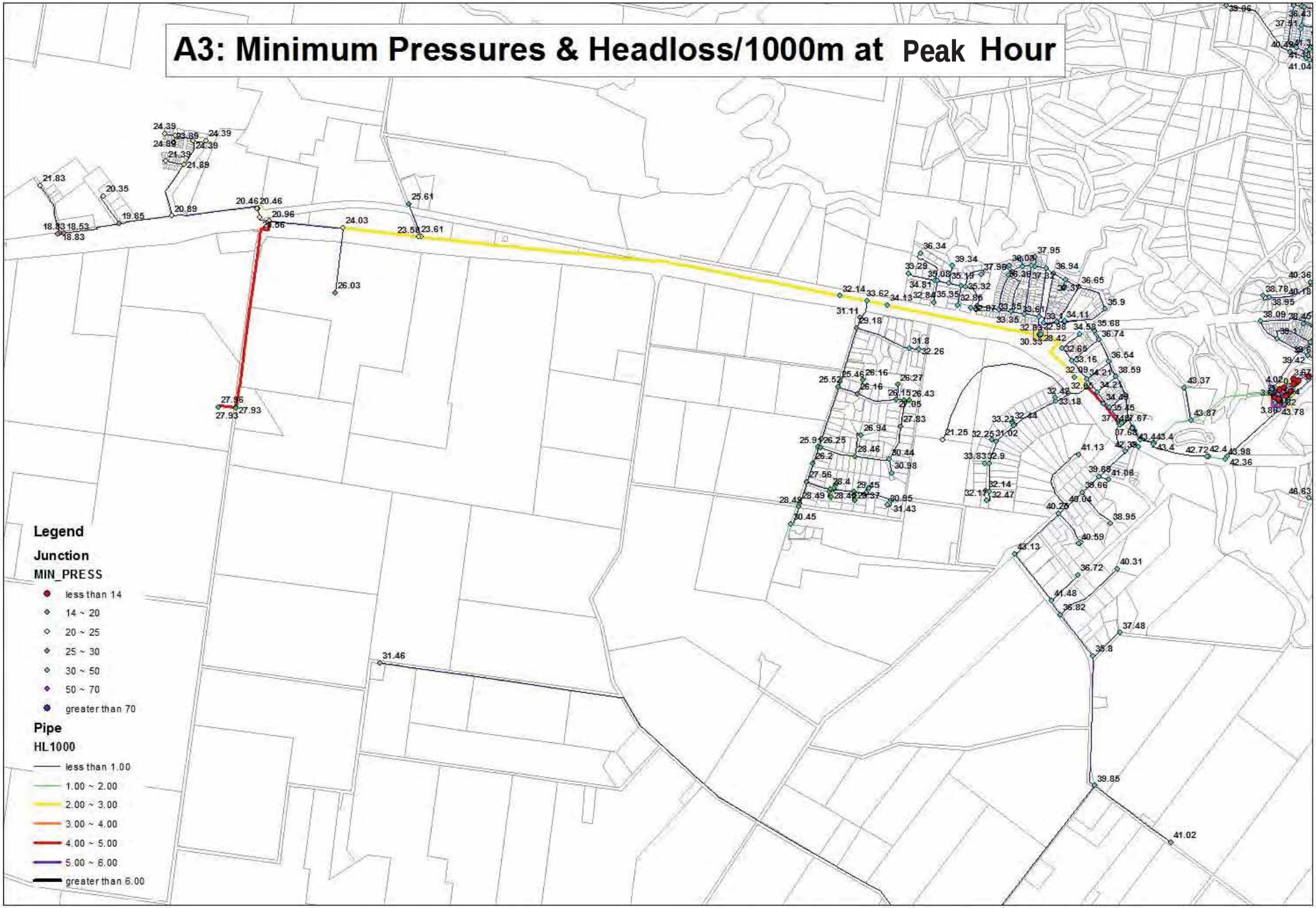
# A1: Minimum Pressures & Headloss/1000m at Peak Hour



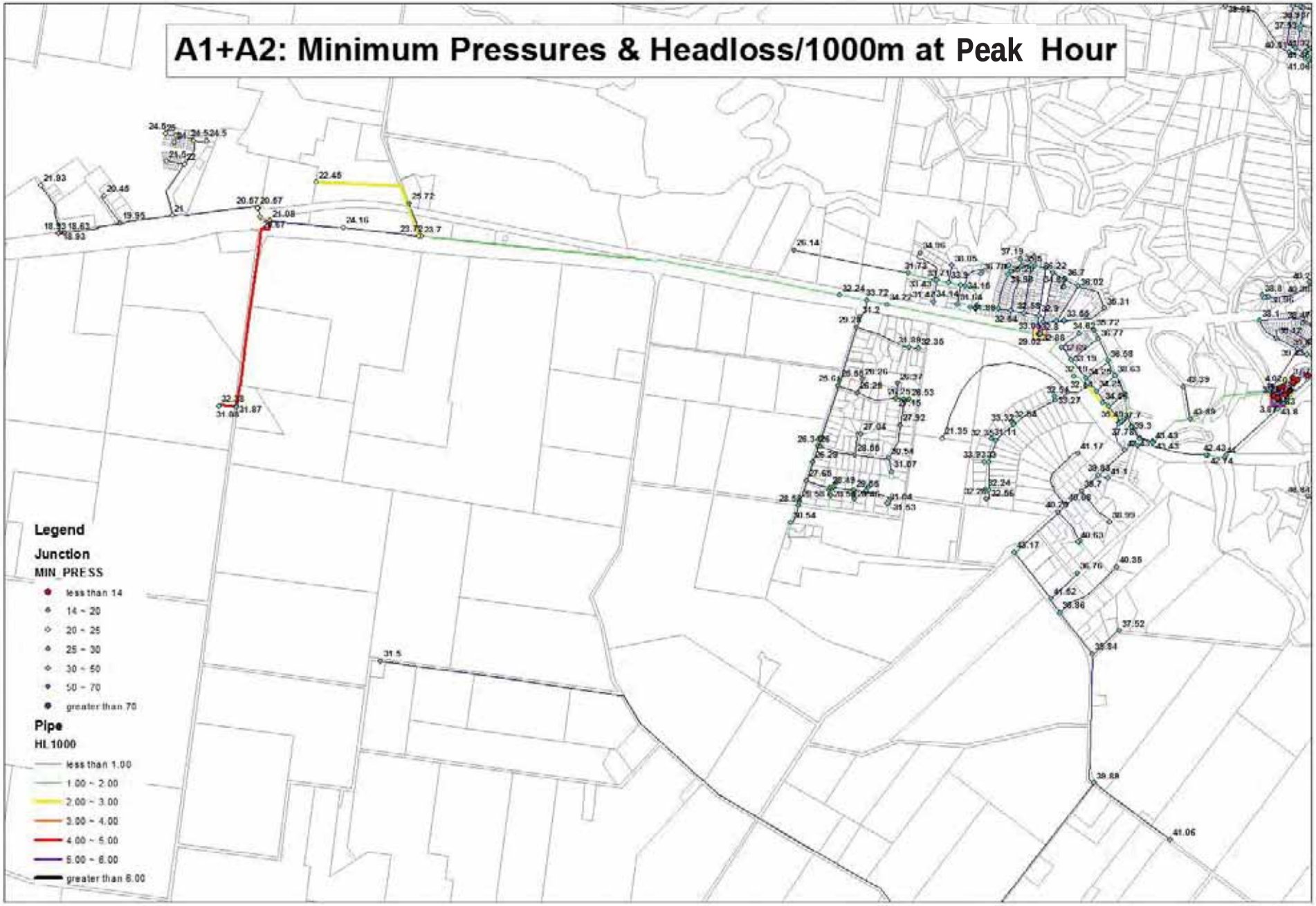
# A2: Minimum Pressures & Headloss/1000m at Peak Hour



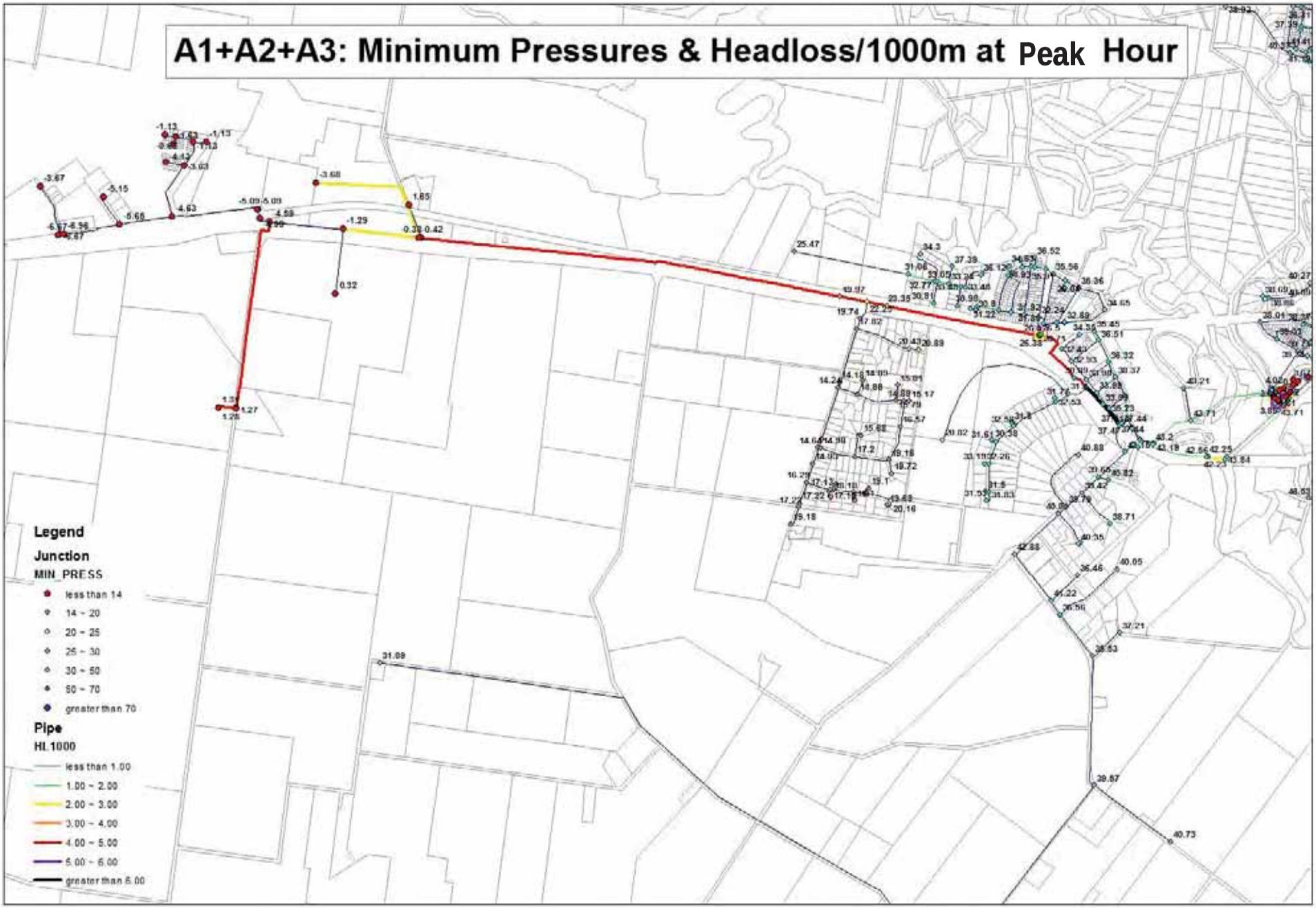
# A3: Minimum Pressures & Headloss/1000m at Peak Hour



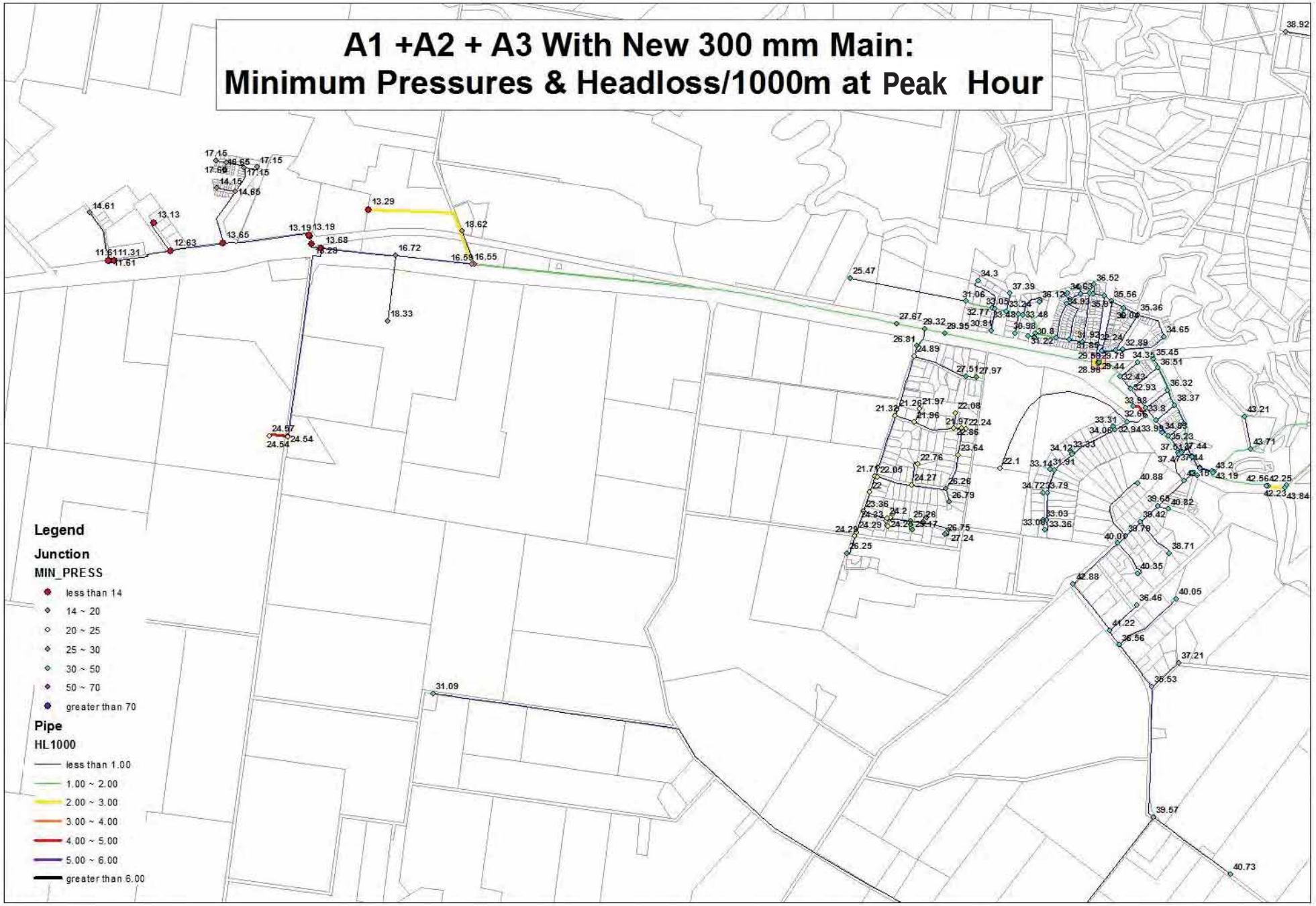
# A1+A2: Minimum Pressures & Headloss/1000m at Peak Hour

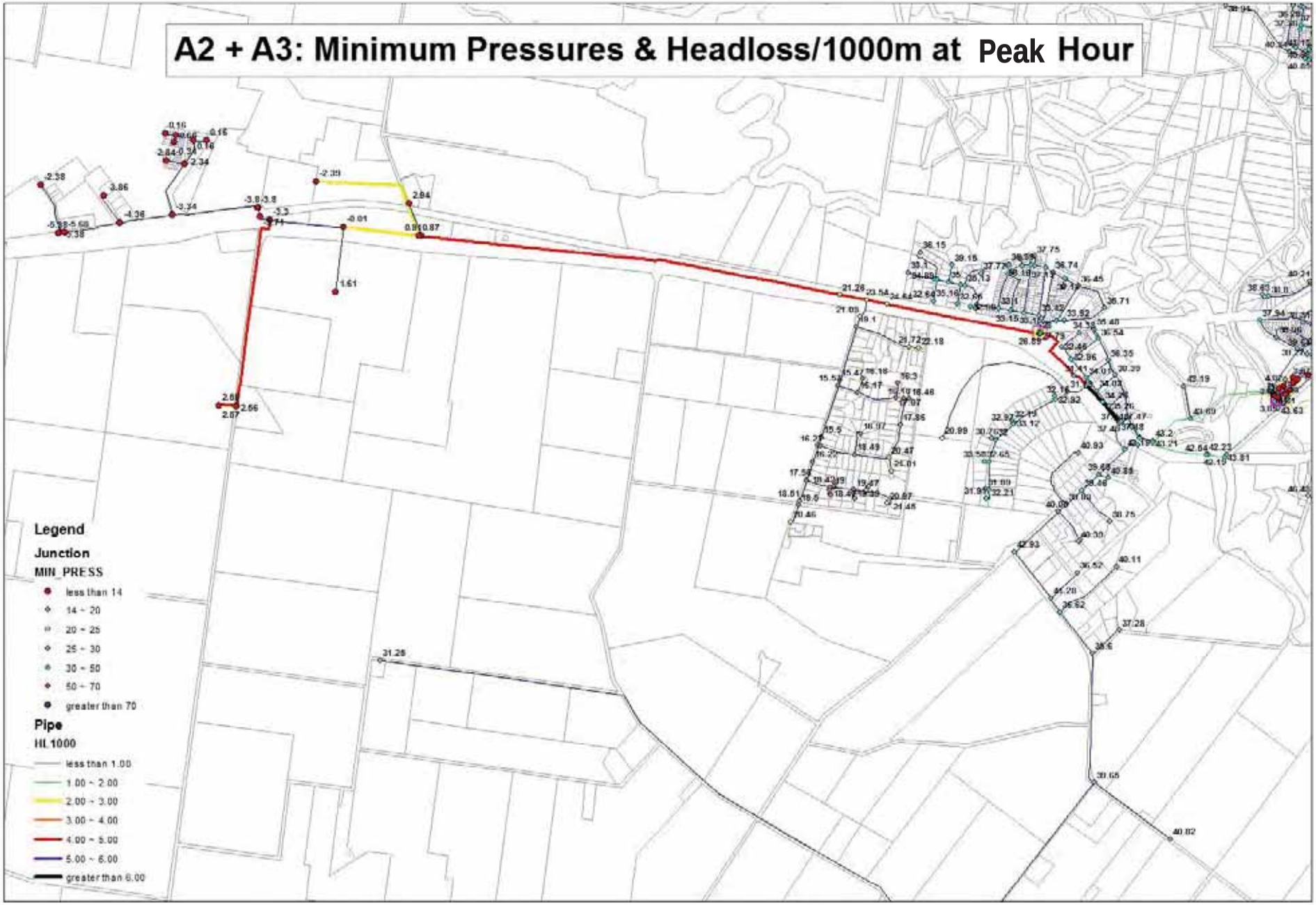


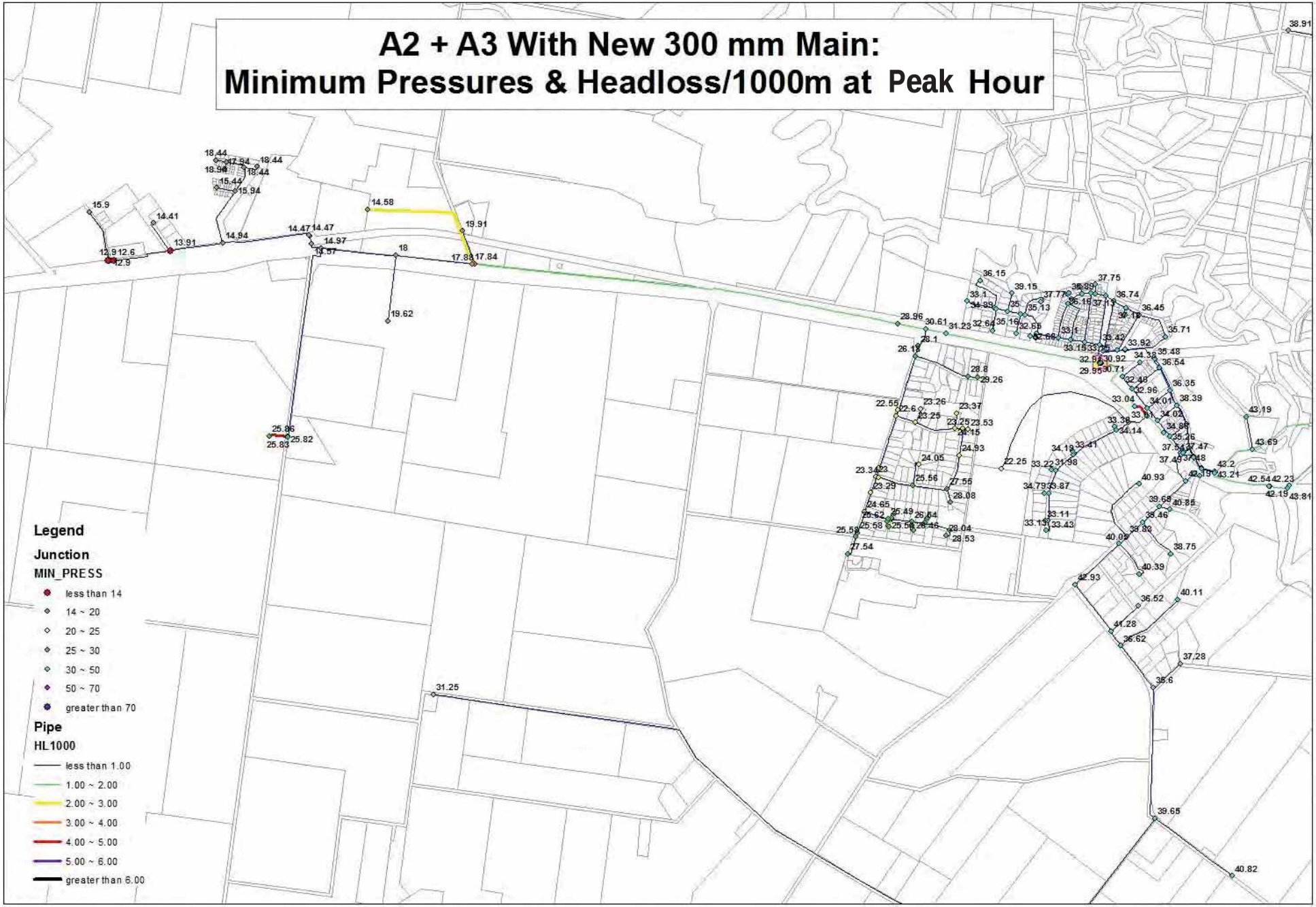
# A1+A2+A3: Minimum Pressures & Headloss/1000m at Peak Hour



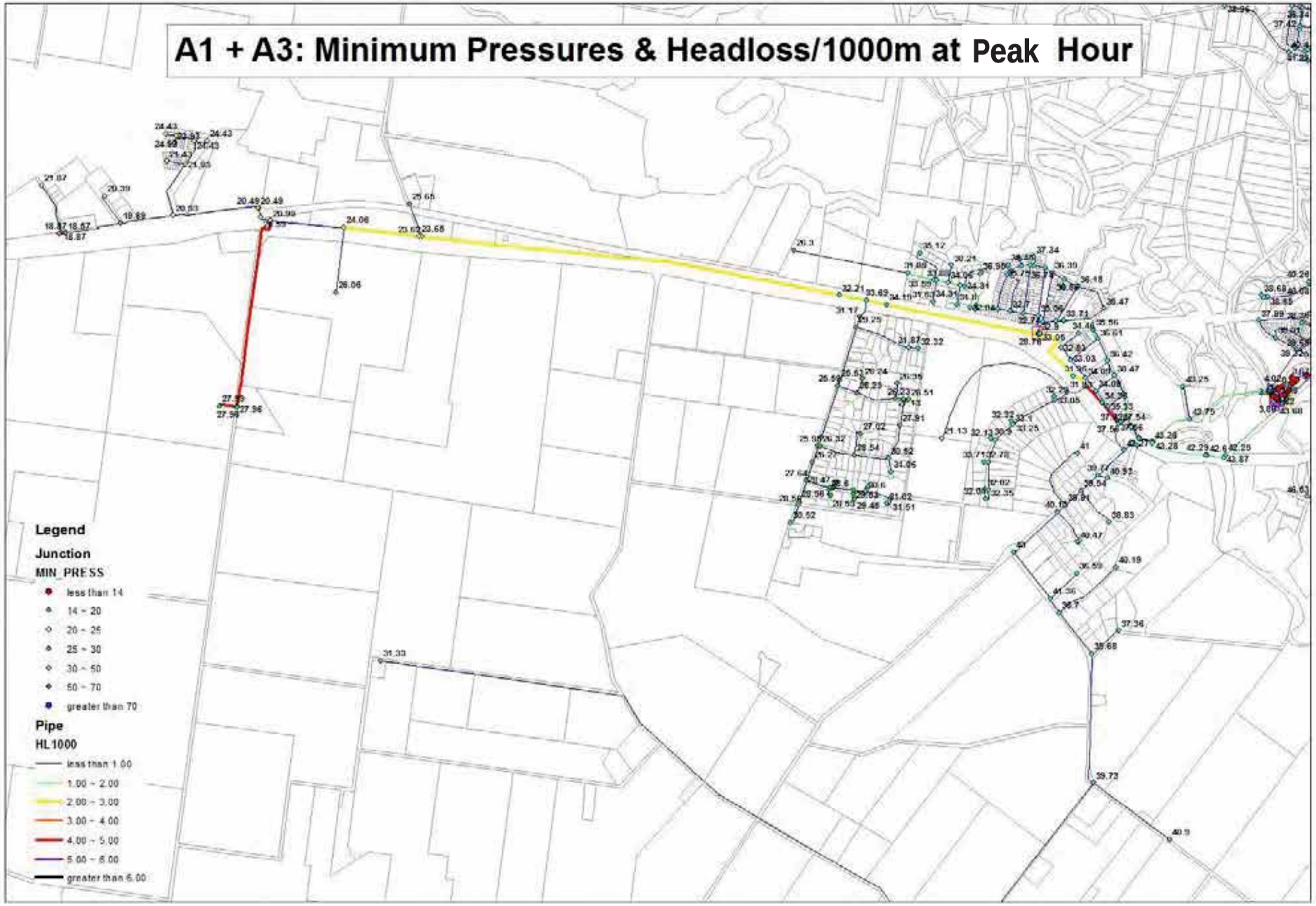
# A1 +A2 + A3 With New 300 mm Main: Minimum Pressures & Headloss/1000m at Peak Hour

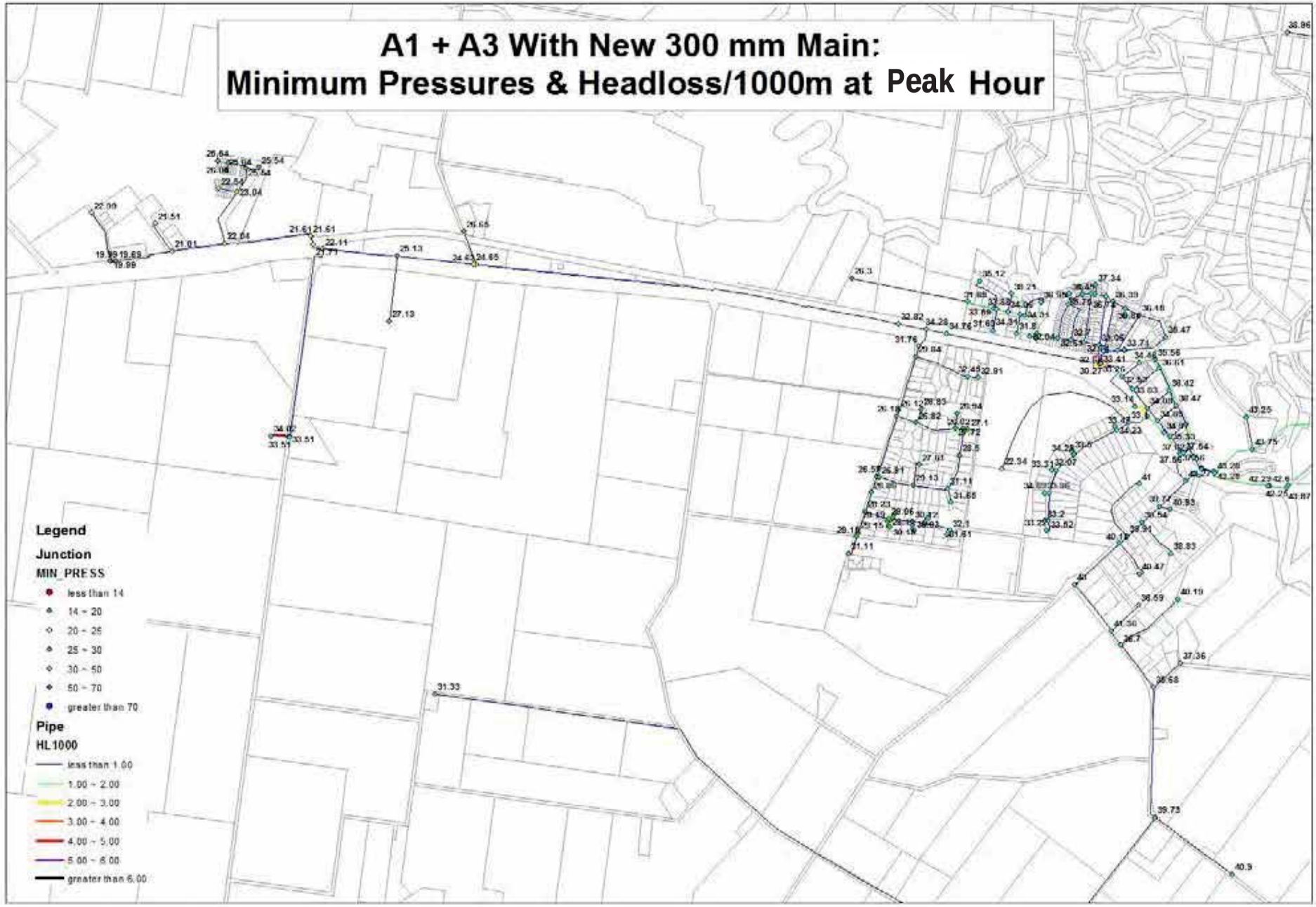



A2 + A3: Minimum Pressures & Headloss/1000m at Peak Hour
Legend
Junction
MIN_PRESS
less than 14
14 - 20
20 - 25
25 - 30
30 - 50
50 - 70
greater than 70
Pipe
HL1000
less than 1.00
1.00 - 2.00
2.00 - 3.00
3.00 - 4.00
4.00 - 5.00
5.00 - 6.00
greater than 6.00


A2 + A3 With New 300 mm Main:
Minimum Pressures & Headloss/1000m at Peak Hour
Legend
Junction
MIN_PRESS
less than 14
14 ~ 20
20 ~ 25
25 ~ 30
30 ~ 50
50 ~ 70
greater than 70
Pipe
HL1000
less than 1.00
1.00 ~ 2.00
2.00 ~ 3.00
3.00 ~ 4.00
4.00 ~ 5.00
5.00 ~ 6.00
greater than 6.00

# A1 + A3: Minimum Pressures & Headloss/1000m at Peak Hour




A1 + A3 With New 300 mm Main:
Minimum Pressures & Headloss/1000m at Peak Hour
Legend
Junction
MIN_PRESS
less than 14
14 ~ 20
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greater than 70
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HL1000
less than 1.00
1.00 ~ 2.00
2.00 ~ 3.00
3.00 ~ 4.00
4.00 ~ 5.00
5.00 ~ 6.00
greater than 6.00

# APPENDIX B TRAFFIC REPORT

TraffixGroup

Traffic Engineers and Transport Planners

# Traffic Engineering Assessment

## West Sale and Wurruk Industrial Land Supply Strategy

**Prepared for**
**Urban Enterprise**

**October, 2017**
**22735R-02A**

**DRAFT**

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# Traffic Engineering Assessment

## West Sale and Wurruk Industrial Land Supply Strategy

### Document Control

| Issue No. | Type | Date | Prepared By | Approved By |
|---|---|---|---|---|
| A | Draft | 25/10/2017 | D. Robertson | D. Robertson |
| | | | | |
| | | | | |

Traffix Template Version 1.1 – March, 2016

**Our Reference: Document1**

# Table of Contents

# 1 Introduction

Traffix Group has been engaged by Urban Enterprise to undertake a traffic engineering assessment of the West Sale and Wurruk Industrial Land Supply Strategy being undertaken by Urban Enterprise on behalf of Wellington Shire Council.

This report provides a traffic engineering assessment of the three candidate areas under consideration as part of the Strategy.

# 2 West Sale and Wurruk Industrial Land Supply Strategy

## 2.1 Overview

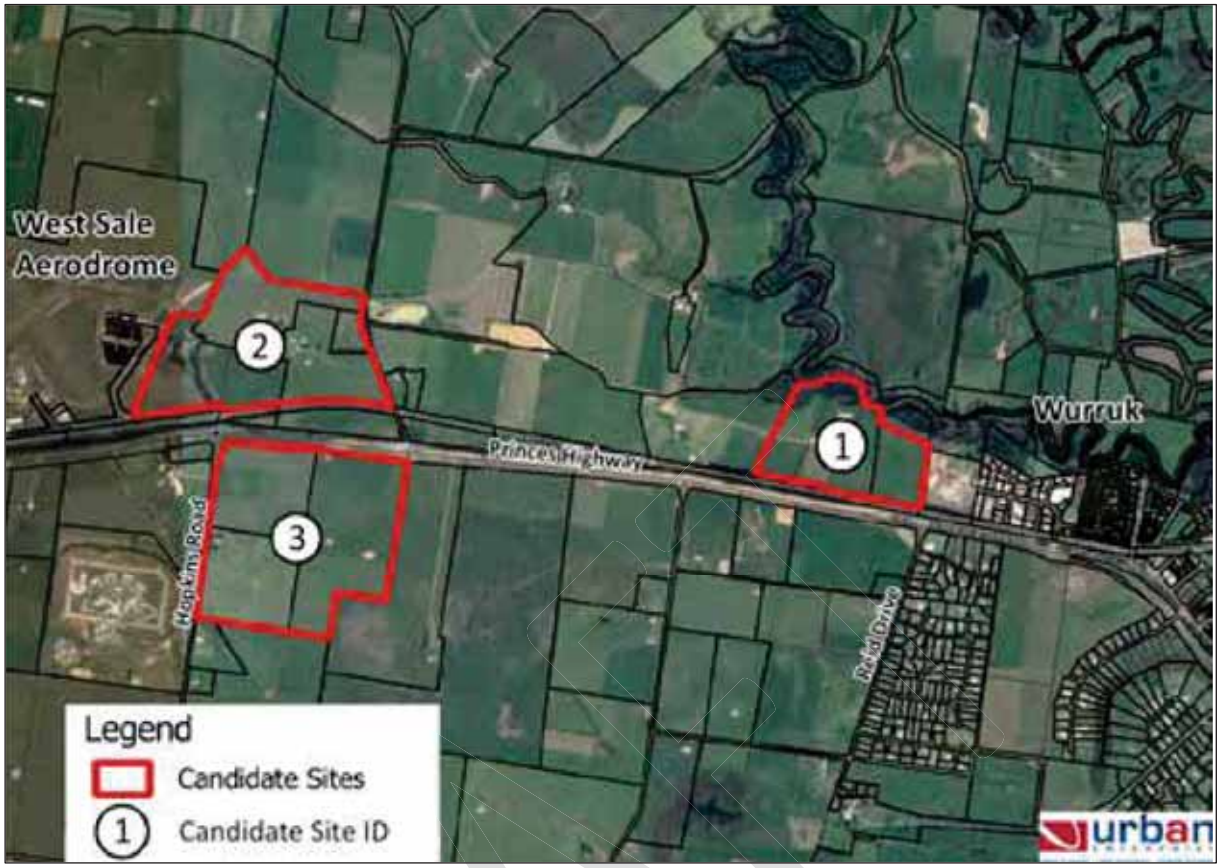
Wellington Shire Council has engaged Urban Enterprise to prepare the West Sale and Wurruk Industrial Land Supply Strategy. The Strategy will review the provision of existing industrial land, assess nominated future sites and consider future land requirements over the short to medium term in Wurruk and West Sale.

## 2.2 Candidate Areas

Three candidate areas have been nominated for review as part of the Strategy. These are described as follows:

- Candidate Area 1: Wurruk
  - West of the existing industrial zoned land in Wurruk
  - Land area: 42 ha
- Candidate Area 2: West Sale Aerodrome
  - North of Princes Highway and east of West Sale Aerodrome (west of Sale-Heyfield Road)
  - Land area: 55 ha
- Candidate Area 3: Fulham
  - South of Princes Highway and east of Fulham Correctional Centre (east of Hopkins Road)
  - Land area: 100 ha

The locations of the three candidate areas are shown in Figure 1.




Source: Urban Enterprise

**Figure 1: Candidate Area Locations**

# 3 Existing Conditions

## 3.1 Road Network

### 3.1.1 Princes Highway

Princes Highway is a State Highway under the control of VicRoads. It is in the Road Zone Category 1 (RDZ1) under the Wellington Planning Scheme.

In the vicinity of the candidate sites it has recently been upgraded to a duplicated road from a two way road.

Roundabouts control its intersections with Hunt Place and Sale-Heyfield Road. Its intersections with Reid Drive, Polocross Lane and Hopkins Road/Williams Drive are controlled by wide median treatments (with Princes Highway having priority).

The speed limit along Princes Highway is 80 km/h eastwards from approximately 300m west of Hunt Place and 100 km/h from that point west to west of Hopkins Road.

Princes Highway in the vicinity of the candidate sites is shown in Photographs 1 and 2. It is noted that at the time the road was inspected, the duplication was not completed.

**Photograph 1: Princes Highway View East from Reid Drive (Westbound Carriageway)**

**Photograph 2: Princes Highway View West from Reid Drive (Eastbound Carriageway)**

### 3.1.2 Sale-Heyfield Road

Sale-Heyfield Road is a State Arterial Road under the control of VicRoads. It is in the Road Zone Category 1 (RDZ1) under the Wellington Planning Scheme. It extends north/northwest from its T-intersection with Princes Highway (controlled by a roundabout).

In the vicinity of Candidate Area 2 it comprises a 7.0m wide two lane two way rural road with gravel shoulders.

Sale-Heyfield Road crosses Melbourne-Bairnsdale railway line approximately 200m north of Princes Highway. The railway level crossing is controlled by flashing lights and boom gates.

The speed limit along Sale-Heyfield Road is 80 km/h between Princes Highway and the bend to the north, and 100 km/h north of that point.

Sale-Heyfield Road in the vicinity of the candidate site is shown in Photographs 3 and 4.

**Photograph 3: Sale-Heyfield Road View South to Railway Level Crossing**

**Photograph 4: Sale-Heyfield Road View North to Bend North of Princes Highway**

### 3.1.3 Hopkins Road

Hopkins Road is a local road under the control of Wellington Shire Council. Hopkins Road is aligned in a north-south direction, intersecting as a cross road with Princes Highway/Williams Drive to the north (controlled by a wide median treatment with priority to Princes Highway) and extending south to Settlement Road (approximately 4.4km). It provides access to Fulham Correctional Centre and rural properties.

In the vicinity of Candidate Area 3 it comprises a 6.4m wide two lane two way rural road.

Wellington Shire Council's Register of Public Roads classifies Hopkins Road as Local Access A - Road (*A major access road for local residential or commercial traffic or public facility. Must be a through road or road to significant destination.*) with an indicative daily traffic volume of 150-1,500 vpd.

Hopkins Road in the vicinity of the candidate site is shown in Photograph 5.

**Photograph 5: Hopkins Road View South from Princes Highway**

### 3.1.4 Other Roads

#### Hunt Place

Hunt Place is a local road under the control of Wellington Shire Council. It is an industrial road with a carriageway width of 12.3m and kerb and channel. It extends north from its T-intersection with Princes Highway (controlled by a roundabout) before turning east-west and terminating as a dead end (court bowl) at its western end. It provides access to the industrial zone in Wurruk.

Hunt Place crosses Melbourne-Bairnsdale railway line approximately 50m north of Princes Highway. The railway level crossing is controlled by flashing lights and boom gates.

Wellington Shire Council's Register of Public Roads classifies Hunt Place as Local Access A - Road (*A major access road for local residential or commercial traffic or public facility. Must be a through road or road to significant destination.)* with an indicative daily traffic volume of 150-1,500 vpd.

Hunt Place is shown in Photographs 6 to 9.

**Photograph 6: Hunt Place View West to End from Riverside Drive**

**Photograph 7: Hunt Place View East from Riverside Drive**

**Photograph 8: Hunt Place View North from Railway Level Crossing**

**Photograph 9: Hunt Place View South Across Railway Level Crossing to Princes Highway**

### Riverside Drive

Riverside Drive is a local road under the control of Wellington Shire Council. It is an industrial road with a carriageway width of 12.3m and kerb and channel. It extends north from its cross-intersection with Hunt Place/Plant Court (Hunt Place has priority) before turning northwest and terminating as a dead end (court bowl) at its western end. It provides access to the industrial zone in Wurruk.

Wellington Shire Council's Register of Public Roads classifies Riverside Drive as Local Access B - Road (*A minor access road for local residential or commercial traffic.*) with an indicative daily traffic volume of 30-500 vpd.

Riverside Drive is shown in Photographs 10 and 11.

**Photograph 10: Riverside Drive View Southeast from End**

**Photograph 11: Riverside Drive View to Courtbowl**

### Williams Drive

Williams Drive is a local road under the control of Wellington Shire Council. It extends north from its cross-intersection with Princes Highway/Hopkins Road (controlled by a wide median treatment with priority to Princes Highway) before turning west and then north before terminating at West Sale Aerodrome. It also provides access to Victorian Emergency Management Training Complex, Gippsland Armed Forces Museum and Federation Training - Fulham Campus via Mortimer Drive.

Williams Road crosses Melbourne-Bairnsdale railway line approximately 70m north of Princes Highway. The railway level crossing is controlled by flashing lights.

Wellington Shire Council's Register of Public Roads classifies Williams Drive as Local Access A - Road (*A major access road for local residential or commercial traffic or public facility. Must be a through road or road to significant destination.*) with an indicative daily traffic volume of 150-1,500 vpd.

Williams Drive is shown in Photographs 12 to 14.

**Photograph 12: Williams Drive View North to Railway Level Crossing**

**Photograph 13: Williams Drive View West from Bend North of Princes Highway**

**Photograph 14: Williams Drive View Southwest from Airport End of Road**

## 3.2 Traffic Volumes

Traffic volume data provided by VicRoads is shown in Table 1. The locations of the counts are shown in Figure 2.

**Table 1: Traffic Volumes (1)**

| Location | Two Way Daily Volume | % Commercial Vehicles |
|---|---|---|
| Sale-Heyfield Road<br>200m North of Princes Highway | 3,139 vpd | 14.4% |
| Princes Highway<br>Between Sale-Heyfield Road and Polocross Lane | 7,081 vpd | 14% |
| Princes Highway<br>320m West of Sale-Heyfield Road | 8,920 vpd | 16.7% |

(1) Dates of counts unknown.


Source: Google Maps

**Figure 2: Traffic Count Locations**

Wellington Shire Council has no traffic volume data for Hopkins Road, Hunt Place, Riverside Drive or Williams Drive. Based on Council's Road Management Plan, these roads have the following indicative daily traffic volumes:

- Hopkins Road: 150-1,500 vpd
- Hunt Place: 150-1,500 vpd
- Riverside Drive: 30-500 vpd
- Williams Drive: 150-1,500 vpd

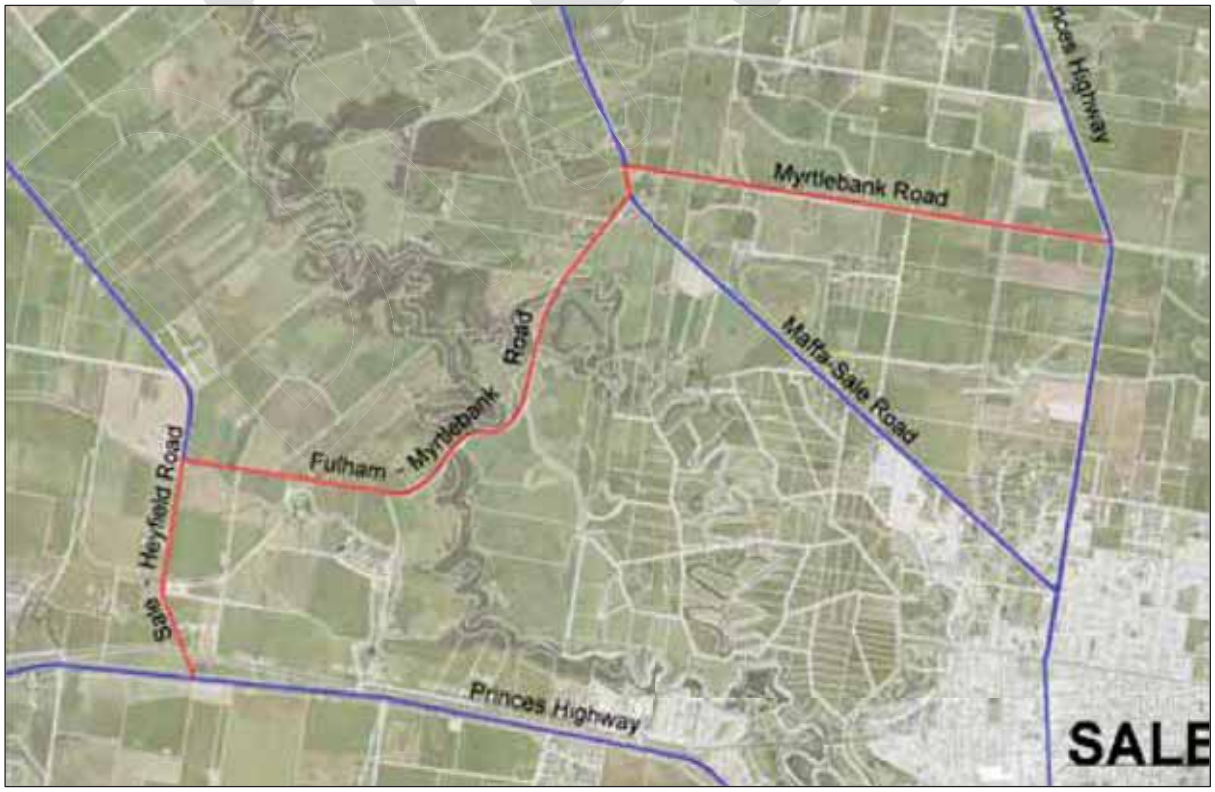
## 3.3 Crash History

Princes Highway between Hopkins Road and Reid Drive has recently been upgraded to a duplicated road from a two way road. Accordingly, recent crash history is no longer relevant to an assessment of the safety of this section of road.

# 4 Sale Alternative Truck Route

The Victorian Government has allocated funds to investigate the feasibility of formalising the Sale Alternative Truck Route, with a business case to be submitted for funding consideration by November, 2017. VicRoads and Wellington Shire Council are jointly involved with this project as the roads are both arterial and municipal maintained.

Figure 3 shows a plan with the route highlighted in red.




Source: VicRoads

**Figure 3: Sale Alternative Truck Route**

As part of the planning works VicRoads is investigating a number of intersection improvements with potential land acquisition requirements to accommodate these, as well as an increased road reserve on the Sale-Heyfield Road. No information is currently available as to the location and width of this increased road reserve.

# 5 Traffic Generation Rates

## 5.1 Overview

*Guide to Traffic Generating Developments Version 2.2 October 2002* (RTA NSW) (the "RTA guide") provides guidance as to the traffic generation of a range of land uses, including industrial uses.

The RTA guide provides the following overview of industry traffic generation:

*The peak traffic generation period for industrial land use is generally determined by three key factors: employee density, travel mode and peak period travel distribution. The employee density will vary with the industry type - from a low density at traditional warehouses to a high density at* high-tech *industrial developments. The peak period travel distributions (i.e. the proportion of workers who travel to or from the site in the peak hour), varies with the type and extent of development. A single use factory generally has a higher proportion of workers travelling in the peak hour than a factory unit development, where different employees have different work patterns. As work patterns continue to overlap, the percentage of those travelling in the peak hour declines.*

*The generation rates given below are for single use developments. Lower rates might be appropriate for multiple-use developments, as discussed above.*

## 5.2 Factories

The RTA guide provides the following traffic generation rates for factories:

- Daily vehicle trips: 5 per 100m$^2$ gross floor area
- Evening peak hour vehicle trips: 1 per 100m$^2$ gross floor area

## 5.3 Warehouses

The RTA guide provides the following traffic generation rates for warehouses:

- Daily vehicle trips: 4 per 100m$^2$ gross floor area
- Morning peak hour vehicle trips: 0.5 per 100m$^2$ gross floor area

## 5.4 Adopted Traffic Generation Rates

The critical time period for traffic impact assessment is typically the evening peak hour.

For the purposes of this assessment, the traffic generation rates for "factories" have been adopted (being the higher daily rate and having an evening peak hour rate); namely:

- Daily vehicle trips: 5 per 100m$^2$ gross floor area
- Evening peak hour vehicle trips: 1 per 100m$^2$ gross floor area

It is noted that these rates have generally been derived from metropolitan areas. Experience suggests that traffic generation rates for industrial uses in regional areas could be in the order of 20% less than these rates.

The adoption of these rates for the West Sale and Wurruk Industrial Land Supply Strategy therefore may result in an overestimation of the volumes of traffic likely to be generated by the candidate areas and, subsequently, an overestimation of the likely traffic impact of the development of the candidate areas.

## 5.5 Floor Areas

The traffic generation rates detailed above are based on floor areas of the land use. At strategic planning level, floor areas are typically not known, as is the case here. For the purposes of this assessment, the following "rules of thumb" have been applied:

- Proportion of total site area available for industrial use: 80% (1)
- Proportion of industrial land available for buildings: 40% (2)

(1) Allows for access roads, reserves, floodways, water treatment ponds, etc.

(2) Allows for accessways, car parking, etc.

Therefore, the traffic generation rates detailed in Section 5.4 will be applied to 32% (= 80% x 40%) of the total land area of each candidate area.

## 5.6 Broad Traffic Distribution

All candidate areas are located some 5km west of Sale and some 40km east of Traralgon. Accordingly, it is assumed for the purposes of this assessment that 40% of employees will reside in Traralgon and 60% will reside in Sale.

Also for the purposes of this assessment, it is assumed that 90% of the evening peak hour traffic generated by the candidate areas will be outbound movements and 10% will be inbound movements.

# 6 Traffic Engineering Impact Assessment of Candidate Areas

## 6.1 Candidate Area 1: Wurruk

### 6.1.1 Potential Access Options

Five potential access options have been identified for Candidate Area 1. These are shown diagrammatically in Figure 4 and described below.


Source: NearMap

**Figure 4: Candidate Area 1 - Potential Access Options**

Option 1.1

- Connection through existing industrial estate via extension of Riverside Drive and via Hunt Place roundabout on Princes Highway.

Option 1.2

- Connection through existing industrial estate via extension of Hunt Place and via Hunt Place roundabout on Princes Highway.

Option 1.3

- New access opposite Reid Drive.
- Change existing wide median treatment to a roundabout.
- Add fourth leg on north side.

Option 1.4

- New roundabout on Princes Highway.
- Location to be determined.
    - No sight distance constraints.

Option 1.5

- Left in/left out to Princes Highway.
- One or two accesses?
- Use existing wide median treatments at Polocross Lane and Reid Drive for vehicles to U-turn.
- Location(s) dependent on weaving distances.

### 6.1.2 Traffic Generation

Candidate Area 1 has a land area of 42 ha.

The resultant likely traffic volumes generated by Candidate Area 1 are therefore:

- Daily vehicle trips: 6,720 vpd
- Evening peak hour vehicle trips: 1,344 vph

### 6.1.3 Traffic Distribution

All traffic generated by Candidate Area 1 will be generated to or from Princes Highway. As detailed in Section 6.1.1, access to Candidate Area 1 is, in essence, via either the Hunt Place roundabout on Princes Highway or via a new connection(s) across the Melbourne-Bairnsdale railway line (and potentially together with via the Hunt Place roundabout on Princes Highway).

The provision of a new railway level crossing(s) on the Melbourne-Bairnsdale railway line is unlikely to be achieved. Accordingly, from a capacity perspective, only access via the Hunt Place roundabout on Princes Highway has been assessed. This is the most conservative approach as all traffic generated by Candidate Area 1 will access the area by a single access point.

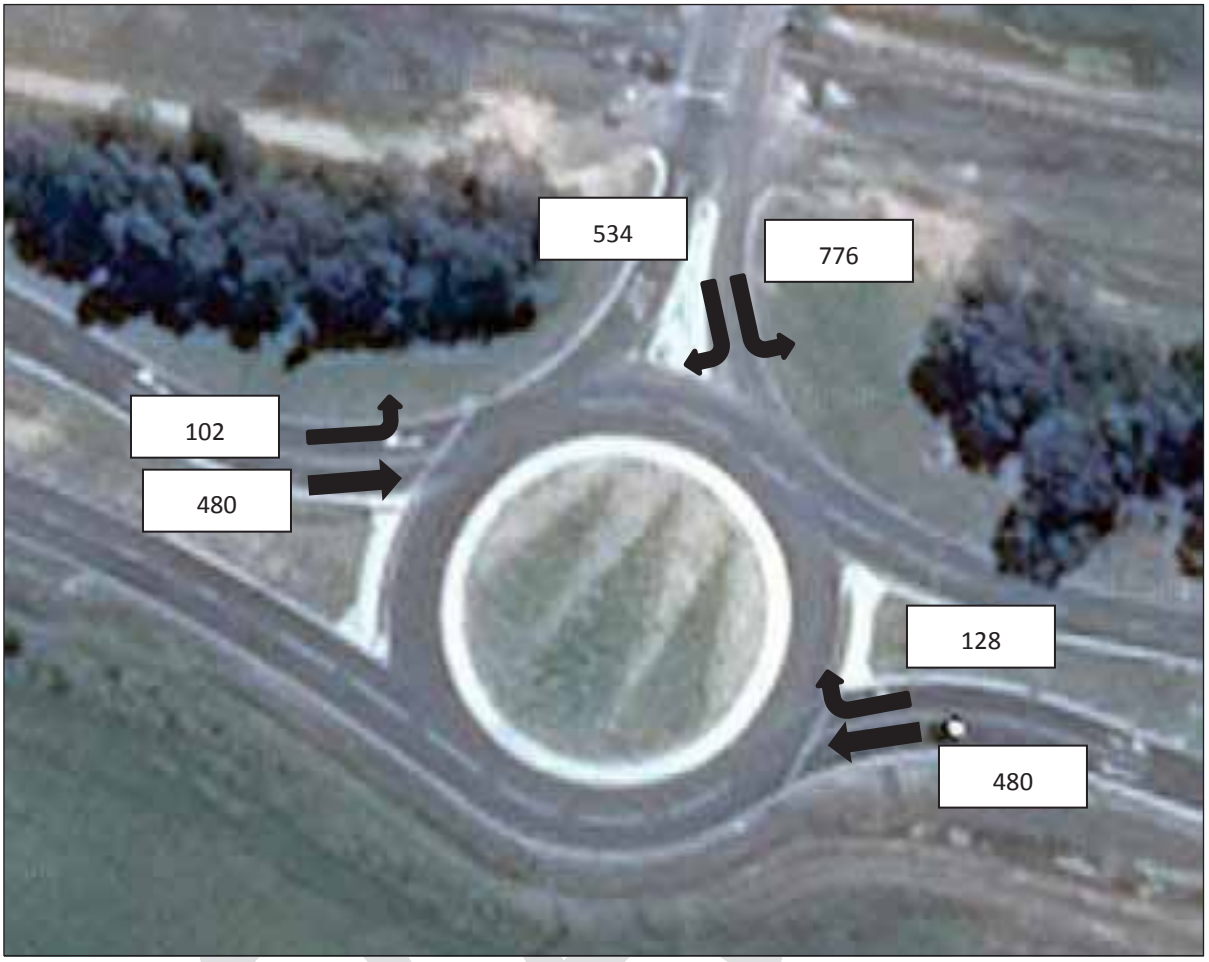
### 6.1.4 Traffic Volumes

As shown in Figure 2, Princes Highway east of Sale-Heyfield Road carries in the order of 7,100 vpd. Assuming that the evening peak hour volume is 15% of the daily volume equates to an evening peak hour volume of 1,065 vph. It is anticipated that this volume will be roughly evenly split between eastbound and westbound, ie 530 vph in each direction.

No traffic volume data is available for Hunt Place. A volume of 100 vph in each direction has been assumed for the purposes of this analysis.

Candidate Area 1 is anticipated to generate 1,344 vph in the evening peak hour. It is assumed that this will comprise 1,210 vph outbound and 130 vph inbound, split 40% to/from the west and 60% to/from the east (as detailed in Section 5.6).

This analysis and assumptions result in the traffic volumes shown in Figure 5.




Source: NearMap

**Figure 5: Candidate Area 1 Traffic Volumes**
**Princes Highway/Hunt Place**

It is noted that this does not allow for any growth in traffic volumes along Princes Highway. Also, it is assumed that Candidate Areas 2 and 3 are not developed.

### 6.1.5 Traffic Impact

SIDRA has been used to analyse the capacity of the affected intersections. SIDRA provides information about the capacity of an intersection in terms of a range of parameters, described as follows:

- **Degree of Saturation (DoS)** is the ratio of the volume of traffic observed making a particular movement compared to the maximum capacity for that movement. Various values of degree of saturation and their rating are shown in Table 2.
- The **95$^{th}$ Percentile Queue** represents the maximum queue length, in metres, that can be expected in 95% of observed queue lengths in the peak hour.
- **Average Delay** (seconds) is the average delay time that can be expected for all vehicles making a particular movement in the peak hour.

**Table 2: SIDRA Levels of Service**

| Level of Service | | Intersection Degree of Saturation | | |
|---|---|---|---|---|
| | | Unsignalised Intersection | Roundabout | Signalised Intersection |
| A | Excellent | ≤ 0.60 | ≤ 0.60 | ≤ 0.60 |
| B | Very Good | 0.60 - 0.70 | 0.60 - 0.70 | 0.60 - 0.70 |
| C | Good | 0.70 - 0.80 | 0.70 - 0.85 | 0.70 - 0.90 |
| D | Acceptable | 0.80 - 0.90 | 0.85 - 0.95 | 0.90 - 0.95 |
| E | Poor | 0.90 - 1.00 | 0.95 - 1.00 | 0.95 - 1.00 |
| F | Very Poor | ≥ 1.0 | ≥ 1.0 | ≥ 1.0 |

### Princes Highway/Hunt Place

The traffic volumes shown in Figure 5 and the existing geometry of the intersection were input into SIDRA to assess the likely performance of the Princes Highway/Hunt Place intersection. The analysis showed that an additional lane (short left turn) was required on the northern leg (Hunt Place) to achieve acceptable intersection performance.

The output of the SIDRA analysis (including the adopted geometry) for the modified geometry is attached at Appendix A and is summarised in Table 3.

**Table 3: Candidate Area 1 - Princes Highway/Hunt Place SIDRA Analysis**

| Movement | Degree of Saturation | Average Delay | 95th Percentile Queue |
|---|---|---|---|
| **Princes Highway (East Approach)** | | | |
| Through | 0.32 | 8.4 sec | 21.4m |
| Right | 0.32 | 16.8 sec | 18.6m |
| **Hunt Place (North Approach)** | | | |
| Left | 0.68 | 6.3 sec | 44.2m |
| Right | 0.59 | 13.2 sec | 31.6m |
| **Princes Highway (West Approach)** | | | |
| Left | 0.21 | 5.7 sec | 12.2m |
| Through | 0.21 | 6.0 sec | 12.21m |

The intersection operates with on overall Level of Service A.

Whilst this analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the existing Princes Highway/Hunt Place roundabout (with a second lane added to the Hunt Place approach) to accommodate the adopted traffic volumes.

### Hunt Place

Hunt Place has a carriageway width of 12.3m and is classified by Council as a Local Access A - Road with an indicative daily traffic volume of 150-1,500 vpd.

Assuming that Hunt Place currently carries 1,000 vpd (at Princes Highway), this volumes will increase to 7,720 vpd following development of Candidate Area 1. Whilst this exceeds the indicative daily traffic volume for a Local Access A - Road, Hunt Place nonetheless has a cross-section and industrial environment that can accommodate this volume of traffic.

### Riverside Drive

Riverside Drive has a carriageway width of 12.3m and is classified by Council as a Local Access B - Road with an indicative daily traffic volume of 30-500 vpd.

Assuming that Riverside Drive currently carries 300 vpd (at Hunt Place), this volume will increase to 7,020 vpd following development of Candidate Area 1 (assuming no connection to Candidate Area 1 via Hunt Place). Whilst this exceeds the indicative daily traffic volume for a Local Access B - Road, Riverside Drive nonetheless has a cross-section and industrial environment that can accommodate this volume of traffic.

### Connection Through to Riverside Drive or Hunt Place

Access to Candidate Area 1 via the Princes Highway/Hunt Place roundabout requires the extension of either (or both) Riverside Drive or Hunt Place through existing privately owned industrial land at the western end of the Wurruk industrial estate. These are shown diagrammatically in Figure 6 and Figure 7.

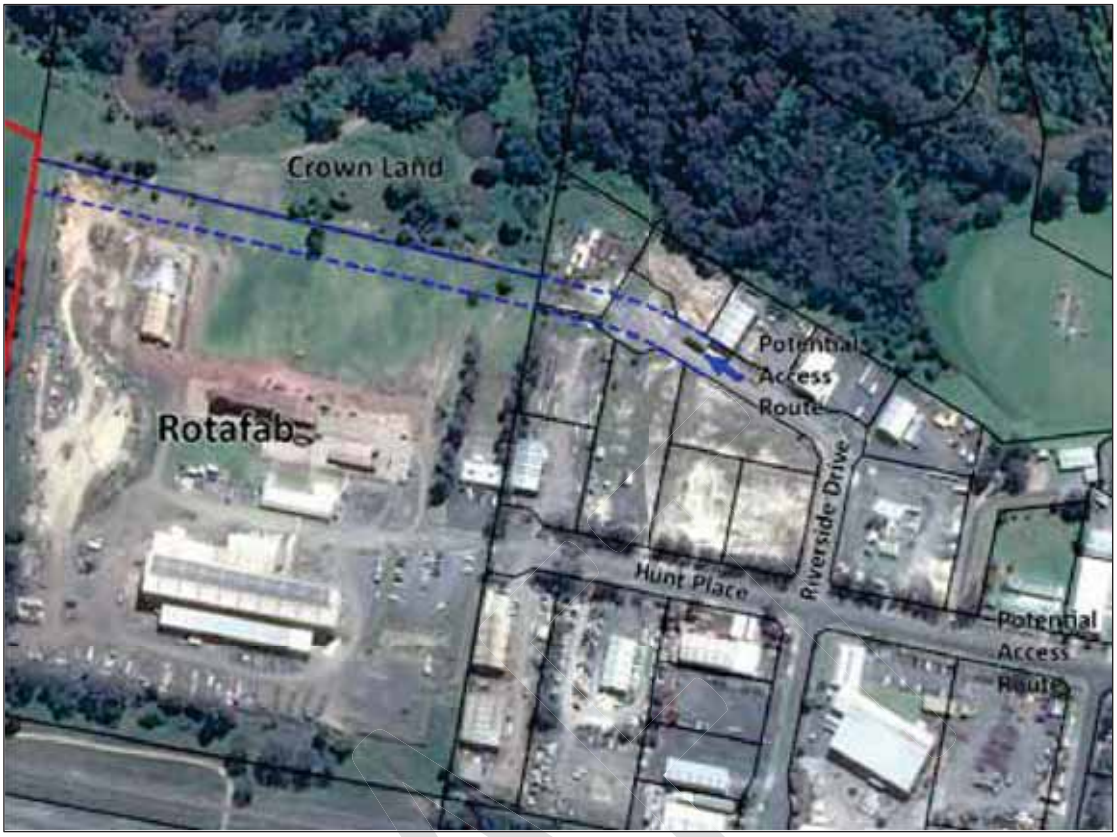



**Figure 7: Potential Riverside Drive Extension**

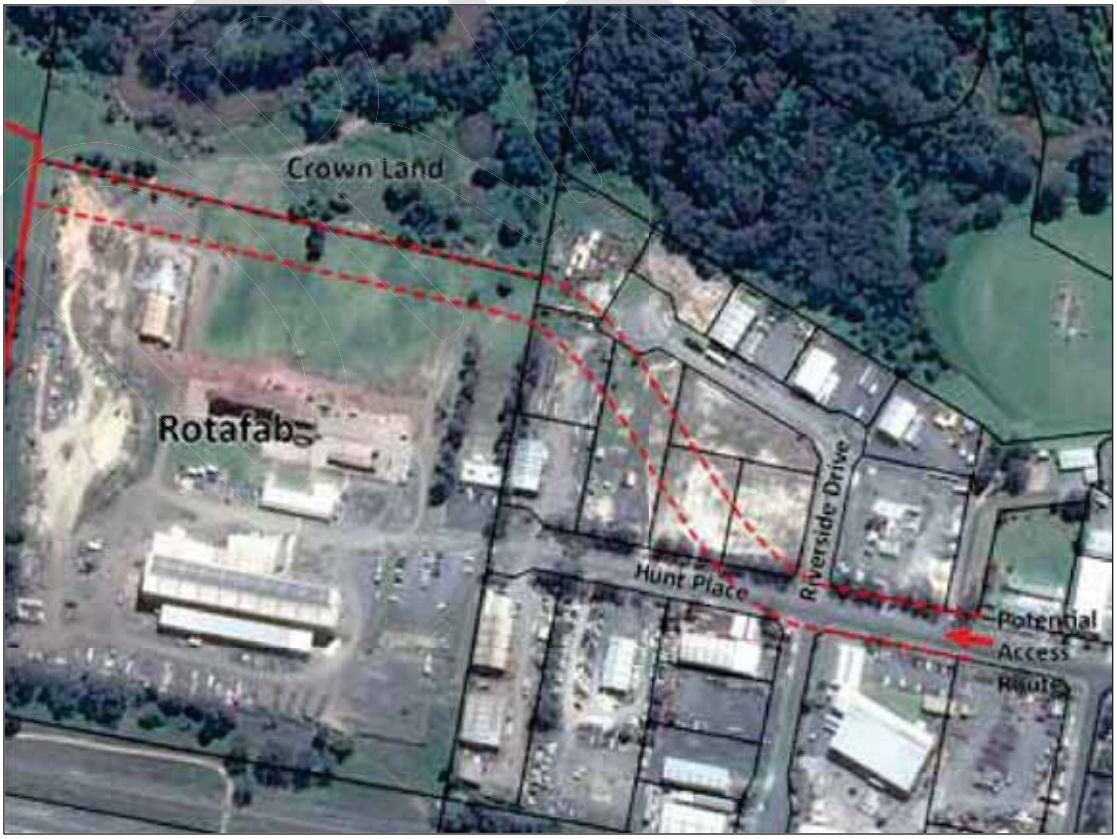



**Figure 8: Potential Hunt Place Extension**

From a traffic engineering perspective, both of these options are workable, with the following noted:

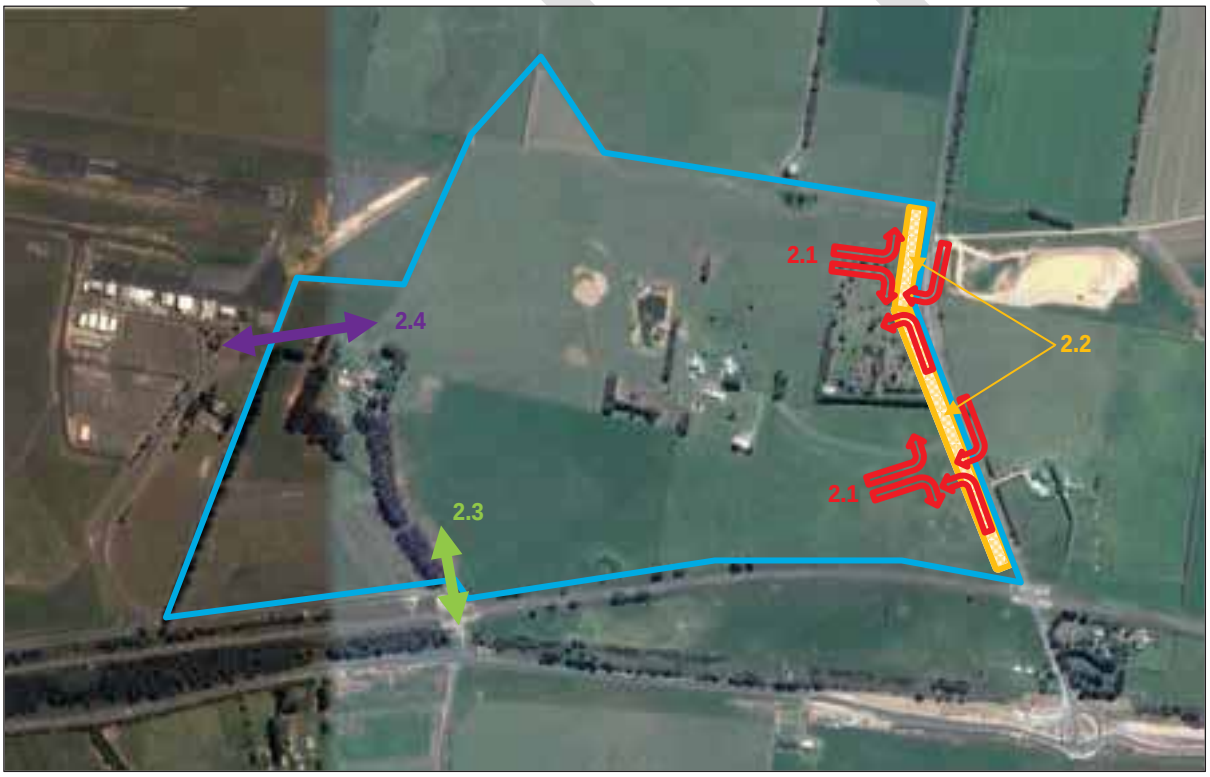
- The Riverside Drive extension requires less new road construction and impacts fewer properties.
- The Riverside Drive extension results in a significant volume of turning traffic at the Hunt Place/Riverside Drive intersection. No capacity issues are anticipated due to the low volumes of traffic in the west and south legs of the intersection.
- The Hunt Place extension results in the northern leg of the Riverside Drive intersection being located on the inside of a curve, with restricted sight distances to the right (west).

The Riverside Drive extension is the preferable option.

## 6.2 Candidate Area 2: West Sale Aerodrome

### 6.2.1 Potential Access Options

Four potential access options have been identified for Candidate Area 2. These are shown diagrammatically in Figure 6 and described below.




Source: NearMap

**Figure 6: Candidate Area 2 - Potential Access Options**

Option 2.1

- Full movement T-intersection(s) on Sale-Heyfield Road.

Option 2.2

- Service road(s) to Sale-Heyfield Road.

Option 2.3

- New road off Williams Drive, north into Site 2.
- Create T-intersection with north-south movement having priority.
- Use existing wide median treatment at Princes Highway/Hopkins Road/Williams Drive, or upgrade to a roundabout?

Option 2.4

- Access via West Sale Aerodrome (Williams Drive).
- Use existing wide median treatment at Princes Highway/Hopkins Road/Williams Drive, or upgrade to a roundabout?

### 6.2.2 Traffic Generation

Candidate Area 2 has a land area of 55 ha.

The resultant likely traffic volumes generated by Candidate Area 2 are therefore:

- Daily vehicle trips: 8,800 vpd
- Evening peak hour vehicle trips: 1,760 vph

### 6.2.3 Traffic Distribution

As discussed in Section 6.2.1, access to Candidate Area 2 is potentially possible via Sale-Heyfield Road and Williams Drive. It is assumed that both roads will be utilised for access purposes.

### 6.2.4 Traffic Volumes

As shown in Figure 2, Princes Highway west of Sale-Heyfield Road carries in the order of 8,900 vpd and Sale-Heyfield Road north of Princes Highway carries in the order of 3,100 vpd. Assuming that the evening peak hour volume is 15% of the daily volume equates to an evening peak hour volume of 1,335 vph on Princes Highway and 465 vph on Sale-Heyfield Road. It is anticipated that these volumes will be roughly evenly split in each direction on both roads.

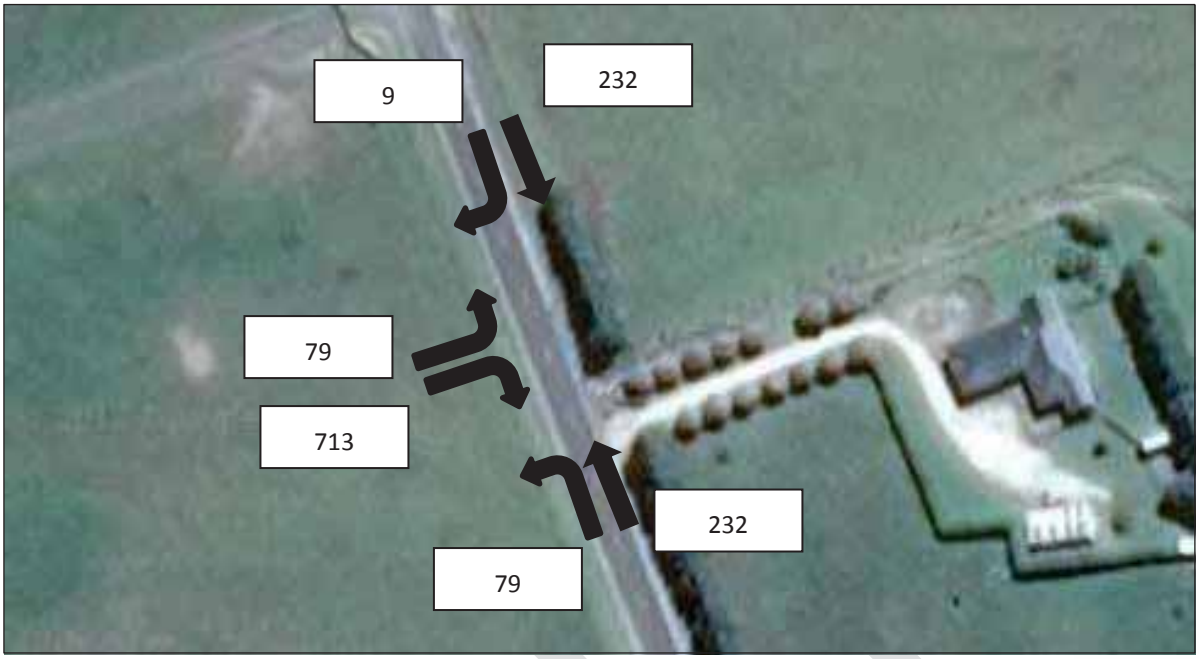
No traffic volume data is available for Williams Drive. A volume of 100 vph in each direction has been assumed for the purposes of this analysis.

No traffic volume data is available for Hopkins Road. A volume of 100 vph in each direction has been assumed for the purposes of this analysis.

Candidate Area 2 is anticipated to generate 1,760 vph in the evening peak hour. It is assumed that this will comprise 1,560 vph outbound and 180 vph inbound, split 10% to/from north and 90% to/from south on Sale-Heyfield Road and 40% to/from the west and 60% to/from the east on Princes Highway (as detailed in Section 5.6).

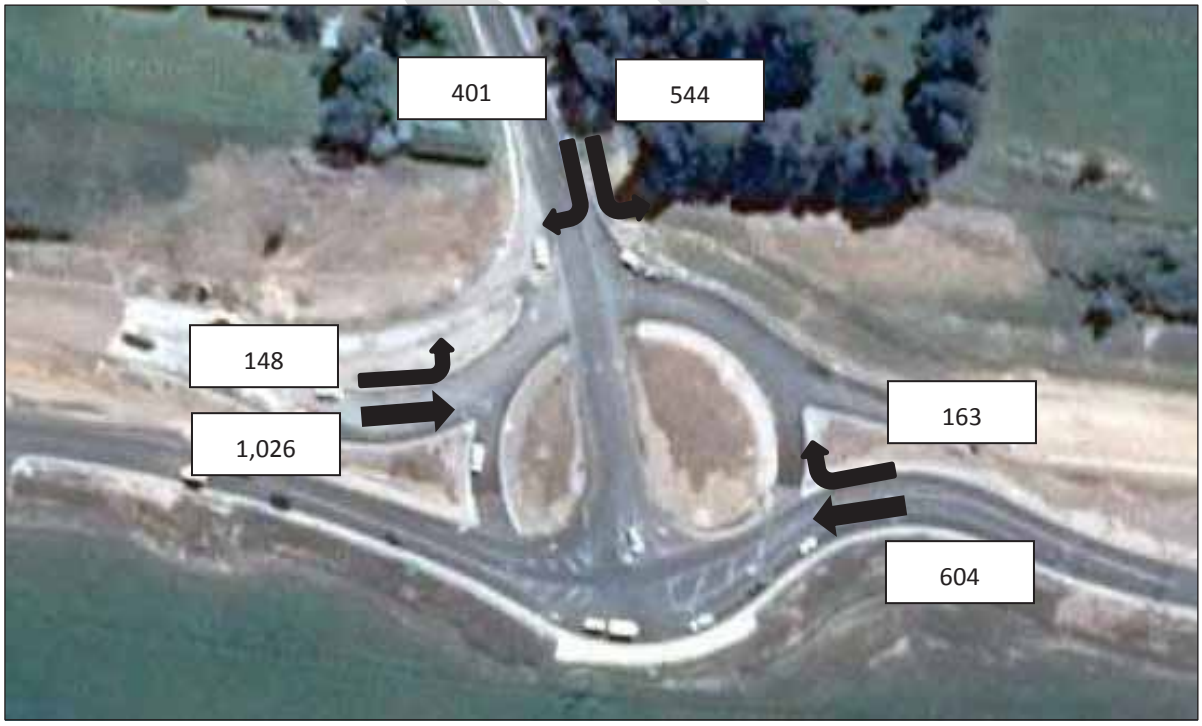
For the purposes of this analysis, it is assumed that traffic generated by Candidate Area 2 will be evenly split between access via Sale-Heyfield Road and via Princes Highway (via Williams Drive).

This analysis and assumptions result in the traffic volumes shown in Figures 7 to 9. (Note - these volumes include traffic generated by the candidate area to/from both access points.)



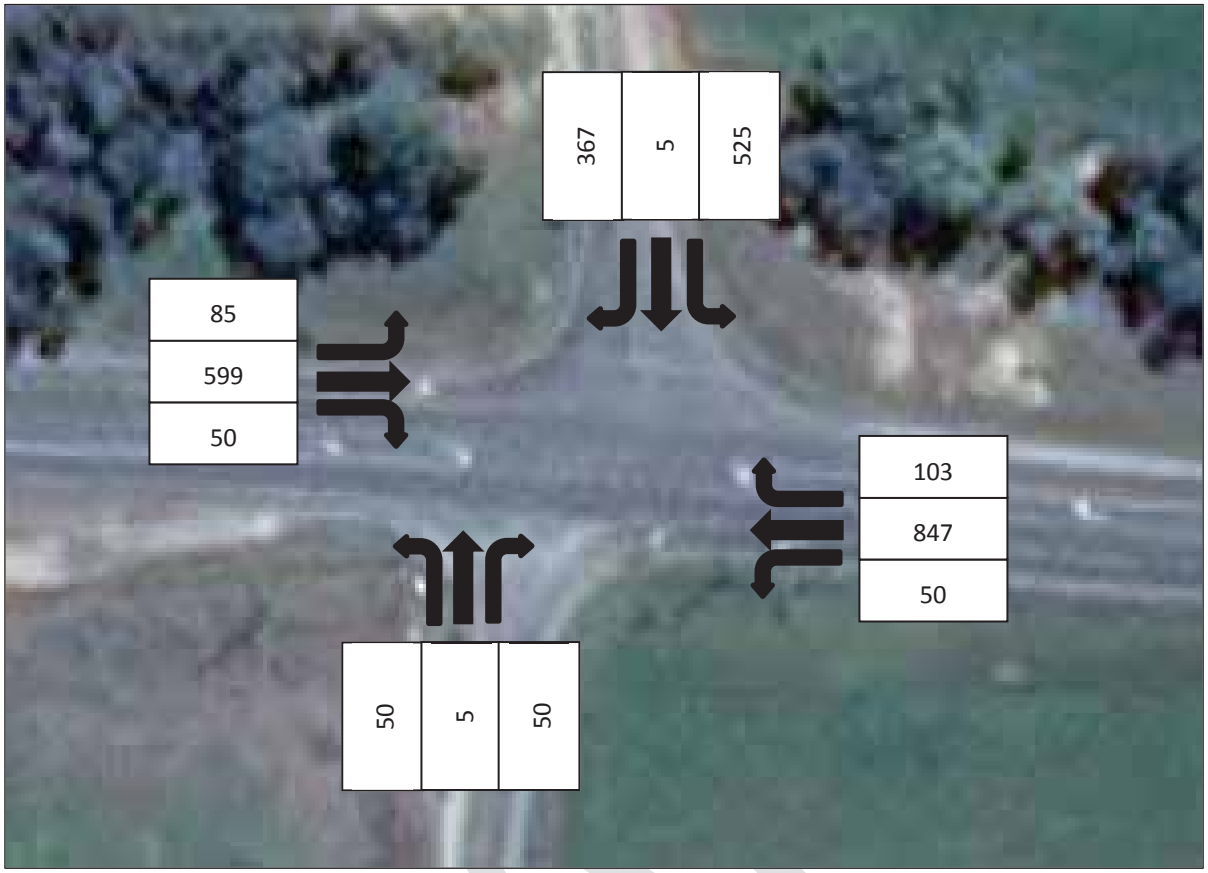

Source: NearMap

**Figure 7: Candidate Area 2 Traffic Volumes**
**Sale-Hayfield Road/Site Access (One Access Point)**




Source: NearMap

**Figure 8: Candidate Area 2 Traffic Volumes**
**Princes Highway/Sale-Heyfield Road**




Source: NearMap

**Figure 9: Candidate Area 2 Traffic Volumes**
**Princes Highway/Williams Drive**

It is noted that this does not allow for any growth in traffic volumes along Princes Highway or Sale-Heyfield Road. Also, it is assumed that Candidate Areas 1 and 3 are not developed.

### 6.2.5 Traffic Impact

#### Sale-Heyfield Road/Site Access

The traffic volumes shown in Figure 7 were input into SIDRA to assess the likely performance of a future Sale-Heyfield Road/site access T-intersection. The analysis showed that the site access leg operated at a DoS greater than 1.0, due to the volume of right turn "out" movements. Further analysis was undertaken to ascertain the maximum number of right turn "out" movements to achieve a DoS of 0.90.

The output of the SIDRA analysis (including the reduced right turn "out" volume) for the adopted geometry is attached at Appendix B and is summarised in Table 4.

**Table 4: Candidate Area 2 - Sale-Heyfield Road/Site Access SIDRA Analysis**

| Movement | Degree of Saturation | Average Delay | 95th Percentile Queue |
|---|---|---|---|
| **Sale-Heyfield Road (South Approach)** | | | |
| Left | 0.05 | 7.2 sec | 0.0m |
| Through | 0.14 | 0.0 sec | 0.0m |
| **Sale-Heyfield Road (North Approach)** | | | |
| Through | 0.14 | 0.0 sec | 0.0m |
| Right | 0.01 | 8.3 sec | 0.2m |
| **Site Access (West Approach)** | | | |
| Left | 0.06 | 10.5 sec | 2.2m |
| Right | 0.90 | 30.4 sec | 119.4m |

This analysis demonstrates that:

- Two access points are required via Sale-Heyfield Road, in addition to access via Williams Drive, for Candidate Area 2; and
- The volume of right turn "out" traffic from each site access on Sale-Heyfield Road needs to be restricted to 509 vph.

Whilst this analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the assumed T-intersection configuration to accommodate the adopted traffic volumes with two T-intersections on Sale-Heyfield Road.

### Princes Highway/Sale-Heyfield Road

The traffic volumes shown in Figure 8 and the existing geometry of the intersection were input into SIDRA to assess the likely performance of the Princes Highway/Sale-Heyfield Road intersection. The analysis showed that an additional lane was required on the northern leg (Sale-Heyfield Road) to achieve acceptable intersection performance.

The output of the SIDRA analysis (including the adopted geometry) for the modified geometry is attached at Appendix C and is summarised in Table 5.

**Table 5: Candidate Area 2 - Princes Highway/Sale-Heyfield Road SIDRA Analysis**

| Movement | Degree of Saturation | Average Delay | 95th Percentile Queue |
|---|---|---|---|
| **Princes Highway (East Approach)** | | | |
| Through | 0.42 | 8.7 sec | 30.5m |
| Right | 0.42 | 17.2 sec | 26.2m |
| **Sale-Heyfield Road (North Approach)** | | | |
| Left | 0.63 | 11.6 sec | 32.1m |
| Right | 0.61 | 17.2 sec | 33.9m |
| **Princes Highway (West Approach)** | | | |
| Left | 0.44 | 6.0 sec | 31.9m |
| Through | 0.44 | 6.4 sec | 31.9m |

The intersection operates with on overall Level of Service B.

Whilst this analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the existing Princes Highway/Sale-Heyfield Road roundabout (with a second lane added to the Sale-Heyfield Road approach) to accommodate the adopted traffic volumes.

### Princes Highway/Williams Drive

The traffic volumes shown in Figure 9 and the geometry of a roundabout were input into SIDRA to assess the likely performance of the Princes Highway/Williams Drive intersection. The analysis showed that two lanes were required on the northern leg (Williams Drive) to achieve acceptable intersection performance.

The output of the SIDRA analysis (including the adopted geometry) for the modified geometry is attached at Appendix D and is summarised in Table 6.

**Table 6: Candidate Area 2 - Princes Highway/Williams Drive SIDRA Analysis**

| Movement | Degree of Saturation | Average Delay | 95th Percentile Queue |
|---|---|---|---|
| **Hopkins Road (South Approach)** | | | |
| Left | 0.20 | 7.4 sec | 7.5m |
| Through | 0.20 | 7.0 sec | 7.5m |
| Right | 0.20 | 14.2 sec | 7.5m |
| **Princes Highway (East Approach)** | | | |
| Left | 0.46 | 7.5 sec | 32.2m |
| Through | 0.46 | 8.1 sec | 32.2m |
| Right | 0.46 | 16.3 sec | 28.7m |
| **Williams Drive (North Approach)** | | | |
| Left | 0.50 | 5.7 sec | 23.7m |
| Through | 0.47 | 6.0 sec | 19.9m |
| Right | 0.47 | 13.2 sec | 19.9m |
| **Princes Highway (West Approach)** | | | |
| Left | 0.27 | 5.8 sec | 15.3m |
| Through | 0.27 | 6.2 sec | 15.3m |
| Right | 0.27 | 13.9 sec | 14.5m |

The intersection operates with on overall Level of Service A.

Whilst this analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is significant spare capacity within the existing Princes Highway/Williams Drive roundabout (with a second lane added to the Williams drive approach) to accommodate the adopted traffic volumes.

### Williams Drive

As detailed in Section 6.2.1, access to Candidate Area 2 via Williams Drive is via either or both a new road off Williams Drive directly into the candidate area or West Sale Aerodrome.

Both will necessitate an upgrade to the railway level crossing from flashing lights to flashing lights and boom gates.

The predicted daily traffic volume on Williams Road at Princes Highway is in the order of 5,500 vpd (comprising 4,400 vpd from Candidate Area 2 and 1,000 vpd existing). A two lane undivided carriageway would be sufficient to accommodate this level of traffic.

## 6.3 Candidate Area 3: Fulham

### 6.3.1 Potential Access Options

Seven potential access options have been identified for Candidate Area 3. These are shown diagrammatically in Figure 10 and described below.


Source: NearMap

**Figure 10: Candidate 3 - Potential Access Options**

Option 3.1

- New access opposite Sale-Heyfield Road.
- Add fourth leg on south side of roundabout on Princes Highway.

Option 3.2

- Left in/left out to Princes Highway.
- One or two accesses?
- Use existing roundabout at Sale-Heyfield Road and existing wide median treatment at Hopkins Road/Williams Drive.
- Location(s) dependent on weaving distances.

Option 3.3

- Service road(s) to Princes Highway.

Option 3.4

- New roundabout on Princes Highway.
- Location to be determined.
  - No sight distance constraints.

Option 3.5

- Full movement T-intersection(s) on Hopkins Road.
- Maintain existing wide median treatment at Princes Highway/Hopkins Road/Williams Road or upgrade to a roundabout?

Option 3.6

- Direct access to Hopkins Road.
- Requires large lots to front Hopkins Road.
- Corner sites to take access off internal road.

Option 3.7

- Service road(s) to Hopkins Road.

### 6.3.2 Traffic Generation

Candidate Area 3 has a land area of 100 ha.

The resultant likely traffic volumes generated by Candidate Area 3 are therefore:

- Daily vehicle trips: 16,000 vpd
- Evening peak hour vehicle trips: 3,200 vph

### 6.3.3 Traffic Distribution

All traffic generated by Candidate Area 3 will be generated to or from Princes Highway via the Princes Highway/Sale-Heyfield Road roundabout and/or via the Princes Highway/Hopkins Road.

### 6.3.4 Traffic Volumes - Single Access Point

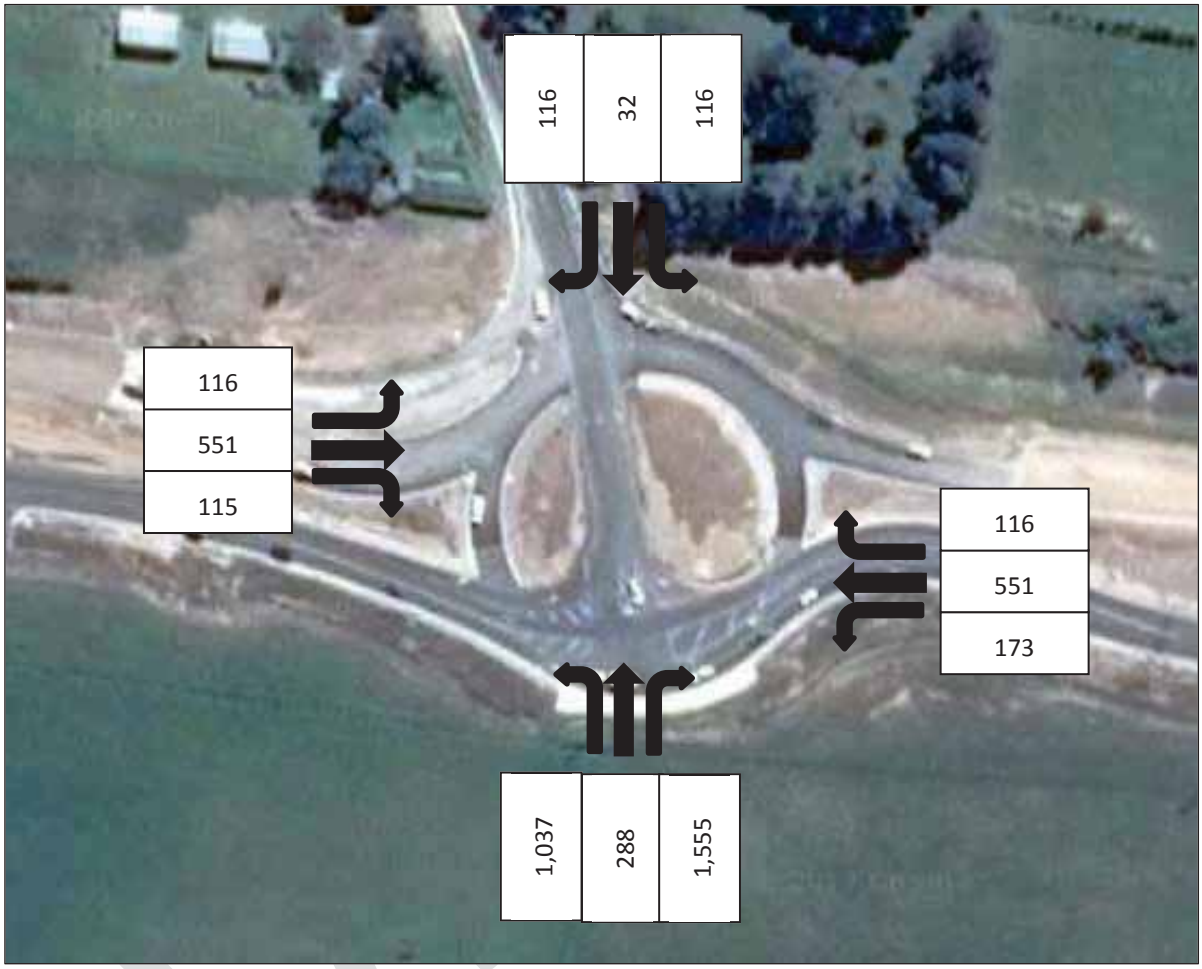
As shown in Figure 2, Princes Highway west of Sale-Heyfield Road carries in the order of 8,900 vpd. Assuming that the evening peak hour volume is 15% of the daily volume equates to an evening peak hour volume of 1,335 vph. It is anticipated that this volume will be roughly evenly split between eastbound and westbound, ie 670 vph in each direction.

No traffic volume data is available for Williams Drive. A volume of 100 vph in each direction has been assumed for the purposes of this analysis.

No traffic volume data is available for Hopkins Road. A volume of 100 vph in each direction has been assumed for the purposes of this analysis.

Candidate Area 3 is anticipated to generate 3,200 vph in the evening peak hour. It is assumed that this will comprise 2,880 vph outbound and 320 vph inbound, split 10% to/from the north on Sale-Heyfield Road and 90% to Princes Highway, split 40% to/from the west and 60% to/from the east (as detailed in Section 5.6).

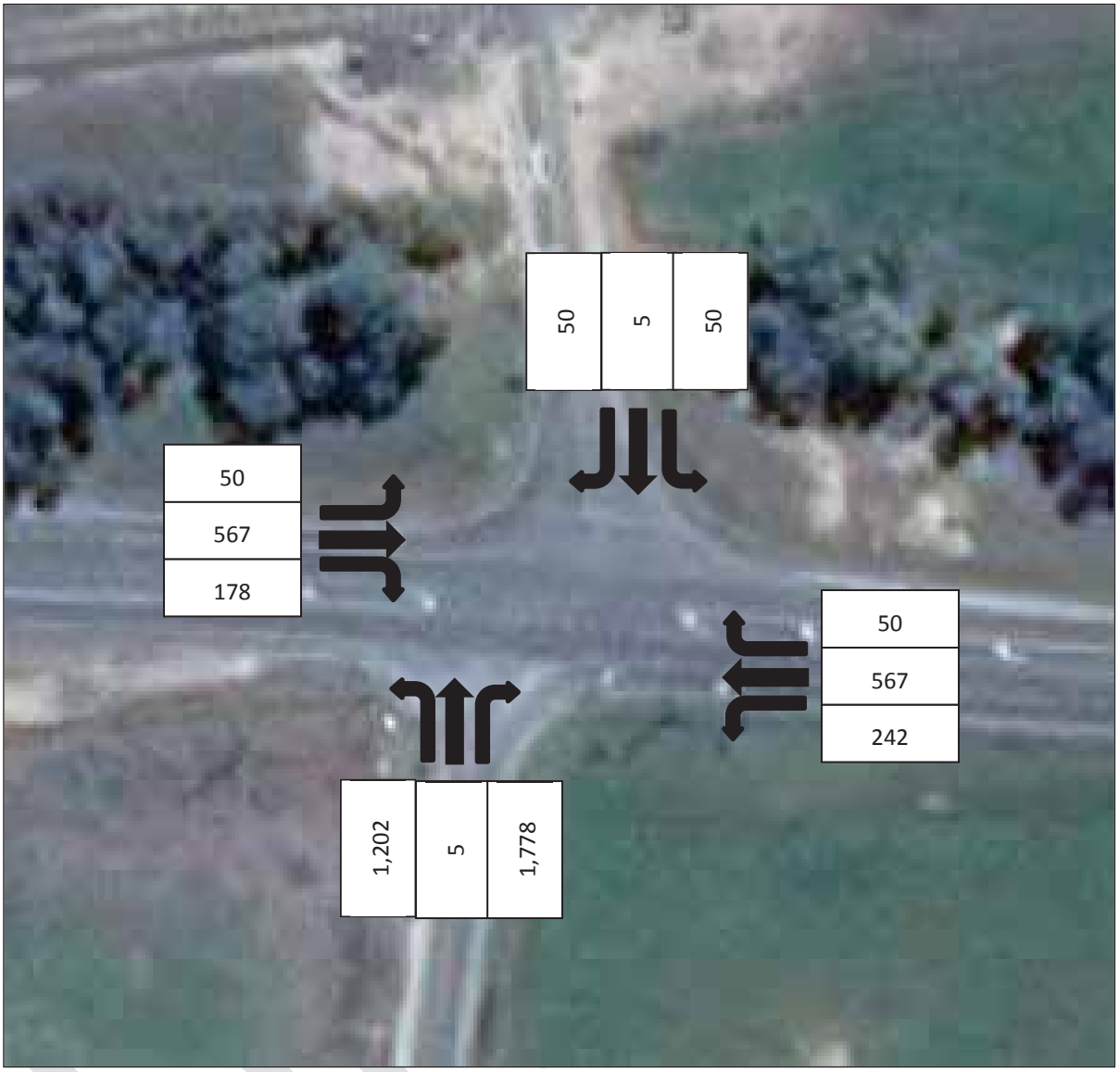
Assuming all traffic generated by Candidate Area 3 is accessed via the Princes Highway/Sale-Heyfield roundabout, this analysis and assumptions result in the traffic volumes shown in Figure 11.




Source: NearMap

**Figure 11: Candidate Area 3 Traffic Volumes**
**Access Only via Princes Highway/Sale-Heyfield Road**

Assuming all traffic generated by Candidate Area 3 is accessed via the Princes Highway/Sale-Heyfield roundabout, this analysis and assumptions result in the traffic volumes shown in Figure 12.




Source: NearMap

**Figure 12: Candidate Area 3 Traffic Volumes**
**Access Only via Princes Highway/Hopkins Road**

It is noted that this does not allow for any growth in traffic volumes along Princes Highway, Sale-Heyfield Road, Williams Road or Hopkins Road. Also, it is assumed that Candidate Areas 1 and 2 are not developed.

### 6.3.5 Traffic Impact - Single Access point

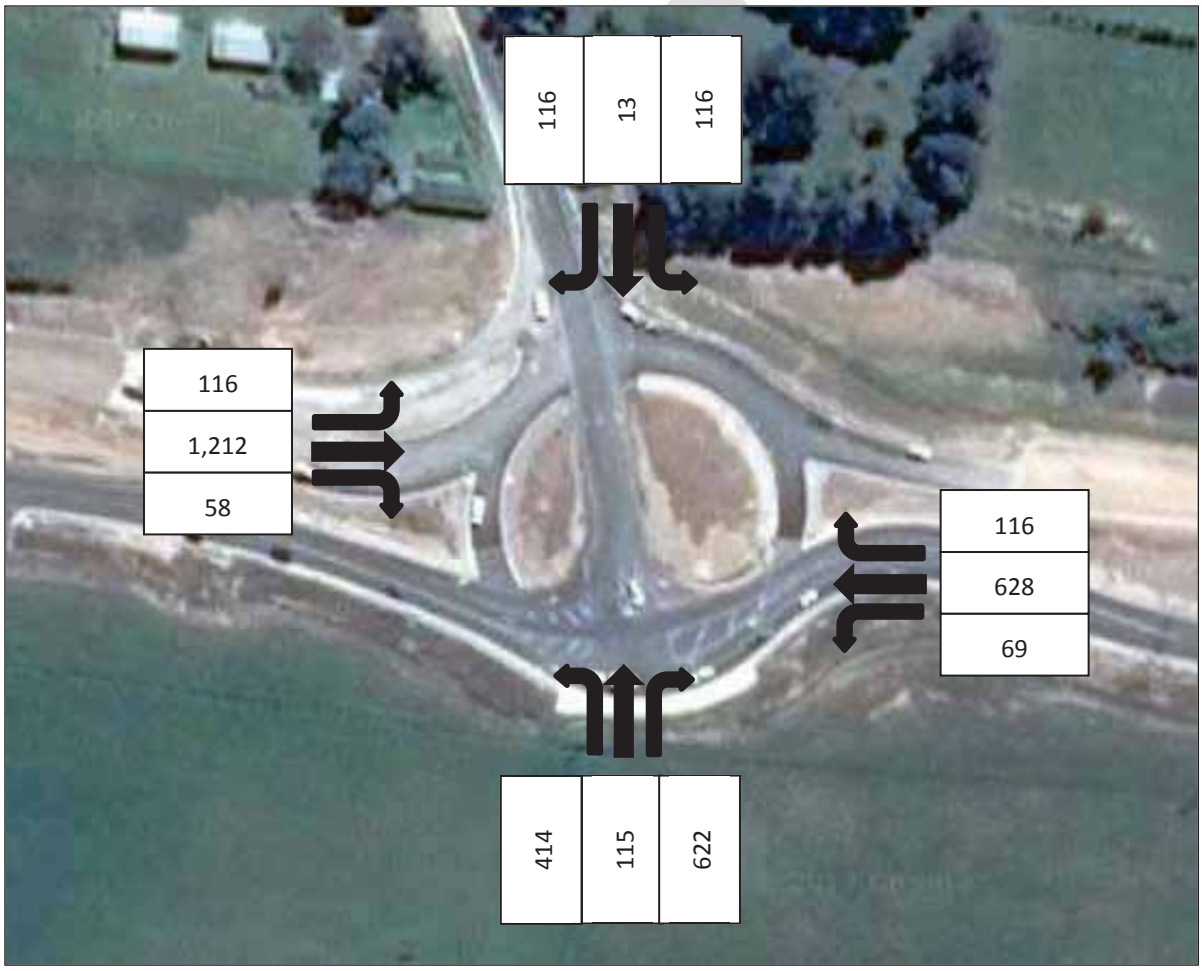
The traffic volumes shown in Figures 11 and 12 were input into SIDRA to assess the likely performance of the Princes Highway/Sale-Heyfield Road and Princes Highway/Hopkins Road intersections. It was apparent that the volume of traffic anticipated to be generated by Candidate Area 3 could not be accommodated by a single access point.

### 6.3.6 Traffic Volumes - Two Access Points

For the purposes of this further analysis, it is assumed that traffic generated by Candidate Area 3 is equally split between via the Princes Highway/Sale-Heyfield roundabout and the Princes Highway/Hopkins Road intersection.

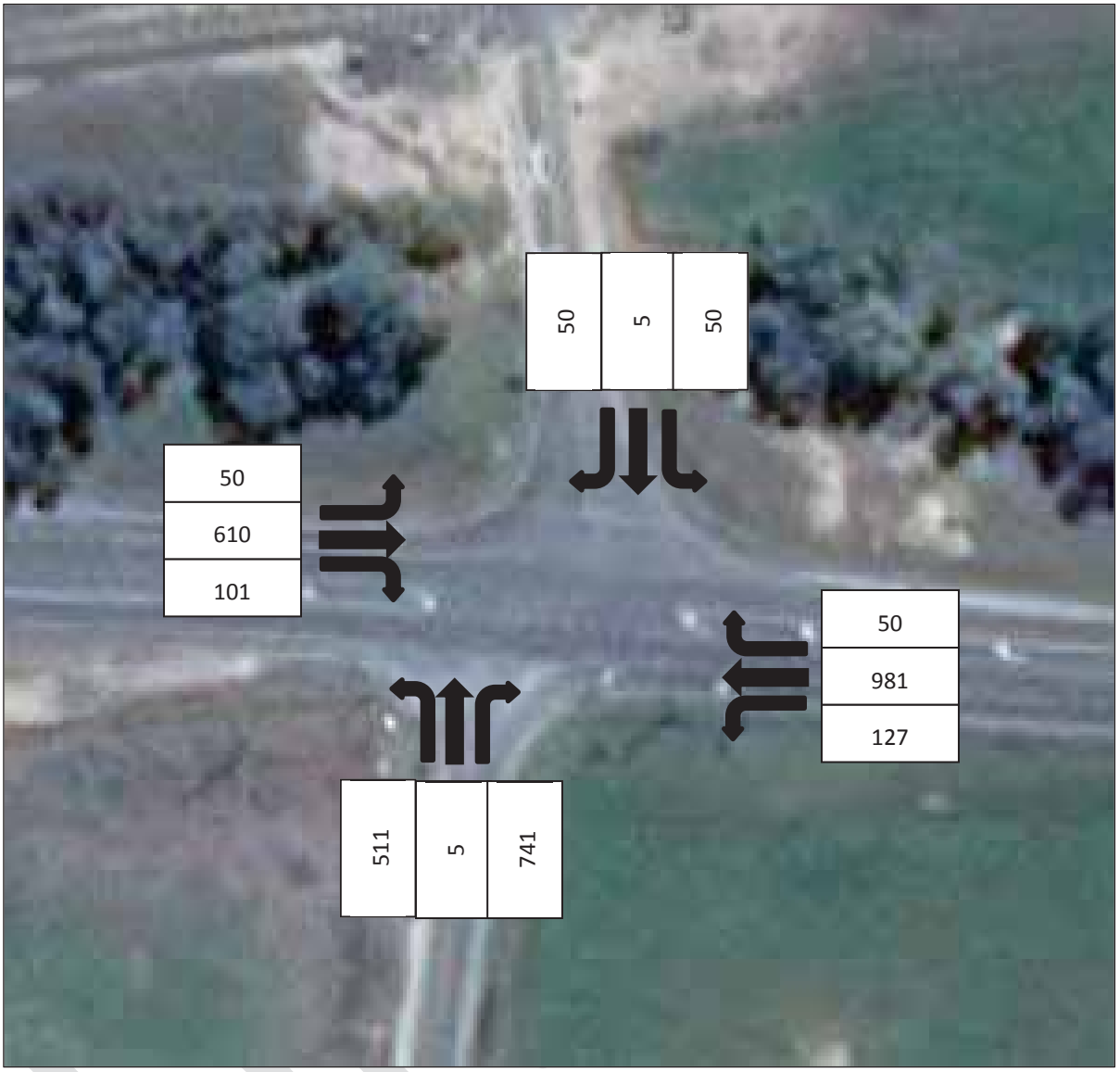
The initial SIDRA analysis resulted in excessive degrees of saturation due to the total volume of traffic generated and the movement of that traffic through the adjacent intersection. An iterative analysis of reduced traffic generated by Candidate Area 3 resulted in satisfactory intersection performance with 80% of the initially projected traffic volume; namely, 2,560 vph in the evening peak period.

This results in the traffic volumes shown in Figures 13 and 14. (Note - these volumes include traffic generated by the candidate area to/from both access points.)




Source: NearMap

**Figure 13: Candidate Area 3 Traffic Volumes (Two Access Points) Princes Highway/Sale-Heyfield Road**




Source: NearMap

**Figure 14: Candidate Area 3 Traffic Volumes (Two Access Points) Princes Highway/Hopkins Road**

### Princes Highway/Sale-Heyfield Road

The traffic volumes shown in Figure 11 and a modified geometry of the intersection were input into SIDRA to assess the likely performance of the Princes Highway/Sale-Heyfield Road intersection. The modification comprised a new leg on the southern approach with a right turn lane, a shared through and right turn lane and a separate left turn lane.

The output of the SIDRA analysis (including the adopted geometry) is attached at Appendix E and is summarised in Table 7.

**Table 7: Candidate Area 3 - Princes Highway/Sale-Heyfield Road SIDRA Analysis (Two Access Points)**

| Movement | Degree of Saturation | Average Delay | 95th Percentile Queue |
|---|---|---|---|
| **Site (South Approach)** | | | |
| Left | 0.30 | 6.5 sec | 12.0m |
| Through | 0.34 | 7.0 sec | 14.6m |
| Right | 0.34 | 15.0 sec | 14.6m |
| **Princes Highway (East Approach)** | | | |
| Left | 0.34 | 5.7 sec | 218.5m |
| Through | 0.34 | 6.1 sec | 218.5m |
| Right | 0.34 | 14.0 sec | 17.7m |
| **Sale-Heyfield Road (North Approach)** | | | |
| Left | 0.66 | 21.2 sec | 36.4m |
| Through | 0.66 | 21.5 sec | 36.4m |
| Right | 0.66 | 29.0 sec | 36.4m |
| **Princes Highway (West Approach)** | | | |
| Left | 0.94 | 26.9 sec | 156.8m |
| Through | 0.94 | 29.6 sec | 156.8m |
| Right | 0.94 | 40.3 sec | 135.1m |

The intersection operates with on overall Level of Service B.

Whilst this analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is sufficient capacity within the modified Princes Highway/Sale-Heyfield Road roundabout to accommodate the adopted traffic volumes.

### Princes Highway/Hopkins Road

The traffic volumes shown in Figure 12 and the geometry of a roundabout were input into SIDRA to assess the likely performance of the Princes Highway/Hopkins Road intersection. The roundabout included two lanes on the south approach (Hopkins Road) (shared right and through and separate left) and a single lane on the north approach (Williams Drive).

The output of the SIDRA analysis (including the adopted geometry) is attached at Appendix F and is summarised in Table 8.

**Table 8: Candidate Area 3 - Princes Highway/Hopkins Road SIDRA Analysis (Two Access Points)**

| Movement | Degree of Saturation | Average Delay | 95th Percentile Queue |
|---|---|---|---|
| **Hopkins Road (South Approach)** | | | |
| Left | 0.82 | 16.4 sec | 57.3m |
| Through | 0.90 | 18.2 sec | 99.1m |
| Right | 0.90 | 25.8 sec | 99.1m |
| **Princes Highway (East Approach)** | | | |
| Left | 0.42 | 5.6 sec | 29.1m |
| Through | 0.42 | 6.1 sec | 29.1m |
| Right | 0.42 | 14.1 sec | 27.6m |
| **Williams Drive (North Approach)** | | | |
| Left | 0.23 | 12.1 sec | 9.8m |
| Through | 0.23 | 12.3 sec | 9.8m |
| Right | 0.23 | 19.8 sec | 9.8m |
| **Princes Highway (West Approach)** | | | |
| Left | 0.67 | 19.3 sec | 77.5m |
| Through | 0.67 | 20.7 sec | 77.5m |
| Right | 0.67 | 30.8 sec | 61.9m |

The intersection operates with on overall Level of Service B.

Whilst this analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the adopted geometry of the roundabout to accommodate the adopted traffic volumes.

### Hopkins Road

The predicted daily traffic volume on Williams Road at Princes Highway is in the order of 7,500 vpd (comprising 6,400 vpd from Candidate Area 3 and 1,000 vpd existing). A two lane undivided carriageway would be sufficient to accommodate this level of traffic.

## 6.4 Conclusions - Capacity Analysis

### 6.4.1 Candidate Area 1: Wurruk

**Princes Highway/Hunt Place**

- The Princes Highway/Hunt Place roundabout needs to be upgraded to include a second lane added to the Hunt Place approach to accommodate the adopted traffic volumes.
- Whilst the analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the existing Princes Highway/Hunt Place roundabout (with a second lane added to the Hunt Place approach) to accommodate the adopted traffic volumes.

**Hunt Place**

- Hunt Place will exceed the indicative daily traffic volume for a Local Access A - Road.
- Hunt Place nonetheless has a cross-section and industrial environment that can accommodate the anticipated volume of traffic.

**Riverside Drive**

- Riverside Drive will exceed the indicative daily traffic volume for a Local Access B - Road.
- Riverside Drive nonetheless has a cross-section and industrial environment that can accommodate the anticipated volume of traffic.

**Extension of Hunt Place or Riverside Drive?**

- The extension of Riverside Drive to connect with Candidate Area 1 is preferable from a traffic engineering perspective than the extension of Hunt Place, although both options are workable.

### 6.4.2 Candidate Area 2: West Sale Aerodrome

- The completed analysis assumed that access to Candidate Area 2 would comprise access via both Sale-Heyfield Road and Princes Highway.

**Sale-Heyfield Road Access**

- Two access points are required via Sale-Heyfield Road, in addition to access via Williams Drive, for Candidate Area 2.
- The volume of right turn “out” traffic from each site access on Sale-Heyfield Road needs to be restricted to 509 vph to achieve an appropriate level of performance for the assumed T-intersection configuration.
- Whilst the analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the assumed T-intersection configuration to accommodate the adopted traffic volumes with two T-intersections on Sale-Heyfield Road.

**Princes Highway/Sale-Heyfield Road**

- The Princes Highway/Sale-Heyfield Road roundabout needs to be upgraded to include a second lane added to the Sale-Heyfield Road approach to achieve acceptable intersection performance.

- Whilst the analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the existing Princes Highway/Sale-Heyfield Road roundabout (with a second lane added to the Sale-Heyfield Road approach) to accommodate the adopted traffic volumes.

**Princes Highway/Williams Drive**

- The Princes Highway/Williams Drive intersection needs to be upgraded to a roundabout with two lanes on the Williams Drive approach to achieve acceptable intersection performance.
- Whilst the analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the modified Princes Highway/Williams Drive intersection (roundabout with a second lane added to the Williams Drive approach) to accommodate the adopted traffic volumes.

**Williams Drive**

- The existing railway level crossing will need to be upgraded from flashing lights to flashing lights and boom gates.
- A two lane undivided carriageway in Williams Drive would be sufficient to accommodate the anticipated volume of traffic.

### 6.4.3 Candidate Area 3: Fulham

- The completed analysis indicated that:
  - At least two access points (assumed to be via Princes Highway/Hopkins Road and the Princes Highway/Sale-Heyfield Road roundabout) are required to accommodate the traffic anticipated to be generated by Candidate Area 3.
  - The volume of traffic generated by Candidate Area 3 needs to be restricted to 80% of the initially projected traffic volume; namely, 2,560 vph in the evening peak period.

**Princes Highway/Sale-Heyfield Road**

- The Princes Highway/Sale-Heyfield Road roundabout needs to be upgraded to a four leg roundabout, with the new leg on the southern approach to comprise a right turn lane, a shared through and right turn lane and a separate left turn lane, to achieve acceptable intersection performance.
- Whilst the analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is sufficient capacity within the modified Princes Highway/Sale-Heyfield Road roundabout to accommodate the adopted traffic volumes.

**Princes Highway/Hopkins Road**

- The Princes Highway/Hopkins Road intersection needs to be upgraded to a roundabout with two lanes on the Hopkins Road approach and a single lane on the Williams Drive approach to achieve acceptable intersection performance.
- Whilst the analysis is based on a number of broad assumptions (including the adopted traffic generation rates), the SIDRA analysis nonetheless shows that there is spare capacity within the adopted geometry of the roundabout to accommodate the adopted traffic volumes.

### Hopkins Road

- A two lane undivided carriageway in Hopkins Road would be sufficient to accommodate the anticipated volume of traffic.

## 6.5 Qualitative Assessment of Potential Access Options

A qualitative assessment of the potential access options is shown in Table 9.

**Table 9: Qualitative Assessment of Potential Access Options**

| Option | Description | Pro's | Con's | Comments |
|---|---|---|---|---|
| **Candidate Area 1** | | | | |
| 1.1 | Connection via Riverside Drive | Uses existing roundabout at Princes Highway/Hunt Place<br>Uses existing railway level crossing - upgrade not needed? | Requires land acquisition<br>Potentially through sensitive area adjacent to Thomson River | |
| 1.2 | Connection via Hunt Place | Uses existing roundabout at Princes highway/Hunt Place<br>Uses existing railway level crossing - no upgrade required? | Requires land acquisition | |
| 1.3 | Access via Princes Highway/ Reid Drive | Uses existing intersection location | Requires new railway level crossing<br>May require land acquisition | Change existing wide median treatment to a roundabout |
| 1.4 | New roundabout on Princes Highway | | Requires new railway level crossing<br>Creates an additional roundabout on Princes Highway | No sight distance issues<br>Location dependent on spacings to treatments to east and west |
| 1.5 | Left in/left out to Princes Highway | Uses existing treatments at Polocross Drive (wide median treatment) and at Reid Drive (roundabout)<br>Some flexibility in location(s) of intersection(s) | Requires new railway level crossing<br>May require wide median treatment at Polocross Drive to be upgraded to a roundabout | Location(s) dictated by weaving distances |

| Option | Description | Pro's | Con's | Comments |
|---|---|---|---|---|
| **Candidate Area 2** | | | | |
| 2.1 | T-intersection(s) on Sale-Heyfield Road | Uses existing roundabout at Princes Highway/Sale-Heyfield Road<br>Uses existing railway level crossing - no upgrade required?<br>Flexibility in location(s) of intersection(s) | Bend in Sale-Heyfield Road limits potential location(s) | Must allow for potential road reserve widening for Sale Alternative Truck Route |
| 2.2 | Service road(s) to Sale-Heyfield Road | Allows development to front Sale-Heyfield Road<br>Uses existing roundabout at Princes Highway/Sale-Heyfield Road<br>Uses existing railway level crossing - no upgrade required?<br>Flexibility in location(s) of service road(s) | Bend in Sale-Heyfield Road limits potential location(s) | Must allow for potential road reserve widening for Sale Alternative Truck Route |
| 2.3 | New road off Williams Drive | Uses existing wide median treatment at Princes Highway/Williams Road /Hopkins Road<br>Uses existing railway level crossing | Upgrade of existing railway level crossing required<br>May require wide median treatment at Princes Highway/ Williams Road/Hopkins Road to be upgraded to a roundabout | New T-intersection with north-south traffic having priority and west leg (existing) giving way |
| 2.4 | Access via West Sale Aerodrome | Uses existing wide median treatment at Princes Highway/Williams Road /Hopkins Road<br>Uses existing railway level crossing | Upgrade of existing railway level crossing required<br>May require wide median treatment at Princes Highway/ Williams Road/Hopkins Road to be upgraded to a roundabout<br>Access via aerodrome car park and environs | |

| Option | Description | Pro's | Con's | Comments |
|---|---|---|---|---|
| **Candidate Area 3** | | | | |
| 3.1 | Access via Princes Highway/Sale-Heyfield roundabout | Uses existing intersection location | May require land acquisition | |
| 3.2 | Left in/left out to Princes Highway | Uses existing treatments at Hopkins Road/Williams Drive (wide median treatment) and at Sale-Heyfield Road (roundabout) | May require wide median treatment at Hopkins Road/Williams Drive to be upgraded to a roundabout | Location(s) dictated by weaving distances<br>No sight distance issues |
| 3.3 | Service road(s) to Princes Highway | Allows development to front Princes Highway<br>Utilises existing treatments at Hopkins Road/Williams Drive (wide median treatment) and at Sale-Heyfield Road (roundabout)<br>Flexibility in location(s) of service road(s) | May require wide median treatment at Hopkins Road/Williams Drive to be upgraded to a roundabout | Location(s) dictated by weaving distances<br>No sight distance issues |
| 3.4 | New roundabout on Princes Highway | | Creates an additional roundabout on Princes Highway | No sight distance issues<br>Location dependent on spacings to treatments to east and west |
| 3.5 | T-intersection(s) on Hopkins Road | Uses existing wide median treatment at Princes Highway/Hopkins Road/Williams Drive<br>Flexibility in location(s) of intersection(s) | May require existing wide median treatment at Princes Highway/Hopkins Road/Williams Drive to be upgraded to a roundabout | No sight distance issues |
| 3.6 | Direct access to Hopkins Road | Allows development to front Hopkins Road<br>Uses existing wide median treatment at Princes Highway/ Hopkins Road/Williams Drive | Large lots only to front Hopkins Road<br>Corner sites to take access off side road | No sight distance issues |

| Option | Description | Pro's | Con's | Comments |
|---|---|---|---|---|
| 3.7 | Service road(s) to Hopkins Road | Allows development to front Hopkins Road<br>Uses existing wide median treatment at Princes Highway/ Hopkins Road/Williams Drive | | No sight distance issues |

# 7 Indicative Costs of Mitigating Works

To assist the comparison of the candidate areas, preliminary indicative costs of the upgrades required as detailed in this report (major intersections and railway level crossings) have been prepared. It is noted that these preliminary indicative costs are not based on any plans, surveys, locations of services and the like, and as such should only be relied upon for a relative comparison of the potential costs of the treatments.

Further, it is noted that, as detailed in Sections 6.1.1, 6.2.1 and 6.3.1, a number of access options exist for the candidate areas including service roads and direct property access (eg on Hopkins Road). These have not been costed.

Table 10 provides a comparison of the relative costs of the required upgrades as detailed in this report.

**Table 10: Comparison of Relative Costs of Required Upgrades (1)**

| | Works | Preliminary Indicative Cost (1) | |
|---|---|---|---|
| | | Works | Total |
| **Candidate Area 1** | Second lane on north (Hunt Place) approach to Princes Highway/Hunt Place roundabout | $180,000 | $1,880,000 |
| | Riverside Drive extension (2) | $1,700,000 | |
| **Candidate Area 2** | T-intersections on Sale-Heyfield Road (two) | $1,800,000 | $4,050,000 |
| | Second lane on north (Sale-Heyfield Road) approach to Princes Highway/Sale-Heyfield Road roundabout | $250,000 | |
| | Upgrade Princes Highway/Williams Drive intersection to a roundabout (with two lanes on northern (Williams Drive) approach) | $1,500,000 | |
| | Upgrade Williams Drive railway level crossing | $500,000 | |
| **Candidate Area 3** | Add fourth (southern) leg to Princes Highway/Sale-Heyfield Road roundabout (2) | $300,000 | $1,800,000 |
| | Upgrade Princes Highway/Hopkins Road intersection to a roundabout | $1,500,000 | |

(1) It is noted that these preliminary indicative costs are not based on any plans, surveys, locations of services and the like, and as such should only be relied upon for a relative comparison of the potential costs of the treatments.

(2) Excludes land acquisition costs.

# Appendix A
# SIDRA Output
# Candidate Area 1 - Princes Highway/Hunt Place

# Appendix B
# SIDRA Output
# Candidate Area 2 - Sale-Heyfield Road/Site Access

# Appendix C
# SIDRA Output
# Candidate Area 2 - Princes Highway/Sale-Heyfield Road

# Appendix D
# SIDRA Output
# Candidate Area 2 - Princes Highway/Williams Drive

# Appendix E
# SIDRA Output
# Candidate Area 3 - Princes Highway/Sale-Heyfield Road

# Appendix F
# SIDRA Output
# Candidate Area 3 - Princes Highway/Hopkins Road

# APPENDIX C CULTURAL HERITAGE REPORT

# APPENDIX D BIODIVERSITY REPORT

Draft Report

# Desktop Biodiversity Assessment: West Sale and Wurruk Industrial Land Supply Strategy

Prepared for

**Urban Enterprise**

September 2017

**Ecology and Heritage Partners Pty Ltd**

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## Contents



## Document Control

| | |
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| **Assessment** | Desktop Biodiversity Assessment |
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| **Project number** | 9353 |
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# 1 Introduction

Ecology and Heritage Partners Pty Ltd was commissioned by Urban Enterprise to conduct a Desktop Biodiversity Assessment for the West Sale and Wurruk Industrial Land Supply Strategy. The Strategy will inform Wellington Shire Council whether sufficient, appropriately zoned industrial land is available to meet the forecast demand over a short-medium term (five to ten-year period) and ensure that its future development can occur in a coordinated and timely manner.

The purpose of this desktop biodiversity assessment was to identify ecological values that are known to, or are likely to occur within the study area, and determine the potential regulatory and legislative implications, and potential key constraints, for future industrial use of the sites. This report discusses the results of the assessment in relation to relevant Commonwealth and State environmental legislation. The report also provides recommendations to address or reduce impacts and, where necessary, highlights components that require further investigation, such as targeted surveys.

## 1.1 Study Area

The study area is located at West Sale and Wurruk, approximately 12 kilometres west of Sale, Victoria (Figure 1). This assessment covers three sites along the Princes Highway, which have the following characteristics:

- Site 1: located to the west of the existing industrial zoned land in Wurruk:
    - Approximately 42 ha in size;
    - Zoned as Farming Zone; and,
    - The northern boundary backs on to the Thompson River and riverside vegetation.
- Site 2: located to the north of the Princes Highway and to the east of the West Sale Aerodrome:
    - Approximately 79 ha in size; and,
    - Zoned as Farming Zone.
- Site 3: located to the south of the Princes Highway and east of the Fulham Correctional Centre:
    - Approximately 104 ha in size; and,
    - Zoned as Faming Zone.

According to the Department of Environment, Land, Water and Planning (DELWP) Native Vegetation Information Management (NVIM) Tool (DELWP 2017a), the study areas occur within the Gippsland Plain bioregion. The study area is located within the jurisdiction of the West Gippsland Catchment Management Authority (CMA) and the Wellington Shire Council municipality.

# 2 Methods

## 2.1 Desktop Assessment

The following relevant literature, online-resources and databases were reviewed to provide an assessment of flora and fauna values associated with the study area:

- The DELWP NVIM Tool (DELWP 2017a) and NatureKit (DELWP 2017b) for:
    - Modelled data for location risk, remnant vegetation patches, scattered trees and habitat for rare or threatened species;
    - Current wetlands; and,
    - The extent of historic and current EVCs.
- EVC benchmarks (DELWP 2017c) for descriptions of EVCs within the relevant bioregion;
- The Victorian Biodiversity Atlas (VBA) for previously documented flora and fauna records within the project locality (DELWP 2017d);
- The Illustrated Flora Information System of Victoria (IFLISV) (Gullan 2017) for assistance with the distribution and identification of flora species;
- The Commonwealth Department of the Environment (DoEE) Protected Matters Search Tool (PMST) for matters of National Environmental Significance (NES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (DoEE 2017);
- Relevant listings under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act), including the latest Threatened and Protected Lists (DELWP 2017e; DELWP 2016);
- The Planning Maps Online (DELWP 2017f) and Planning Schemes Online (DELWP 2017g) to ascertain current zoning and environmental overlays in the study area;
- Other relevant environmental legislation and policies as required; and,
- Aerial photography of the study area.

## 2.2 Permitted Clearing Assessment (the Guidelines)

Under the *Planning and Environment Act 1987,* Clause 52.17 of the Planning Schemes requires a planning permit from the relevant local Council to remove, destroy or lop native vegetation. The assessment process for the clearing of vegetation follows the 'Permitted clearing of native vegetation - Biodiversity assessment guidelines' (the Guidelines) (DEPI 2013). The 'Biodiversity assessment handbook - Permitted clearing of native vegetation' (the Handbook) provides clarification regarding the application of the Guidelines (DELWP 2015).

For the purposes of this desktop assessment, modelled native vegetation and condition scores provided by DELWP (2017b) was used to estimate the extent of native vegetation to be removed and quantity and quantity of biodiversity offsets that may be required for each site. However, a site assessment will be required to assess the extent and quality of native vegetation to be removed prior to submitting a planning permit to Council. The sub-sections below explains this process.

### 2.2.1 *Risk-based Pathway*

The Guidelines manage the impacts on biodiversity from native vegetation removal using a risk-based approach. Two factors – extent risk and location risk – are used to determine the risk associated with an application for a permit to remove native vegetation. The location risk (A, B or C) has been determined for all areas in Victoria and is available on DELWP's Native Vegetation Information Management (NVIM) Tool (DELWP 2017a). Determination of risk-based pathway is summarised in Table 1.

**Table 1.** Risk-based pathways for applications to remove native vegetation (DEPI 2013)

| Extent | | Location | | |
|---|---|---|---|---|
| | | A | B | C |
| Native Vegetation | < 0.5 hectares | Low | Low | High |
| | ≥ 0.5 hectares and < 1 hectare | Low | Moderate | High |
| | ≥ 1 hectare | Moderate | High | High |
| Scattered Trees | < 15 scattered trees | Low | Moderate | High |
| | ≥ 15 scattered trees | Moderate | High | High |

**Notes:** For the purpose of determining the risk-based pathway of an application to remove native vegetation the extent includes any other native vegetation that was permitted to be removed on the same contiguous parcel of land with the same ownership as the native vegetation to be removed, where the removal occurred in the five year period before an application to remove native vegetation is lodged.

### 2.2.2 *Vegetation Assessment*

Native vegetation (as defined in Table 2) is assessed using two key parameters: extent (in hectares) and condition. Extent is determined through a field assessment. The condition score for Moderate and High Risk-based pathways must be assessed through a habitat hectare[1] assessment conducted by a qualified ecologist. The condition score for Low Risk-based pathways may be based on either modelled data available on the NVIM Tool (DELWP 2017a), or through a habitat hectare assessment.

In addition, all mapped wetlands (based on the DELWP 'Current Wetlands' layer) must be included as native vegetation, with the modelled condition score assigned to them (DELWP 2017b).

[1] A 'habitat hectare' is a unit of measurement which combines the condition and extent of native vegetation.

**Table 2.** Determination of remnant native vegetation (DEPI 2013)

| Category | Definition | Extent | Condition |
|---|---|---|---|
| Remnant patch of native vegetation | An area of vegetation where at least 25 per cent of the total perennial understorey plant cover is native.<br>OR<br>An area with three or more native canopy trees where the canopy foliage cover is at least 20 per cent of the area. | Measured in hectares.<br>Based on hectare area of the remnant patch. | Vegetation Quality Assessment Manual (DSE 2004). |
| Scattered tree | A native canopy tree that does not form part of a remnant patch. | Measured in hectares.<br>Each scattered tree is assigned an extent of 0.071 hectares (30m diameter). | Scattered trees are assigned a default condition score of 0.2. |

**Notes:** Native vegetation is defined in the Victoria Planning Provisions as 'plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses'.

### *2.2.3 Offsets*

Offsets are required to compensate for the permitted removal of native vegetation.

The offset requirements for Low risk-based pathway applications are calculated using the NVIM Tool, resulting in a Biodiversity Assessment Report.

The offset requirements for a Moderate or High risk-based pathway are calculated by DELWP, based on the vegetation condition scores determined during a biodiversity assessment. This results in a Biodiversity Assessment Report OR Biodiversity Impact and Offset Requirements report (BIOR) produced by DELWP.

For the purposes of this desktop assessment, a scenario of native vegetation clearing was carried out using modelled native vegetation and condition scores provided by DELWP (2017b), and assuming that all of the modelled vegetation within the three sites is proposed to be removed. The estimation of the offsets required was calculated using the EnSym offsets tool.

## 2.3 Assessment Qualifications and Limitations

Data and information held within the ecological databases and mapping programs reviewed in the desktop assessment (e.g. VBA, PMST, Biodiversity Interactive Maps etc.) are unlikely to represent all flora and fauna observations within, and surrounding, the study area. It is therefore important to acknowledge that a lack of documented records does not necessarily indicate that a species or community is absent.

The assessment was based on desktop information only and did not include a site assessment.

# 3 Results

## 3.1 Native Vegetation

### *3.1.1 Ecological Vegetation Classes (EVCs)*

Pre-1750 modelled EVC mapping indicates that study area would have been historically dominated by Plains Grassy Woodland (EVC 55) and Plains Grassy Woodland/Gilgai Wetland Mosaic (EVC 259), with smaller areas of Floodplain Reedbed (EVC 863) and Floodplain Riparian Woodland (EVC 56) located along the banks of the Thomson River in Site 1 (DELWP 2017b).

Current (2005) modelled mapping of EVCs indicates that approximately 35.35 hectares of native vegetation remains within the study area (Table 3) (DELWP 2017b). Plains Grassy Woodland is modelled as occurring in all three sites, with the largest extent (14.91 hectares) of this EVC occurring within the western side of Site 2 (Figure 2). Floodplain Riparian Woodland is also modelled to be present within Site 1, and Plains Grassy Woodland/Gilgai Wetland Mosaic is modelled to be present in Site 3. All of these EVCs have a Bioregional Conservation Status of Endangered.

**Table 3.** Extent of remnant native vegetation modelled to be present in each of the three sites within the study area (2005 data; DELWP 2017b).

| Site | EVC | EVC Number | Bioregional Conservation Status | Area (ha) |
|---|---|---|---|---|
| 1 | Plains Grassy Woodland | 55 | Endangered | 1.36 |
| 1 | Floodplain Riparian Woodland | 56 | Endangered | 5.22 |
| 2 | Plains Grassy Woodland | 55 | Endangered | 8.16 |
| 2 | Plains Grassy Woodland/ Gilgai Wetland Mosaic | 259 | Endangered | 5.70 |
| 3 | Plains Grassy Woodland | 55 | Endangered | 14.91 |

Recent and historical aerial imagery suggests that remnant vegetation is still present within Site 1 adjacent to Thomson River (Plate 1a). However, current aerial imagery shows little evidence of native canopy cover throughout the Site 2 and 3, and it is likely that parts of these Sites have been cleared and used for agriculture (Plate 1b-c).

Rows of trees are present along fencelines and driveways, however many appear to be in straight lines and are possibly planted, which would mean that they are exempt from native vegetation clearing regulations. In particular, the area in the west of Site 2 appears to be largely cleared of any woodland vegetation, contrary to DELWP's current EVC modelling (see Figure 2). A site assessment will be required to confirm that these trees are indeed planted. It is possible that some of these trees are scattered remnant trees and/or small areas of remnant woodland. It is also possible that a native understorey and groundcover persists in some areas, even though a canopy is lacking.

(a)

(b)

(c)

**Plate 1.** Recent aerial imagery of the three sites. (a) Site 1; (b) Site 2; (c) Site 3. Source: ESRI; date not provided.

### *3.1.2 Current Wetlands*

The DELWP Current Wetlands layer identified wetlands present in all three sites, with a total area of 2.23 hectares (Figure 2; Table 4; DELWP 2017b). Due to the difficulty in mapping wetlands, under the Guidelines all mapped wetlands based on this layer that are to be impacted must be included as native vegetation, with the modelled condition score assigned to them (DELWP 2017b).

**Table 4.** Extent of mapped wetlands present in each of the three sites within the study area (DELWP 2017b).

| Site | Area (ha) |
|---|---|
| 1 | 0.59 |
| 2 | 1.42 |
| 3 | 0.23 |

## 3.2 Significance Assessment

### 3.2.1 Flora

The VBA contains records of five nationally significant and 19 State significant flora species previously recorded within 10 kilometres of the study area (DELWP 2017d) (Appendix 1.1; Figure 4). The PMST nominated an additional five nationally significant species which have not been previously recorded but have the potential to occur in the locality (DoE 2017).

The majority of the nearby significant flora records are from the Holey Plains State Park, located approximately 10 km to the south west of the study area, with a smaller number of records in nearby riparian and wetland habitats within the Gippsland Lakes and a nearby flora reserve (Herb Guyatt Flora Reserve) (Figure 4).

It is possible that the native vegetation present within Site 1 adjacent to Thomson River provides habitat for significant flora. However given the remainder of the Site 1, and all of Site 2 and Site 3 appears to be cleared there are unlikely to be any other areas that provide habitat for significant flora, particularly if understorey vegetation has been heavily disturbed. It is also possible that the small wetland areas indicated by the DELWP Current Wetlands layer provide habitat for significant flora species; however, this is dependent on the history and degree of disturbance (which is likely to be high) and will need to be clarified with a site assessment.

Depending on the condition of the remnant vegetation near Thomson River, and the condition of any other remnant vegetation that may be present (including wetlands), there may be suitable habitat for several State significant flora species (Appendix 1). In particular, Rough-grain Love-grass *Eragrostis trachycarpa* and Lanky Buttons *Leptorhynchos elongatus* have been recorded in roadside vegetation adjacent to Site 2, although these records are from the early 1990s and the species may no longer persist in the area.

Two nationally significant species have been found within 10 km of the study area within the last ten years: Wellington Mint-bush *Prostanthera galbraithiae* and River Swamp Wallaby-grass *Amphibromus fluitans.* Further notes on these two species are as follows:

**Wellington Mint-bush**

There are several records of the nationally significant Wellington Mint-bush located in the Holey Plains State Park. This park is the stronghold for this species, and supports ten of the 11 current or recently known populations of Wellington Mint-bush, with plants from the 11$^{th}$ population at Dutson Downs (approximately 25 km east of the study area) not being recorded since 1986 (Carter and Walsh 2006). Given the lack of records outside of the Holey Plains State Park, and that the preferred habitat of Wellington Mint Bush is heathy open forest, heathland and heathy woodland usually on gravelly sand (Carter and Walsh 2006), it is unlikely that the study area supports habitat for this species.

**River Swamp Wallaby-grass**

River Swamp Wallaby-grass is known from the Rosedale, Meeniyan and Wonthaggi areas in Gippsland, and occurs in both natural and man-made water-bodies, including swamps, lagoons, billabongs and dams (TSSC 2008). Habitat could potentially occur within the study area for River Swamp Wallaby-grass, within wetlands

and remnant vegetation near Thomson River. A site assessment would establish the presence of suitable habitat and the species' likelihood of presence.

### *3.2.2 Fauna*

The VBA contains records of six nationally significant, 22 State significant and 9 regionally significant fauna species previously recorded within 10 kilometres of the study area (DELWP 2017d) (Appendix 2.1; Figure 5). The PMST nominated an additional 11 nationally significant species which have not been previously recorded but have the potential to occur in the locality (DoE 2016).

Habitat within the study area may be suitable to support three EPBC Act-listed species, namely Grey-headed Flying Fox *Pteropus poliocephalus*, Dwarf Galaxias *Galaxiella pusilla* and Growling Grass Frog *Litoria raniformis*.

Grey-headed Flying Fox is a highly mobile species and forages on flowering eucalypts, which may be present within the woodland patch to the north-east of the study area (Site 1).

Wetland habitat within the study area, including farm dams may provide suitable habitat for a range of aquatic and wetland dependant fauna including fish, frogs and wetland birds. Nationally significant fauna that may utilise this habitat include Dwarf Galaxias and Growling Grass Frog *Litoria raniformis*. These species also have potential to occur in the adjoining Thomson River which may be impacted by the project due to sedimentation and changes in hydrology.

There are a high number of records of State and regionally significant wetland birds within 10 kilometres of the study area including Magpie Goose *Anseranas semipalmata*, Musk Duck *Biziura lobata*, Australian Shoveler *Anas rhynchotis*, Hardhead *Aythya australis*, Eastern Great Egret *Ardea modesta*, Pied Cormorant *Phalacrocorax varius*, Royal Spoonbill *Platalea regia* and Latham's Snipe *Gallinago hardwickii*. However most of these records are contained within the larger wetlands associated with Sale Common Nature Conservation Reserve located approximately 6 kilometres to the south-east of the study area.

The VBA and PMST contain records for 15 migratory species. The majority of records are from the coastline, lakes and wetlands in the surrounding landscape associated with the Gippsland Lakes Ramsar site (Figure 5). Aerial imagery indicates that the study area does not support any significant water bodies, and as such it is unlikely to provide 'important habitat' for migratory species as defined under the EPBC Act; although, migratory species may fly over the study area during their migration period or en-route to better quality habitats in the surrounding area.

### *3.2.3 Communities*

Three nationally listed ecological communities are predicted to occur within 10 kilometres of the study area (DoEE 2017):

- Natural Damp Grassland of the Victorian Coastal Plains;
- Gippsland Red Gum (*Eucalyptus tereticornis* subsp. *mediana*) Grassy Woodland and Associated and Native Grassland; and,
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains.

Any Plains Grassy Woodland that is present within the study area will need to be assessed against the condition thresholds for the Gippsland Red Gum (*Eucalyptus tereticornis* subsp. *mediana*) Grassy Woodland and Associated and Native Grassland, as the study area falls within the indicative area for the occurrence of this community (Plate 2), and the Gippsland Plains Grassy Woodland EVC can correspond to this community (DEWHA 2010).

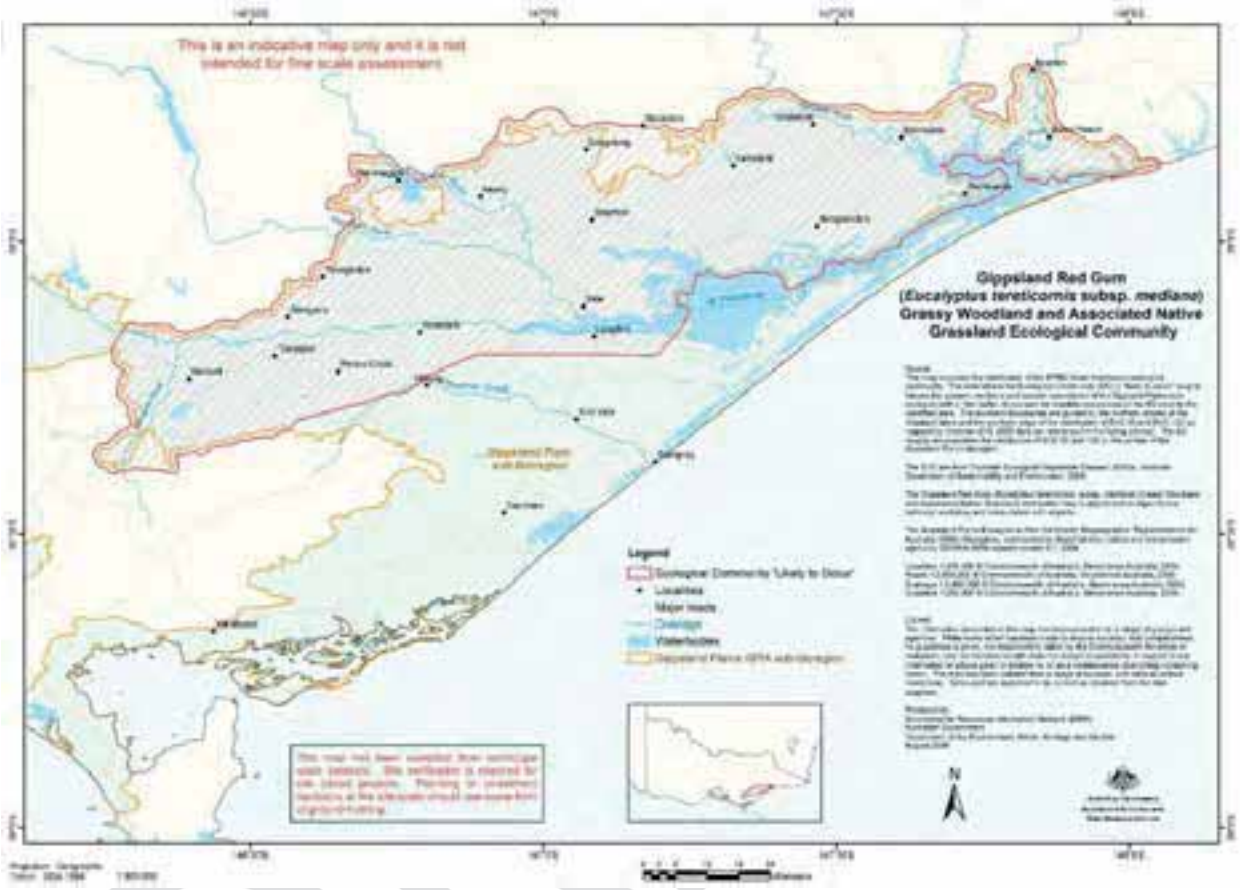


**Plate 2.** Indicative map of the distribution of the Gippsland Red Gum (*Eucalyptus tereticornis* subsp. *mediana*) Grassy Woodland and Associated and Native Grassland (DEWHA 2010).

It is unlikely that Natural Damp Grassland of the Victorian Coastal Plains occurs within the study area, given that grassland EVCs are not modelled to occur (DELWP 2017b), and that the study area has been used for agricultural purposes, likely resulting in a high level of understorey degradation.

Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains has potential to occur in the study area. The DELWP Current Wetlands layer indicates the presence of several wetlands, and there is an area of modelled Plains Grassy Woodland/Gilgai Wetland Mosaic EVC in Site 3 (Figure 2). The listing advice for this community lists Gilgai Wetland (EVC 678) as one of the EVCs that can correspond with the Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains ecological community (TSSC 2012). If the area has been significantly disturbed as a result of cultivation, then the potential for this community to occur is low.

Two FFG Act-listed ecological communities are modelled to occur in the study area (Figure 2, DELWP 2017b):

- Central Gippsland Plains Grassland; and,
- Forest Red Gum Grassy Woodland.

Both of these communities correspond to the nationally significant Gippsland Red Gum (*Eucalyptus tereticornis* subsp. *mediana*) Grassy Woodland and Associated and Native Grassland, and may occur in the study area if remnant Plains Grassy Woodland is found to occur.

## 3.3 Permitted Clearing Assessment (the Guidelines)

### *3.3.1 Vegetation proposed to be removed*

In the event that native vegetation within the three sites is proposed to be cleared, a site assessment would be required to determine the extent of clearing and the associated risk-based pathway. Location Risk for each site is provided in Figure 3. An explanation of how risk-based pathway is determined is provided in Section 2.2.1.

For the purposes of this desktop assessment, a scenario of native vegetation clearing was investigated using modelled native vegetation and condition scores provided by DELWP (2017b), and assuming that all of the modelled vegetation is proposed to be removed. The estimation of the offsets required was calculated using the EnSym offsets tool.

Note that this includes the extent of modelled EVCs as well as the extent of wetlands provided in the DELWP Current Wetlands layer.

**Site 1:**

The study area is within Location A, with 7.170 hectares of modelled native vegetation present. If all modelled vegetation is proposed to be removed, the permit application would fall under the Moderate Risk-based pathway.

**Table 5.** Permitted Clearing Assessment (the Guidelines).

| | |
|---|---|
| **Risk-based pathway** | Moderate |
| **Total Extent*** | 7.170 |
| **Remnant Patch (ha)** | 7.170 |
| **Scattered Trees (no.)** | 0 |
| **Location Risk** | A |
| **Strategic Biodiversity Score** | 0.332 |

* Extent based on modelled native vegetation extent provided by DELWP (2017b)

**Site 2:**

The study area is within Location A, with 16.323 hectares of modelled native vegetation present. If all modelled vegetation is proposed to be removed, the permit application would fall under the Moderate Risk-based pathway.

**Table 5.** Permitted Clearing Assessment (the Guidelines)

| | |
|---|---|
| **Risk-based pathway** | High |
| **Total Extent*** | 16.337 |
| **Remnant Patch (ha)** | 16.337 |
| **Scattered Trees (no.)** | 0 |
| **Location Risk** | C |
| **Strategic Biodiversity Score** | 0.770 |

* Extent based on modelled native vegetation extent provided by DELWP (2017b)

Site 3:

The study area is within Location A, with 14.089 hectares of modelled native vegetation present. If all modelled vegetation is proposed to be removed, the permit application would fall under the High Risk-based pathway.

**Table 4.** Permitted Clearing Assessment (the Guidelines)

| | |
|---|---|
| **Risk-based pathway** | Moderate |
| **Total Extent*** | 14.101 |
| **Remnant Patch (ha)** | 14.101 |
| **Scattered Trees (no.)** | 0 |
| **Location Risk** | A |
| **Strategic Biodiversity Score** | 0.111 |

* Extent based on modelled native vegetation extent provided by DELWP (2017b)

### *3.3.2 Offset Targets*

Based on an estimate of 100% loss of vegetation modelled by DELWP, the offset requirement for native vegetation removal is as follows: Site 1 = 1.762 General Biodiversity Equivalence Units (BEU); Site 2 = 1.728 General BEUs along with 9.023 Specific units of habitat for Rough-grain Love-grass; Site 3 = 0.471 General BEUs. Please note that these results are based on desktop data only and are unlikely to represent the true offset targets at each site.

**Table 6.** Offset targets, based on the assumption of 100% loss of all modelled vegetation (DELWP 2017b) within study area. BEU = Biodiversity Equivalence Units

| | **Site 1** | **Site 2** | **Site 3** |
|---|---|---|---|
| **General Offsets Required** | 1.762 General BEUs | 1.728 General BEUs | 0.471 General BEUs |
| **Specific Offsets Required** | None | 9.023 specific units of habitat for Rough-grain Love-grass | None |
| **Vicinity (catchment / LGA)** | West Gippsland CMA or Wellington Shire Council | West Gippsland CMA or Wellington Shire Council | West Gippsland CMA or Wellington Shire Council |
| **Minimum Strategic Biodiversity Score*** | 0.265 | 0.443 | 0.089 |

# 4 Legislative and Policy Implications

## 4.1 *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)

The EPBC Act establishes a Commonwealth process for the assessment of proposed actions likely to have a significant impact on any matters of National Environment Significance (NES), described in Table 7.

**Table 7.** Potential impacts to matters of National Environmental Significance (NES)

| Matter of NES | Potential Impacts |
|---|---|
| World Heritage properties | The proposed action will not impact any properties listed for World Heritage. |
| National heritage places | The proposed action will not impact any places listed for national heritage. |
| Ramsar wetlands of international significance | The study area occurs within the same catchment as one Ramsar wetland (DoEE 2017): Gippsland Lakes.<br>Management practices and construction techniques should be consistent with Construction Techniques for Sediment Pollution Control (EPA 1991) and Environmental Guidelines for Major Construction Sites (EPA 1996). It is possible that the proposed action will impact the ecological character of any Ramsar wetland if erosion and sediment control, and changes to surface-water flows, is not properly considered. |
| Threatened species and ecological communities | There is potential for one listed flora species occurring in the study area – River Swamp Wallaby-grass.<br>It is possible that there may be habitat for three fauna species listed under the EPBC Act: Grey-headed Flying Fox, Growling Grass Frog and Dwarf Galaxias.<br>It is possible that two listed communities occur in the study area: Gippsland Red Gum (*Eucalyptus tereticornis* subsp. *mediana*) Grassy Woodland and Associated and Native Grassland occurs within the study area; and, Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains. |
| Migratory and marine species | The PMST search nominated 15 migratory species as having been recorded within 10 kilometres of the study area (DoEE 2017). However, the study area is unlikely to provide important habitat that migratory species would be dependent upon. |
| Commonwealth marine area | The proposed action will not impact any Commonwealth marine areas. |
| Nuclear actions (including uranium mining) | The proposed action is not a nuclear action. |
| Great Barrier Reef Marine Park | The proposed action will not impact the Great Barrier Reef Marine Park. |
| Water resources impacted by coal seam gas or mining development | The proposed action is not a coal seam gas or mining development. |

### 4.1.1 *Implications*

Development of the study area has potential to have a significant impact upon two matters of NES: Ramsar Wetlands of International Significance, and, threatened species and ecological communities. A site assessment is recommended to determine the presence and potential impact to threatened species and ecological communities. A hydrological assessment is recommended to determine what impact the development is likely to have on the water quality and quantity of Thomson River and downstream

Gippsland Lakes. If a significant impact to any matter of NES is likely, the proposed development should be referred to the Commonwealth Minster of the Environment for consideration under the EPBC Act. -

### *4.2 Environment Effects Act 1978*

The EE Act provides for assessment of proposed actions that are capable of having a significant effect on the environment via the preparation of an Environment Effects Statement (EES). A project with potential adverse environmental effects that, individually or in combination, could be significant in a regional or State context should be referred. An action may be referred for an EES decision where:

- one of the following occurs:
    - Potential clearing of 10 hectares or more of native vegetation from an area that:
        - is of an EVC identified as endangered by DELWP;
        - is of Very High conservation significance; or,
        - is not authorised under an approved Forest Management Plan or Fire Protection Plan.
    - Potential long-term loss of a significant proportion (1-5% depending on conservation status of species) of known remaining habitat or population of a threatened species within Victoria.
- or where two or more of the following occur:
    - Potential clearing of 10 hectares or more of native vegetation, unless authorised under an approved Forest Management Act or Fire Protection Plan;
    - Matters listed under the FFG Act:
        - Potential loss of a significant area of a listed ecological community;
        - Potential loss of a genetically important population of an endangered or threatened species;
        - Potential loss of critical habitat; or,
        - Potential significant effects on habitat values of a wetland supporting migratory birds.

#### *4.2.1 Implications*

More than 10 hectares of EVCs identified as Endangered has been modelled by DELWP occur within the study area. As such, development of the study area may trigger an EES referral. A site assessment to confirm the extent of Endangered EVCs should be undertaken before assessing whether an EES referral is required.

### *4.3 Flora and Fauna Guarantee Act 1988 (Victoria)*

The FFG Act is the primary legislation dealing with biodiversity conservation and sustainable use of native flora and fauna in Victoria. Proponents are required to apply for an FFG Act Permit to 'take' listed and/or protected flora species, listed vegetation communities and listed fish species in areas of public land (i.e. within road reserves, drainage lines and public reserves). An FFG Act permit is generally not required for

removal of species or communities on private land, or for the removal of habitat for a listed terrestrial fauna species.

There may be suitable habitat within the study area for species 'listed' or 'protected' under the FFG Act, however this will need to be confirmed by a site assessment (Appendix 1, Appendix 2).

### *4.3.1 Implications*

An FFG Act permit is not required to impact on listed species or ecological communities on private land. However, the presence of FFG Act-listed species and ecological communities is relevant when assessing triggers for an EES referral.

## *4.4 Planning and Environment Act 1987*

The *Planning and Environment Act 1987* outlines the legislative framework for planning in Victoria and for the development and administration of planning schemes. All planning schemes contain native vegetation provisions at Clause 52.17 which require a planning permit from the relevant local Council to remove, destroy or lop native vegetation on a site of more than 0.4 hectares, unless an exemption under clause 52.17-7 of the Victorian Planning Schemes applies (Appendix 1.5.3) or a subdivision is proposed with lots less than 0.4 hectares[2]. Local planning schemes may contain other provisions in relation to the removal of native vegetation.

### *4.4.1 Planning Zones and Overlays*

The study area is located within the Wellington Shire Council municipality. The following zoning and overlays apply (DELWP 2017f, 2017g):

- Farming Zone (FZ);
- Flood and Land Subject to Inundation Overlay (Schedule 6); and,
- Public Use Schedule 1 (PUZ1).

### *4.4.2 The Guidelines*

The State Planning Policy Framework and the decision guidelines at Clause 52.17 (Native Vegetation) and Clause 12.01 require Planning and Responsible Authorities to have regard for 'Permitted clearing of native vegetation - Biodiversity assessment guidelines' (the Guidelines) (DEPI 2013).

### *4.4.3 Implications*

Based on an estimate of modelled DELWP data, and assuming 100% loss of vegetation, the following pathways apply:

- Site 1:

[2] In accordance with the Victorian Civil and Administrative Tribunal's (VCAT) decision Villawood v Greater Bendigo CC (2005) VCAT 2703 (20 December 2005) all native vegetation is considered lost where proposed lots are less than 0.4 hectares in area and must be offset at the time of subdivision.

  - The study area is within Location A, with 7.170 hectares of modelled native vegetation present.
  - The permit application would fall under the Moderate Risk-based pathway
- Site 2:
  - The study area is within Location A, with 16.323 hectares of modelled native vegetation present.
  - The permit application would fall under the Moderate Risk-based pathway.
- Site 3:
  - The study area is within Location A, with 14.089 hectares of modelled native vegetation present.
  - The permit application would fall under the High Risk-based pathway.

Based on an estimate of 100% loss of vegetation as modelled by DELWP, the offset requirement for native vegetation removal is as follows:

- Site 1: 1.762 General Biodiversity Equivalence Units (BEU);
- Site 2: 1.728 General BEUs along with 9.023 Specific units of habitat for Rough-grain Love-grass; and,
- Site 3: 0.471 General BEUs.

A Planning Permit from Wellington Shire Council is required to remove, destroy or lop any native vegetation. The application will be referred to DELWP if greater than 0.5 hectares of vegetation are proposed for removal. Offsets will need to be achieved in accordance with the Guidelines. Specific offsets for Rough-grain Love-grass are likely to be difficult to locate and require additional effort to secure than general offsets.

### 4.5 *Catchment and Land Protection Act 1994*

The CaLP Act contains provisions relating to catchment planning, land management, noxious weeds and pest animals. Landowners are responsible for the control of any infestation of noxious weeds and pest fauna species to minimise their spread and impact on ecological values.

As the study area is expected to have been disturbed as a result of agricultural disturbances and from adjoining land uses, there is potential for a number of declared noxious weeds and animals to be present.

#### *4.5.1 Implications*

The development is likely to require management actions to avoid the introduction or spread of declared noxious weeds and pest animals to ensure compliance with the CaLP Act. Compliance with the CaLP Act will be required in all sections of the study area and can be addressed through the preparation of a Construction Environmental Management Plan (CEMP) or similar document.

### 4.6 *Wildlife Act 1975*

The *Wildlife Act 1975* (and associated Wildlife Regulations 2013) is the primary legislation in Victoria providing for protection and management of wildlife. Authorisation for habitat removal may be obtained

under the *Wildlife Act 1975* through a licence granted under the *Forests Act 1958*, or under any other Act such as the *Planning and Environment Act 1987*.

### *4.6.1 Implications*

Removal of any habitat trees or shrubs should be supervised by a trained fauna handler with appropriate authorisation under the Act for salvage and translocation.

## 4.7 Best Practice Mitigation Measures

Recommended measures to mitigate impacts upon terrestrial and aquatic values present within the study area may include:

- Consideration of Water Sensitive Urban Design techniques such as stormwater treatment wetlands, bio-retention systems, porous paving or swales;
- Minimise impacts to native vegetation and habitats through construction and micro-siting techniques, including fencing retained areas of native vegetation. If indeed necessary, trees should be lopped or trimmed rather than removed. Similarly, soil disturbance and sedimentation within wetlands should be avoided or kept to a minimum, to avoid, or minimise impacts to fauna habitats;
- All contractors should be aware of ecologically sensitive areas to minimise the likelihood of inadvertent disturbance to areas marked for retention. Habitat Zones (areas of sensitivity) should be included as a mapping overlay on any construction plans;
- Tree Retention Zones (TRZs) should be implemented to prevent indirect losses of native vegetation during construction activities (DSE 2011). A TRZ applies to a tree and is a specific area above and below the ground, with a radius 12 x the DBH. At a minimum standard a TRZ should consider the following:
    - A TRZ of trees should be a radius no less than two metres or greater than 15 metres;
    - Construction, related activities and encroachment (i.e. earthworks such as trenching that disturb the root zone) should be excluded from the TRZ;
    - Where encroachment exceeds 10% of the total area of the TRZ, the tree should be considered as lost and offset accordingly;
    - Directional drilling may be used for works within the TRZ without being considered encroachment. The directional bore should be at least 600 millimetres deep;
    - The above guidelines may be varied if a qualified arborist confirms the works will not significantly damage the tree (including stags / dead trees). In this case the tree would be retained and no offset would be required; and,
    - Where the minimum standard for a TRZ has not been met an offset may be required.
- Removal of any habitat trees or shrubs (particularly hollow-bearing trees) should be undertaken between February and September to avoid the breeding season for the majority of fauna species. If any habitat trees or shrubs are proposed to be removed, this should be undertaken under the

supervision of an appropriately qualified zoologist to salvage and translocate any displaced fauna. A Fauna Management Plan may be required to guide the salvage and translocation process;

- Where possible, construction stockpiles, machinery, roads, and other infrastructure should be placed away from areas supporting native vegetation, LOTs and/or wetlands;
- Ensure that best practice sedimentation and pollution control measures are undertaken at all times, in accordance with Environment Protection Agency guidelines (EPA 1991; EPA 1996; Victorian Stormwater Committee 1999) to prevent offsite impacts to waterways and wetlands; and,
- As indigenous flora provides valuable habitat for indigenous fauna, it is recommended that any landscape plantings that are undertaken as part of the proposed works are conducted using indigenous species sourced from a local provenance, rather than exotic deciduous trees and shrubs.

In addition to these measures, the following documents should be prepared and implemented prior to any construction activities:

- Construction Environmental Management Plan (CEMP). The CEMP should include specific species/vegetation conservation strategies, daily monitoring, sedimentation management, site specific rehabilitation plans, weed and pathogen management measures, etc.;
- Weed Management Plan. This plan should follow the guidelines set out in the CaLP Act, and clearly outline any obligations of the project team in relation to minimising the spread of weeds as a result of this project. This may include a pre-clearance weed survey undertaken prior to any construction activities to record and map the locations of all noxious and environmental weeds;
- Significant Species Conservation Management Plan (CMP). A CMP will be required if significant species or their habitats are proposed to be impacted, and may include a salvage and translocation plan;
- Fauna Management Plan. This may be required if habitat for common fauna species is likely to be impacted and salvage and translocation must be undertaken to minimise the risk of injury or death to those species ; and,
- A Kangaroo Management Plan (KMP). The KMP provides a long-term, adaptable strategy for the management of Eastern Grey Kangaroos, and must be prepared to the satisfaction of DELWP.

## 4.8 Offset Impacts

### *4.8.1 Offset Options*

Potential offsets may be sourced using the following mechanisms:

- BushBroker: BushBroker maintains a register of landowners who are willing to sell offset credits. Offsets secured by Bushbroker are done so via a Section 69 Agreement under the *Conservation, Forest and Lands Act 1987*.
- Trust for Nature: Trust for Nature holds a list of landowners who are willing to sell vegetation offsets. Offsets secured by Trust for Nature are done so under the Victorian *Conservation Trust Act 1972*.
- Local Councils: The proponent may contact local councils to seek availability of offsets.

- Over-the-Counter Offsets Scheme: The Guidelines include the expansion of the "Over-the-Counter" (OTC) Offsets Scheme, allowing non-government agencies to establish themselves as OTC Facilities. OTC Facilities will broker native vegetation offsets (credits) between landholders (with offset sites) and permit holders (with offset requirements).

### *4.8.2 Offset Strategy*

Ecology and Heritage Partners are a DELWP accredited OTC offset broker.

Ecology and Heritage Partners can investigate whether the offset obligations that are ultimately generated by this proposal can be satisfied through existing credits registered in our OTC database. Several landowners registered in our offset database have suitable General Biodiversity Equivalence Unit (BEUs) native vegetation credits available within Wellington Shire Council and the West Gippsland CMA, and it is anticipated that the relevant General offset obligations generated by this proposal can be secured through an OTC scheme without any difficulty should a permit be issued for the development.

If Specific offsets for Rough-grain Love-grass are required, Ecology and Heritage Partners can conduct further investigations to locate suitable offsets.

# 5 Opportunities and Further Requirements

Native vegetation and biodiversity values are most likely to be present in Site 1 adjacent to Thomson River, as indicated by modelled DELWP vegetation and aerial imagery. Opportunities for the proposed future development of the sites are likely to have a lower impact on biodiversity values in other areas of Site 1 away from the Thomson River, as well as within Sites 2 and 3. Although there is modelled vegetation elsewhere in the study area, the extent of remnant vegetation in the remainder of the study area is likely to be very low, as indicated by the lack of extensive areas of tree canopies in aerial photos.

Other considerations include the following:

- If Plains Grassy Woodland is present within the study area, it should be assessed against the condition thresholds for the nationally significant Gippsland Red Gum (*Eucalyptus tereticornis* subsp. *mediana*) Grassy Woodland and Associated and Native Grassland. If Gilgai Wetland is present it should be assessed against the condition thresholds for the nationally significant Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains. Depending on the outcome of the site assessment, a referral under the EPBC Act may be required.
    - The likelihood of other nationally significant species or communities present is considered to be low, with a site inspection required to determine whether there is habitat for Grey-headed Flying Fox, Growling Grass Frog and Dwarf Galaxias;
- Due to the proximity of the Gippsland Lakes Ramsar site, a referral may be required if significant impacts are expected to occur as a result of the development.
- Any offsets associated with native vegetation removal will need to include the extent of mapped wetlands provided in the DELWP Current Wetlands layer (a total of 2.23 hectares), in addition to any native vegetation recorded during a site visit;
- Any permit applications for vegetation removal within the Moderate or High risk-based pathway will need to include additional information in the permit application:
    - A habitat hectare assessment of the native vegetation to be removed.
    - A statement outlining what steps have been taken to minimise the impacts of the removal of native vegetation on biodiversity.
    - An assessment of whether the proposed removal of native vegetation will have a significant impact on Victoria's biodiversity, with specific regard to the proportional impact on habitat for any rare or threatened species.
    - An offset strategy that details how a compliant offset will be secured to offset the biodiversity impacts of the removal of native vegetation.
- The information provided in this report is based on requirements under the current Guidelines (DEPI 2013). It should be noted that DELWP are currently revising the Guidelines, with the new native vegetation clearing assessment guidelines due to be released later in 2017. There is likely to be a transitional period, however any permit applications under the revised guidelines may require additional considerations.

As the findings of this assessment are preliminary only and based on desktop information, a site visit is recommended to determine the accuracy of the data reviewed and provide further clarity regarding the presence of ecological values, particularly the extent of native vegetation, the presence of habitat for significant species, and the presence of the nationally significant ecological communities.

Further requirements associated with development of the study area, as well as additional studies or reporting that may be required, are provided in Table 8.

**Table 8.** Further requirements associated with development of the study area

| Relevant Legislation | Implications | Further Action |
|---|---|---|
| *Environment Protection and Biodiversity Conservation Act 1999* | Development of the study area has potential to have a significant impact upon two matters of NES: Ramsar Wetlands of International Significance, and, threatened species and ecological communities. A site assessment is recommended to determine the presence and potential impact to threatened species and ecological communities. A hydrological assessment is recommended to determine what impact the development is likely to have on the water quality and quantity of Thomson River and downstream Gippsland Lakes. If a significant impact to any matter of NES is likely, the proposed development should be referred to the Commonwealth Minster of the Environment for consideration under the EPBC Act. - | Conduct site assessment and confirm development footprint |
| *Flora and Fauna Guarantee Act 1988* | An FFG Act permit is not required to impact on listed species or ecological communities on private land. However, the presence of FFG Act-listed species and ecological communities is relevant when assessing triggers for an EES referral. | No further action required. |
| *Planning and Environment Act 1987* | Implications based on presence of native vegetation based on modelled DELWP data:<br>Site 1: The study area is within Location A, with 7.170 hectares of modelled native vegetation present. If all modelled vegetation is proposed to be removed, the permit application would fall under the Moderate Risk-based pathway.<br>Site 2: The study area is within Location A, with 16.323 hectares of modelled native vegetation present. If all modelled vegetation is proposed to be removed, the permit application would fall under the Moderate Risk-based pathway<br>Site 3: The study area is within Location A, with 14.089 hectares of modelled native vegetation present. If all modelled vegetation is proposed to be removed, the permit application would fall under the High Risk-based pathway.<br>Based on an estimate of 100% loss of vegetation as modelled by DELWP, the offset requirement for native vegetation removal is as follows:<br>Site 1: 1.762 General Biodiversity Equivalence Units (BEU);<br>Site 2: 1.728 General BEUs along with 9.023 Specific | Conduct site biodiversity assessment and confirm development footprint.<br>Calculate offsets requirements and complete planning permit application.<br>Planning Permit conditions may include a requirement for:<br>• Demonstration of impact minimisation.<br>• Identification of a compliant offset, as detailed in Section 3.1.<br>• A Construction Environment Management Plan (CEMP).<br>• A Bushfire Management Statement.<br>• A Kangaroo Management Plan (KMP). |

| Relevant Legislation | Implications | Further Action |
|---|---|---|
| | units of habitat for Rough-grain Love-grass; and,<br><br>Site 3: 0.471 General BEUs.<br><br>A Planning Permit from Wellington Shire Council is required to remove, destroy or lop any native vegetation. The application will be referred to DELWP if greater than 0.5 hectares of vegetation are proposed for removal. Offsets will need to be achieved in accordance with the Guidelines. Specific offsets for Rough-grain Love-grass are likely to be difficult to locate and require additional effort to secure than general offsets. | |
| *Catchment and Land Protection Act 1994* | Several weed species listed under the CaLP Act were recorded within the study area. To meet requirements under the CaLP Act, listed noxious weeds should be appropriately controlled throughout the study area. | Include management actions to avoid and minimise the spread of declared noxious species in accordance with the Act. Any actions to be implemented should be included in a CEMP or similar document. |
| *Water Act 1989* | A 'works on waterways' permit is likely to be required from the West Gippsland CMA where any action impacts on waterways within the study area. | Obtain a 'works on waterways' permit from West Gippsland CMA if works on Thomason River or other waterways is proposed. |
| *Wildlife Act 1975* | Any persons engaged to conduct salvage and translocation or general handling of terrestrial fauna species must hold a current Management Authorisation. | Ensure wildlife specialists hold a current Management Authorisation. |

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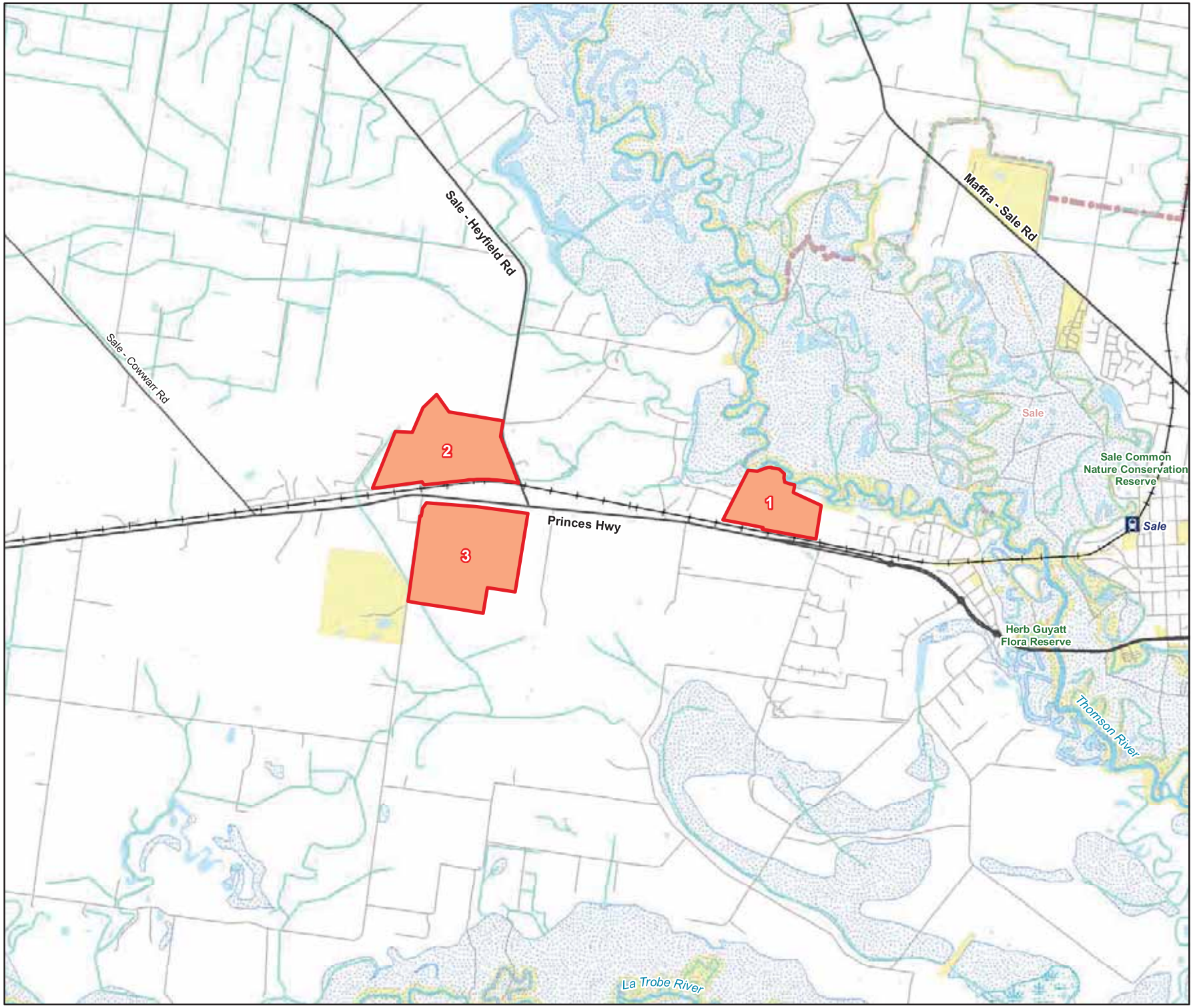
## Figures




# Figure 1

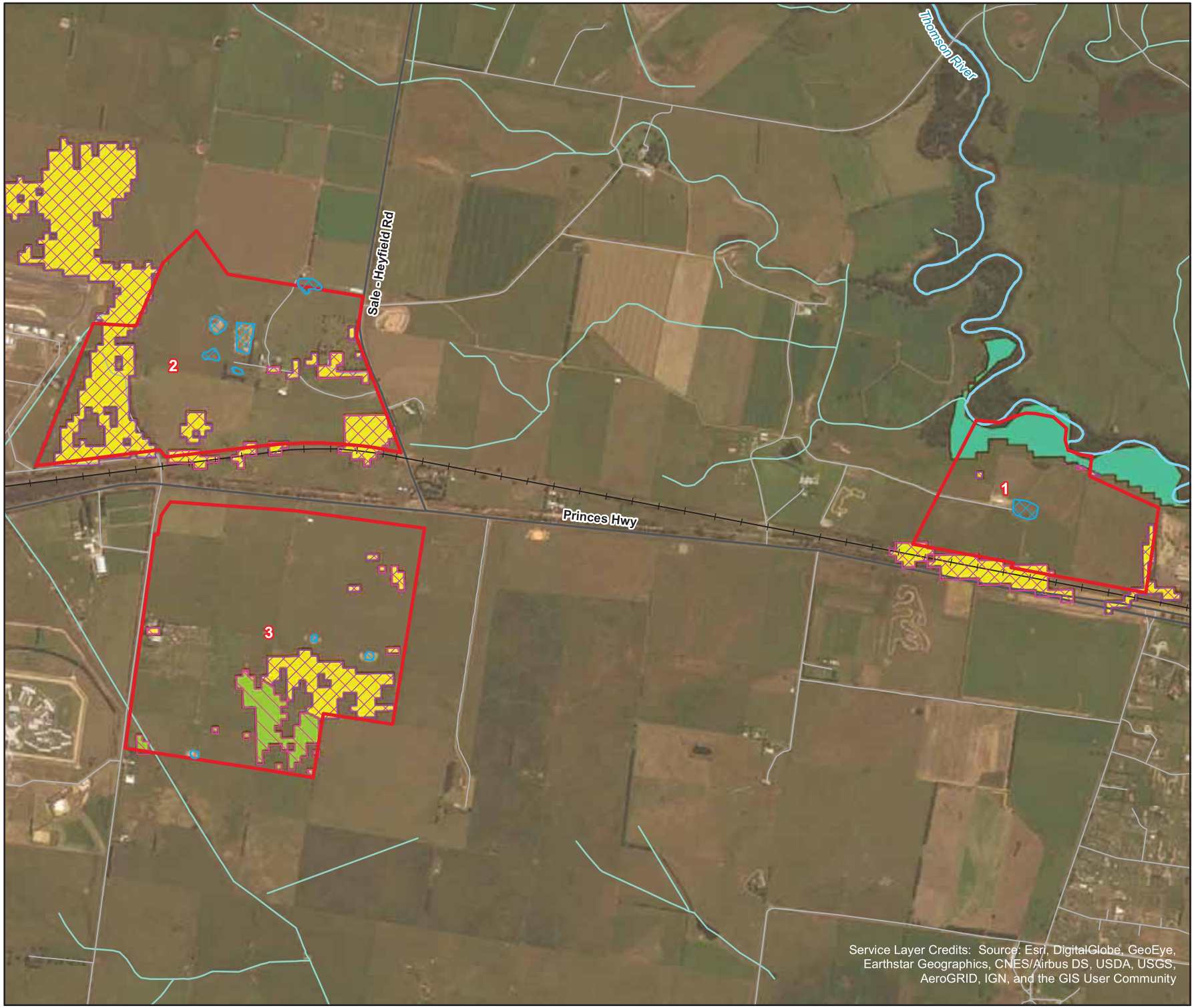
**Location of the study area**

*West Sale and Wurruk Industrial Land Supply Strategy: Desktop Biodiversity Assessment*

ecology & heritage partners



9353_Fig01_StudyArea 5/09/2017 lroy




## Legend

- Study Area
- Current Wetlands

**FFG Act listed vegetatin community (DELWP 2005)**

- Central Gippsland Plains Grassland
- Forest Red Gum Grassy Woodland

**Modelled Ecological Vegetation Classes (DELWP 2005)**

- Floodplain Riparian Woodland
- Plains Grassy Woodland
- Plains Grassy Woodland/Gilgai Wetland Mosaic


# Figure 2

**Ecological features**

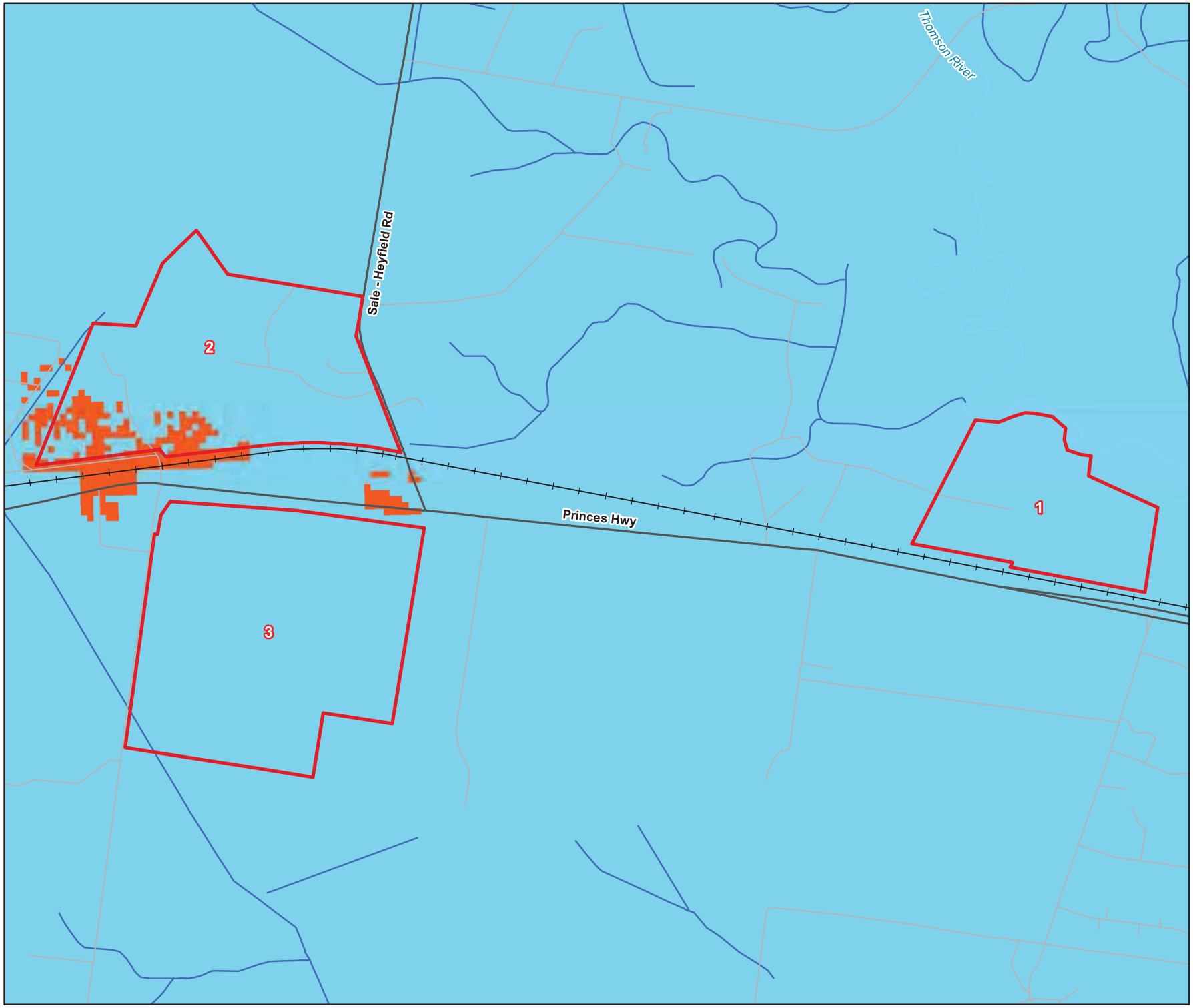
*West Sale and Wurruk Industrial Land Supply Strategy: Desktop Biodiversity Assessment*

N

0 250 500

Metres

ecology & heritage partners




**Legend**

- Study Area

**Location risk**

- Location A
- Location C


# Figure 3

## Native Vegetation Location Risk

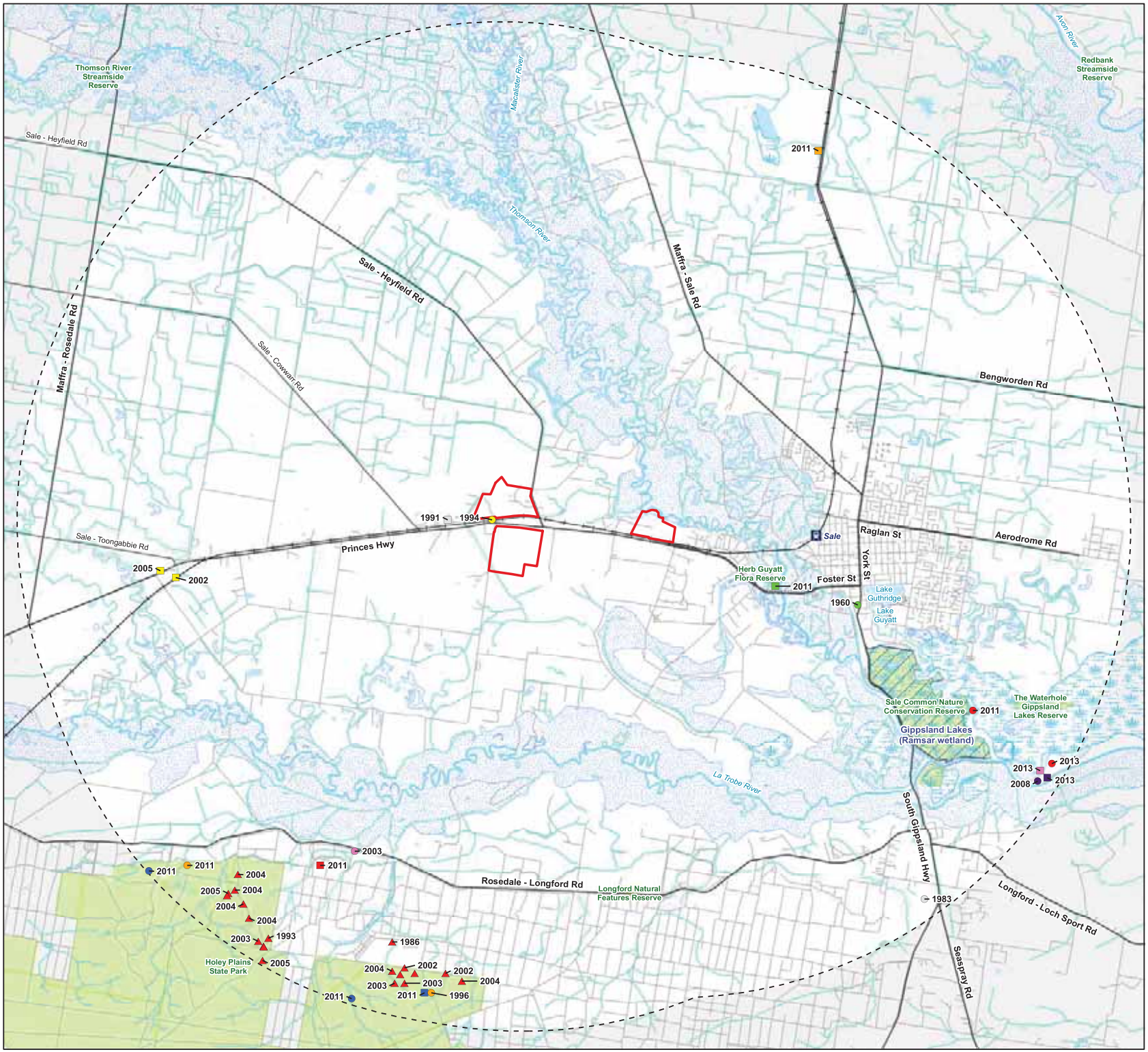
*West Sale and Wurruk Industrial Land Supply Strategy: Desktop Biodiversity Assessment*

N

0 250 500

Metres

ecology & heritage partners




**Legend**

- Study Area

**Significant flora**

- Coast Grey-box
- Eastern Water-ribbons
- Golden Grevillea
- Lanky Buttons
- Pink Zieria
- Promontory Peppermint
- Purple Diuris
- River Swamp Wallaby-grass
- Rough-grain Love-grass
- Rush Lily
- Slender Wire-lily
- Small Scurf-pea
- Tall Club-sedge
- Variable Bossiaea
- Veiled Fringe-sedge
- Wavy Swamp Wallaby-grass
- Wellington Mint-bush


# Figure 4

**Previously documented significant flora within 10km of the study area**

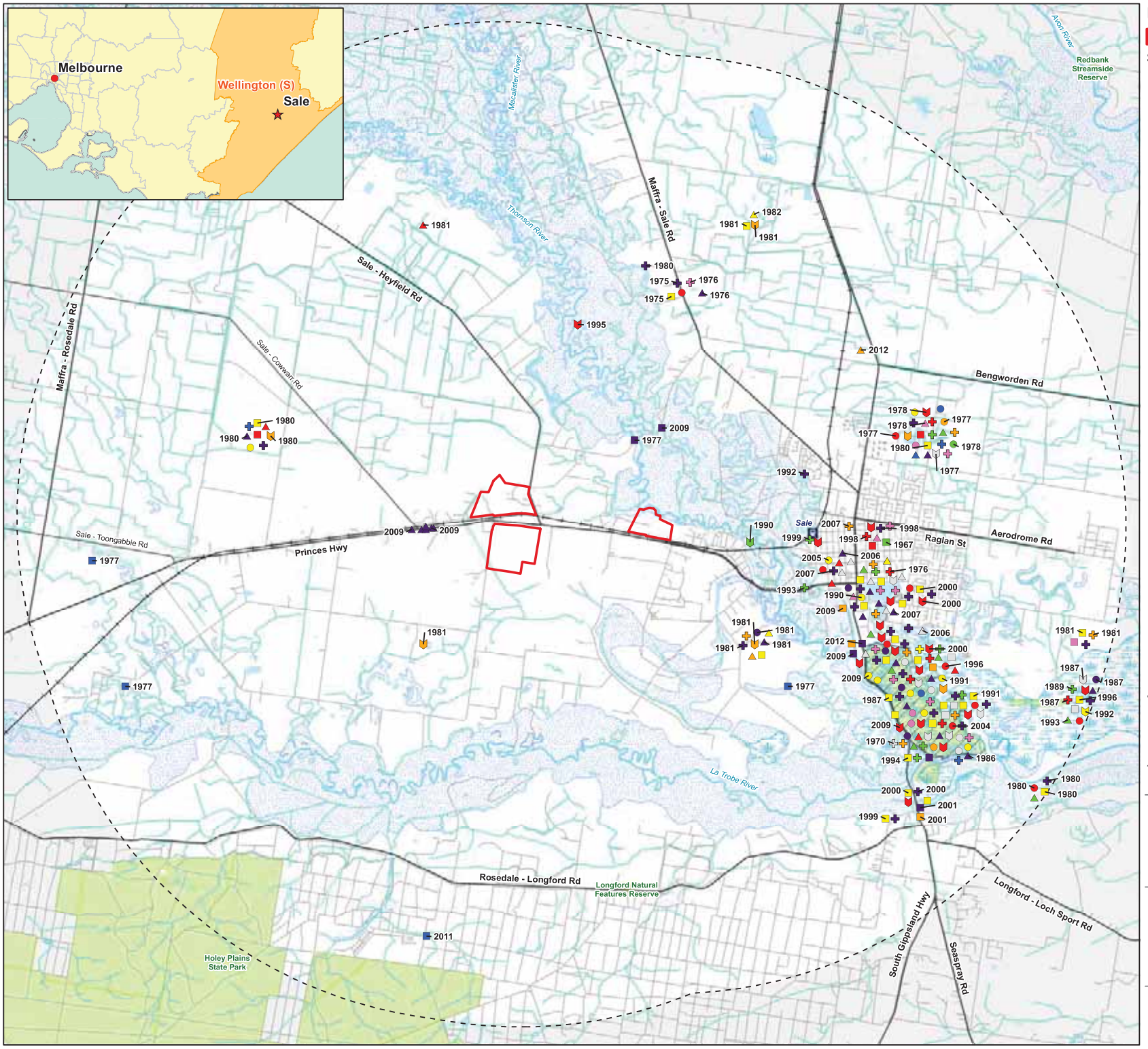
*West Sale and Wurruk Industrial Land Supply Strategy: Desktop Biodiversity Assessment*

N

0 2 4

Kilometres

ecology & heritage partners




# Figure 5

**Previously documented significant fauna within 10km of the study area**

*West Sale and Wurruk Industrial Land Supply Strategy: Desktop Biodiversity Assessment*

ecology & heritage partners

# Appendix 1 - Flora

**Table A1.1** Significant flora recorded within 10 kilometres of the study area

**Likelihood:** Habitat characteristics of significant flora species previously recorded within 10 kilometres of the study area, or that may potentially occur within the study area were assessed to determine their likelihood of occurrence. The likelihood of occurrence rankings are defined below.

**1 - Known occurrence**
- Recorded within the study area recently (i.e. within ten years)

**2 - High Likelihood**
- Previous records of the species in the local vicinity; and/or,
- The study area contains areas of high quality habitat.

**3 - Moderate Likelihood**
- Limited previous records of the species in the local vicinity; and/or,
- The study area contains poor or limited habitat.

**4 - Low Likelihood**
- Poor or limited habitat for the species however other evidence (such as a lack of records or environmental factors) indicates there is a very low likelihood of presence.

**5 – Unlikely**
- No suitable habitat and/or outside the species range.

| Scientific name | Common name | Total # of documented records | Last documented record | EPBC | FFG | DEPI | Likely occurrence in study area* |
|---|---|---|---|---|---|---|---|
| NATIONAL SIGNIFICANCE | | | | | | | |
| *Amphibromus fluitans* | River Swamp Wallaby-grass | 2 | 2008 | VU | - | - | 2/3 |
| *Dianella amoena* # | Matted Flax-lily | - | - | EN | L | e | 4 |
| *Dodonaea procumbens* | Trailing Hop-bush | 1 | 1900 | VU | - | v | 4 |
| *Glycine latrobeana* | Clover Glycine | 1 | 1882 | VU | L | v | 4 |
| *Prasophyllum correctum* # | Gaping Leek-orchid | - | - | EN | L | e | 4 |
| *Prasophyllum frenchii* # | Maroon Leek-orchid | - | - | EN | L | e | 4 |
| *Prostanthera galbraithiae* | Wellington Mint-bush | 20 | 2011 | VU | L | v | 4 |
| *Rulingia prostrata* # | Dwarf Kerrawang | - | - | EN | L | e | 4 |
| *Thelymitra epipactoides* | Metallic Sun-orchid | 1 | 1895 | EN | L | e | 4 |
| *Xerochrysum palustre* # | Swamp Everlasting | - | - | VU | L | v | 4 |

| Scientific name | Common name | Total # of documented records | Last documented record | EPBC | FFG | DEPI | Likely occurrence in study area* |
|---|---|---|---|---|---|---|---|
| STATE SIGNIFICANCE | | | | | | | |
| *Amphibromus sinuatus* | Wavy Swamp Wallaby-grass | 3 | 2013 | - | - | v | 2/3 |
| *Bolboschoenus fluviatilis* | Tall Club-sedge | 1 | 2011 | - | - | k | 2/3 |
| *Bossiaea heterophylla* | Variable Bossiaea | 2 | 2011 | - | - | r | 3 |
| *Cardamine tenuifolia* | Slender Bitter-cress | 1 | 1884 | - | - | P | 4 |
| *Cullen parvum* | Small Scurf-pea | 2 | 2005 | - | L | e | 3 |
| *Cycnogeton microtuberosum* | Eastern Water-ribbons | 7 | 2013 | - | - | r | 4 |
| *Diuris punctata* | Purple Diuris | 5 | 2003 | - | L | v | 2/3 |
| *Eragrostis trachycarpa* | Rough-grain Love-grass | 1 | 1991 | - | - | r | 2/3 |
| *Eucalyptus bosistoana* | Coast Grey-box | 1 | 1983 | - | - | r | 3 |
| *Eucalyptus willisii* s.s. | Promontory Peppermint | 2 | 2011 | - | - | r | 3 |
| *Fimbristylis velata* | Veiled Fringe-sedge | 2 | 2013 | - | - | r | 3 |
| *Grevillea chrysophaea* | Golden Grevillea | 5 | 2011 | - | - | r | 3 |
| *Laxmannia gracilis* | Slender Wire-lily | 1 | 2011 | - | - | r | 3 |
| *Leionema lamprophyllum* subsp. *lamprophyllum* | Shiny Leionema | 1 | 1770 | - | - | r | 4 |
| *Leptorhynchos elongatus* | Lanky Buttons | 1 | 1994 | - | - | e | 3 |
| *Pseudanthus ovalifolius* | Oval-leaf Pseudanthus | 1 | 1899 | - | - | r | 4 |
| *Pterostylis grandiflora* | Cobra Greenhood | 1 | 1899 | - | - | r | 4 |
| *Sowerbaea juncea* | Rush Lily | 1 | 2011 | - | - | r | 3 |
| *Zieria veronicea* subsp. *veronicea* | Pink Zieria | 2 | 1960 | - | - | r | 4 |

**Notes:** EPBC = *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), FFG = *Flora and Fauna Guarantee Act 1988* (FFG Act), DEPI= Advisory List of Rare or Threatened Plants in Victoria (DEPI 2014), L = Listed, # = Records identified from EPBC Act Protected Matters Search Tool, Data source: Victorian Biodiversity Atlas (DELWP 2017d); Protected Matters Search Tool (DoEE 2017). Order: Alphabetical.* the likelihood of occurrence for species marked with a 2/3 is dependent on the extent/quality of remnant vegetation and wetlands within the study area.

# Appendix 2 – Fauna

**Table A2.1.** Significant fauna within 10 kilometres of the study area

**Likelihood:** Habitat characteristics of significant fauna species previously recorded within 10 kilometres of the study area, or that may potentially occur within the study area were assessed to determine their likelihood of occurrence. The likelihood of occurrence rankings are defined below.

| | | |
|---|---|---|
| 1 | High Likelihood | • Known resident in the study area based on site observations, database records, or expert advice; and/or,<br>• Recent records (i.e. within five years) of the species in the local area (DELWP 2017d); and/or,<br>• The study area contains the species' preferred habitat. |
| 2 | Moderate Likelihood | • The species is likely to visit the study area regularly (i.e. at least seasonally); and/or,<br>• Previous records of the species in the local area (DELWP 2017d); and/or,<br>• The study area contains some characteristics of the species' preferred habitat. |
| 3 | Low Likelihood | • The species is likely to visit the study area occasionally or opportunistically whilst en route to more suitable sites; and/or,<br>• There are only limited or historical records of the species in the local area (i.e. more than 20 years old); and/or,<br>• The study area contains few or no characteristics of the species' preferred habitat. |
| 4 | Unlikely | • No previous records of the species in the local area; and/or,<br>• The species may fly over the study area when moving between areas of more suitable habitat; and/or,<br>• Out of the species' range; and/or,<br>• No suitable habitat present. |

-

| | |
|---|---|
| EPBC | *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) |
| FFG | *Flora and Fauna Guarantee Act 1988* (FFG Act) |
| DSE | Advisory List of Threatened Vertebrate Fauna in Victoria (DSE 2013); Advisory List of Threatened Invertebrate Fauna in Victoria (DSE 2009) |
| NAP | National Action Plan (Cogger et al 1993; Duncan et al. 1999; Garnet et al 2011; Woinarski et al 2014; Sands and New 2002; Tyler 1997) |

| | | | |
|---|---|---|---|
| EX | Extinct | DD | Data deficient (insufficiently or poorly known |
| RX | Regionally extinct | L | Listed as threatened under FFG Act |
| CR | Critically endangered | EN | Endangered |
| # | Listed on the Protected Matters Search Tool | NT | Near threatened |
| VU | Vulnerable | CD | Conservation dependent |
| LC | least concern | RA | Rare |

| Common Name | Scientific Name | Last Documented Record (VBA) | # Records (VBA) | EPBC Act | FFG ACT | DSE (2013) | National Action Plan | Likelihood |
|---|---|---|---|---|---|---|---|---|
| **NATIONAL SIGNIFICANCE** | | | | | | | | |
| Spot-tailed Quoll # | *Dasyurus maculatus macula* | - | - | EN | L | EN | VU | 4 |
| Greater Glider # | *Petauroides volans* | - | - | VU | - | VU | VU | 3 |
| Grey-headed Flying-fox | *Pteropus poliocephalus* | 2012 | 2 | VU | L | VU | VU | 2 |
| New Holland Mouse # | *Pseudomys novaehollandiae* | - | - | - | L | VU | - | 4 |
| Australasian Bittern | *Botaurus poiciloptilus* | 1992 | 9 | EN | L | EN | VU | 3 |
| Australian Painted Snipe | *Rostratula australis* | 1977 | 2 | VU | L | CR | VU | 3 |
| Northern Siberian Bar-tailed Godwit # | *Limosa lapponica menzbieri* | - | - | EN | - | - | VU | 4 |
| Eastern Curlew # | *Numenius madagascariensis* | - | - | CR | - | VU | - | 4 |
| Curlew Sandpiper # | *Calidris ferruginea* | - | - | CR | - | EN | - | 4 |
| Swift Parrot # | *Lathamus discolor* | - | - | CR | L | EN | EN | 4 |
| Regent Honeyeater | *Anthochaera phrygia* | 1933 | 1 | CR | L | CR | EN | 4 |
| Painted Honeyeater # | *Grantiella picta* | - | - | VU | L | VU | NT | 4 |
| Green and Golden Bell Frog # | *Litoria aurea* | - | - | VU | - | VU | EN | 4 |
| Growling Grass Frog | *Litoria raniformis* | 1963 | 3 | VU | L | EN | VU | 3 |
| Dwarf Galaxias | *Galaxiella pusilla* | 2012 | 7 | VU | L | EN | VU | 2 |
| Australian Grayling # | *Prototroctes maraena* | - | - | VU | L | VU | VU | 4 |
| Golden Sun Moth # | *Synemon plana* | - | - | CR | L | CR | - | 4 |
| **STATE SIGNIFICANCE** | | | | | | | | |
| Yellow-bellied Sheathtail Bat | *Saccolaimus flaviventris* | 1990 | 1 | - | L | DD | LC | 3 |
| Magpie Goose | *Anseranas semipalmata* | 2007 | 13 | - | L | NT | - | 2 |

| Common Name | Scientific Name | Last Documented Record (VBA) | # Records (VBA) | EPBC Act | FFG ACT | DSE (2013) | National Action Plan | Likelihood |
|---|---|---|---|---|---|---|---|---|
| Musk Duck | *Biziura lobata* | 1999 | 18 | - | - | VU | - | 2 |
| Freckled Duck | *Stictonetta naevosa* | 2008 | 8 | - | L | EN | - | 2 |
| Australasian Shoveler | *Anas rhynchotis* | 2006 | 17 | - | - | VU | - | 2 |
| Hardhead | *Aythya australis* | 2008 | 18 | - | - | VU | - | 2 |
| Blue-billed Duck | *Oxyura australis* | 1989 | 3 | - | L | EN | - | 3 |
| White-throated Needletail | *Hirundapus caudacutus* | 1992 | 14 | - | - | VU | - | 3 |
| Little Bittern | *Ixobrychus minutus dubius* | 1970 | 1 | - | L | EN | - | 3 |
| Eastern Great Egret | *Ardea modesta* | 2009 | 127 | - | L | VU | - | 1 |
| Intermediate Egret | *Ardea intermedia* | 1998 | 5 | - | L | EN | - | 2 |
| Little Egret | *Egretta garzetta nigripes* | 1999 | 9 | - | L | EN | - | 2 |
| White-bellied Sea-Eagle | *Haliaeetus leucogaster* | 2009 | 33 | - | L | VU | - | 2 |
| Black Falcon | *Falco subniger* | 1999 | 2 | - | - | VU | - | 3 |
| Brolga | *Grus rubicunda* | 1850 | 1 | - | L | VU | - | 4 |
| Baillon's Crake | *Porzana pusilla palustris* | 1978 | 2 | - | L | VU | - | 3 |
| Australian Bustard | *Ardeotis australis* | 1850 | 4 | - | L | CR | NT | 4 |
| Common Greenshank | *Tringa nebularia* | 2001 | 6 | - | - | VU | - | 4 |
| Marsh Sandpiper | *Tringa stagnatilis* | 2006 | 1 | - | - | VU | - | 4 |
| Caspian Tern | *Hydroprogne caspia* | 2009 | 6 | - | L | NT | - | 4 |
| Hooded Robin | *Melanodryas cucullata cucullata* | 1979 | 2 | - | L | NT | NT | 4 |
| Diamond Firetail | *Stagonopleura guttata* | 1998 | 3 | - | L | NT | NT | 4 |
| **REGIONAL SIGNIFICANCE** | | | | | | | | |
| Eastern Pygmy-possum | *Cercartetus nanus* | 1967 | 2 | - | - | NT | - | 4 |

| Common Name | Scientific Name | Last Documented Record (VBA) | # Records (VBA) | EPBC Act | FFG ACT | DSE (2013) | National Action Plan | Likelihood |
|---|---|---|---|---|---|---|---|---|
| Pied Cormorant | *Phalacrocorax varius* | 2011 | 15 | - | - | NT | - | 2 |
| Nankeen Night Heron | *Nycticorax caledonicus hillii* | 1991 | 4 | - | - | NT | - | 2 |
| Glossy Ibis | *Plegadis falcinellus* | 2006 | 8 | - | - | NT | - | 3 |
| Royal Spoonbill | *Platalea regia* | 2007 | 81 | - | - | NT | - | 1 |
| Latham's Snipe | *Gallinago hardwickii* | 2009 | 50 | - | - | NT | - | 1 |
| Whiskered Tern | *Chlidonias hybridus javanicus* | 1991 | 7 | - | - | NT | - | 4 |
| White-winged Black Tern | *Chlidonias leucopterus* | 1992 | 2 | - | - | NT | - | 4 |
| Azure Kingfisher | *Alcedo azurea* | 2009 | 12 | - | - | NT | - | 2 |

**Data source:** Victorian Biodiversity Atlas (DELWP 2017d); Protected Matters Search Tool (DoEE 2017).

**Taxonomic order:** Mammals (Strahan 1995 *in* Menkhorst and Knight 2004); Birds (Christidis and Boles, 2008); Reptiles and Amphibians (Cogger et al. 1983 *in* Cogger 1996); Fish (Nelson 1994).

## APPENDIX 3 - Ensym Report

# Testing Clearing proposal (modelled)

This report provides biodiversity information associated with the proposed native vegetation clearing. PLEASE NOTE: This report used modelled condition scores. A habitat hectare assessment is required  before the shapefiles are submitted to DELWP for processing.

**Date of issue:** **02/08/2017** **Ref: Scenario Testing**
**Time of issue:** **2:56 pm**

| **Project ID** | EHP9353_Sale_SA1_VG94 |
|---|---|

## Summary of marked native vegetation

| | |
|---|---|
| **Risk-based pathway** | Moderate |
| **Total extent** | 7.170 ha |
| Remnant patches | 7.170 ha |
| Scattered trees | 0 trees |
| Location risk | A |

| | |
|---|---|
| **Strategic biodiversity score of all marked native vegetation** | 0.332 |

## Offset requirements

If the marked vegetation was cleared, using modelled scores, the following offsets would be applicable.

| **Offset type** | **General offset** |
|---|---|
| **General offset amount (general biodiversity equivalence units)** | 1.762 general units |
| **General offset attributes** | |
| Vicinity | West Gippsland Catchment Management Authority (CMA) or Wellington Shire Council |
| Minimum strategic biodiversity score | 0.265[1] |

NB: values presented in tables throughout this document may not add to totals due to rounding



[1] Minimum strategic biodiversity score is 80 per cent of the weighted average score across habitat zones where a general offset is required

# Testing Clearing proposal (modelled)

## Next steps

Any proposal to remove native vegetation must meet the application requirements of the moderate risk-based pathway and it will be assessed under the moderate risk-based pathway.

If you wish to remove the marked native vegetation, you must complete the required habitat hectare assessment to determine the condition score of the native vegetation and then submit the related shapefiles to the Department of Environment, Land, Water and Planning (DELWP) for processing, by email to nativevegetation.support@delwp.vic.gov.au. DELWP will provide a Biodiversity impact and offset requirements report that is required to meet the permit application requirements.



## Biodiversity impact of removal of native vegetation

### Habitat hectares

Habitat hectares are calculated for each habitat zone within your proposal using the extent in the GIS data you provided and modelled condition scores.

| Habitat zone | Modelled condition score | Extent (ha) | Habitat hectares |
|---|---|---|---|
| 1-1-A | 0.571 | 0.359 | 0.205 |
| 2-2-A | 0.200 | 0.007 | 0.001 |
| 3-3-A | 0.254 | 0.023 | 0.006 |
| 4-4-A | 0.218 | 0.067 | 0.015 |
| 5-5-A | 0.339 | 0.799 | 0.271 |
| 6-6-A | 0.200 | 0.062 | 0.012 |
| 7-7-A | 0.200 | 0.003 | 0.001 |
| 8-8-A | 0.267 | 0.038 | 0.010 |
| 9-9-A | 0.200 | 0.000 | 0.000 |
| 10-1-WL | 0.200 | 0.586 | 0.117 |
| 11-1-B | 0.544 | 5.225 | 2.841 |
| **TOTAL** | | | **3.479** |

### Impacts on rare or threatened species habitat above specific offset threshold

The specific-general offset test was applied to your proposal. The test determines if the proposed removal of native vegetation has a proportional impact on any rare or threatened species habitats above the specific offset threshold. The threshold is set at 0.005 per cent of the total habitat for a species. When the proportional impact is above the specific offset threshold a specific offset for that species' habitat is required.

The specific-general offset test found your proposal does not have a proportional impact on any rare or threatened species' habitats above the specific offset threshold. No specific offsets are required. A general offset is required as set out below.

### Clearing site biodiversity equivalence score(s)

The general biodiversity equivalence score for the habitat zone(s) is calculated by multiplying the habitat hectares by the strategic biodiversity score.

# Testing Clearing proposal (modelled)

| Habitat zone | Habitat hectares | Proportion of habitat zone with general offset | Strategic biodiversity score | General biodiversity equivalence score (GBES) |
|---|---|---|---|---|
| 1-1-A | 0.205 | 100.000 % | 0.538 | 0.110 |
| 2-2-A | 0.001 | 100.000 % | 0.768 | 0.001 |
| 3-3-A | 0.006 | 100.000 % | 0.767 | 0.004 |
| 4-4-A | 0.015 | 100.000 % | 0.614 | 0.009 |
| 5-5-A | 0.271 | 100.000 % | 0.406 | 0.110 |
| 6-6-A | 0.012 | 100.000 % | 0.550 | 0.007 |
| 7-7-A | 0.001 | 100.000 % | 0.488 | 0.000 |
| 8-8-A | 0.010 | 100.000 % | 0.336 | 0.003 |
| 9-9-A | 0.000 | 100.000 % | 0.343 | 0.000 |
| 10-1-WL | 0.117 | 100.000 % | 0.100 | 0.012 |
| 11-1-B | 2.841 | 100.000 % | 0.323 | 0.918 |

## Mapped rare or threatened species' habitats on site

This table sets out the list of rare or threatened species' habitats mapped at the site beyond those species for which the impact is above the specific offset threshold. These species habitats do not require a specific offset according to the specific-general offset test.

| Species number | Species common name | Species scientific name |
|---|---|---|
| 10045 | Lewin's Rail | Lewinia pectoralis pectoralis |
| 10050 | Baillon's Crake | Porzana pusilla palustris |
| 10170 | Australian Painted Snipe | Rostratula benghalensis australis |
| 10185 | Little Egret | Egretta garzetta nigripes |
| 10186 | Intermediate Egret | Ardea intermedia |
| 10187 | Eastern Great Egret | Ardea modesta |
| 10195 | Australian Little Bittern | Ixobrychus minutus dubius |
| 10197 | Australasian Bittern | Botaurus poiciloptilus |
| 10212 | Australasian Shoveler | Anas rhynchotis |
| 10215 | Hardhead | Aythya australis |
| 10216 | Blue-billed Duck | Oxyura australis |
| 10217 | Musk Duck | Biziura lobata |
| 10220 | Grey Goshawk | Accipiter novaehollandiae novaehollandiae |
| 10226 | White-bellied Sea-Eagle | Haliaeetus leucogaster |
| 10230 | Square-tailed Kite | Lophoictinia isura |

# Testing Clearing proposal (modelled)

| Species number | Species common name | Species scientific name |
|---|---|---|
| 10238 | Black Falcon | Falco subniger |
| 10598 | Painted Honeyeater | Grantiella picta |
| 12283 | Lace Monitor | Varanus varius |
| 13117 | Brown Toadlet | Pseudophryne bibronii |
| 13207 | Growling Grass Frog | Litoria raniformis |
| 4686 | Australian Grayling | Prototroctes maraena |
| 501084 | Purple Diuris | Diuris punctata var. punctata |
| 505337 | Austral Crane's-bill | Geranium solanderi var. solanderi s.s. |

## Offset requirements

If a permit is granted to remove the marked native vegetation the permit condition will include the requirement to obtain a native vegetation offset.

To calculate the required offset amount required the biodiversity equivalence scores are aggregated to the proposal level and multiplied by the relevant risk multiplier.

Offsets also have required attributes:

- General offsets must be located in the same Catchment Management Authority (CMA) boundary or Local Municipal District (local council) as the clearing and must have a minimum strategic biodiversity score of 80 per cent of the clearing.[2]

The offset requirements for your proposal are as follows:

| Offset type | Clearing site biodiversity equivalence score | Risk multiplier | Offset requirements | |
|---|---|---|---|---|
| | | | Offset amount (biodiversity equivalence units) | Offset attributes |
| General | 1.175 GBES | 1.5 | 1.762 general units | Offset must be within West Gippsland CMA or Wellington Shire Council<br>Offset must have a minimum strategic biodiversity score of 0.265 |

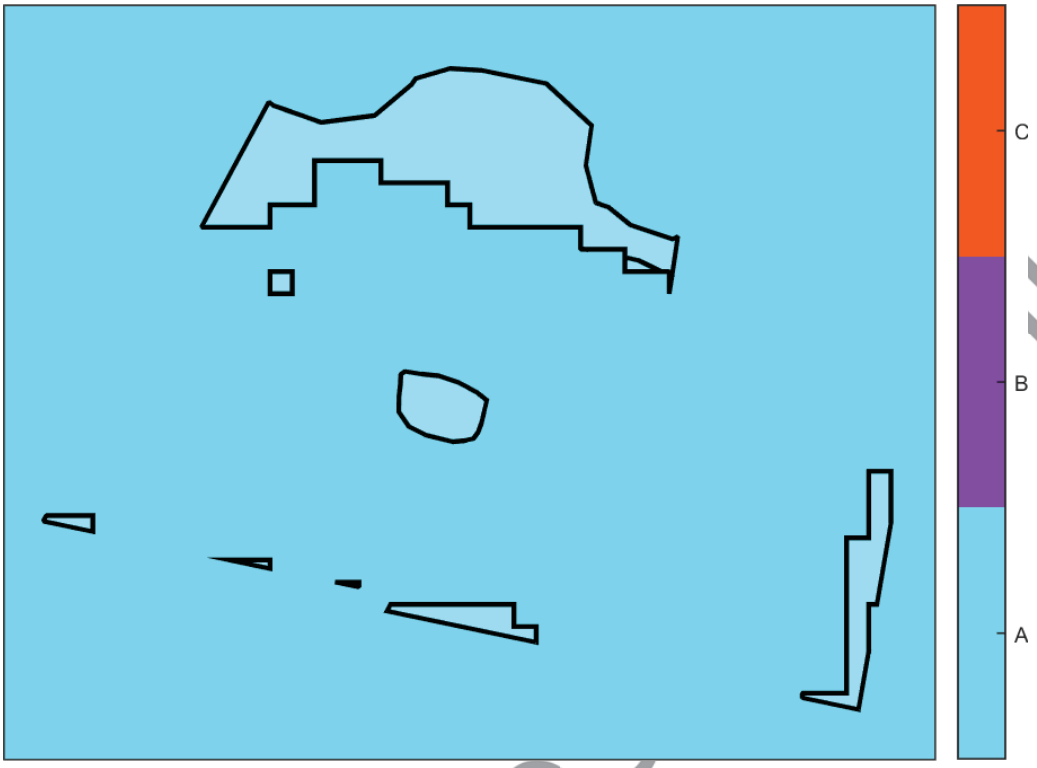


[2] Strategic biodiversity score is a weighted average across habitat zones where a general offset is required

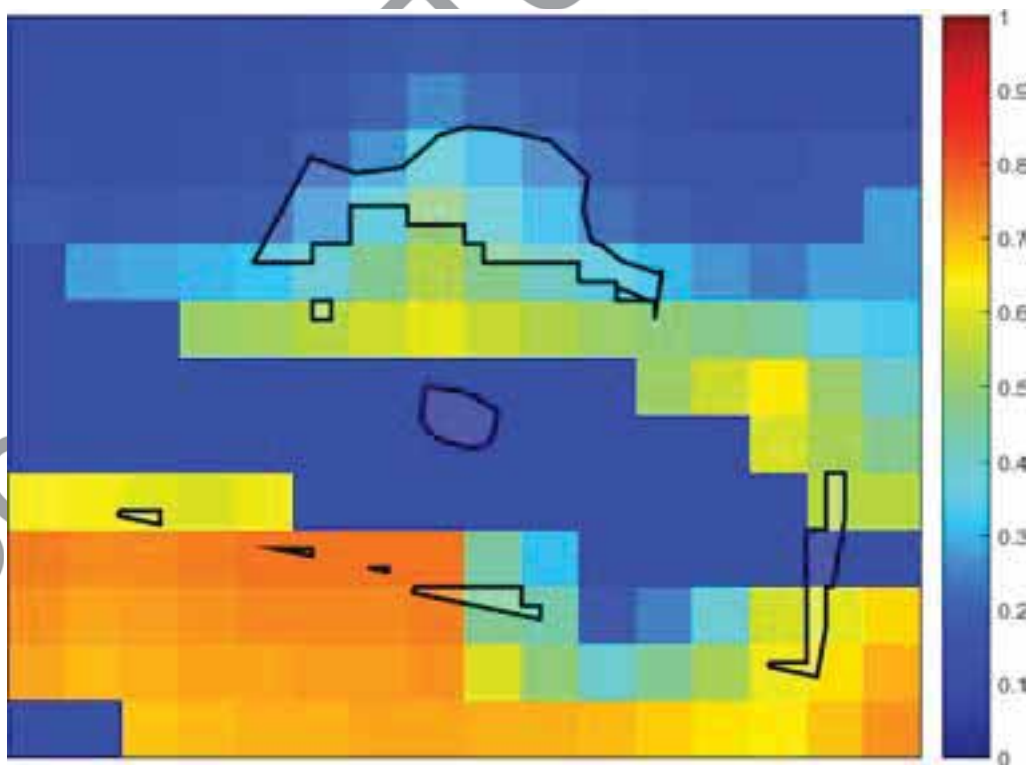
# Testing Clearing proposal (modelled)

## Images of marked native vegetation

**1. Native vegetation location risk map**




**2. Strategic biodiversity score map**



# Testing Clearing proposal (modelled)

## Glossary

**Condition score**

This is the site-assessed condition score for the native vegetation. Each habitat zone in the clearing proposal is assigned a condition score according to the habitat hectare assessment method. This information has been provided by or on behalf of the applicant in the GIS file.

**Dispersed habitat**

A dispersed species habitat is a habitat for a rare or threatened species whose habitat is spread over a relatively broad geographic area greater than 2,000 hectares.

**General biodiversity equivalence score**

The general biodiversity equivalence score quantifies the relative overall contribution that the native vegetation to be removed makes to Victoria's biodiversity. The general biodiversity equivalence score is calculated as follows:

$$\textit{General biodiversity equivalence score} = \textit{habitat hectares} \times \textit{strategic biodiversity score}$$

**General offset amount**

This is calculated by multiplying the general biodiversity equivalence score of the native vegetation to be removed by the risk factor for general offsets. This number is expressed in general biodiversity equivalence units and is the amount of offset that is required to be provided should the application be approved. This offset requirement will be a condition to the permit for the removal of native vegetation.

$$\textit{Risk adjusted general biodiversity equivalence score} = \textit{general biodiversity equivalence score clearing} \times 1.5$$

**General offset attributes**

General offset must be located in the same Catchment Management Authority boundary or Municipal District (local council) as the clearing site. They must also have a strategic biodiversity score that is at least 80 per cent of the score of the clearing site.

**Habitat hectares**

Habitat hectares is a site-based measure that combines extent and condition of native vegetation. The habitat hectares of native vegetation is equal to the current condition of the vegetation (condition score) multiplied by the extent of native vegetation. Habitat hectares can be calculated for a remnant patch or for scattered trees or a combination of these two vegetation types. This value is calculated for each habitat zone using the following formula:

$$\textit{Habitat hectares} = \textit{total extent}\ (\textit{hectares}) \times \textit{condition score}$$

**Habitat importance score**

The habitat importance score is a measure of the importance of the habitat located on a site for a particular rare or threatened species. The habitat importance score for a species is a weighted average value calculated from the habitat importance map for that species. The habitat importance score is calculated for each habitat zone where the habitat importace map indicates that species habitat occurs.

# Testing Clearing proposal (modelled)

**Habitat zone**

Habitat zone is a discrete contiguous area of native vegetation that:

- is of a single Ecological Vegetation Class
- has the same measured condition.

**Highly localised habitat**

A highly localised habitat is habitat for a rare or threatened species that is spread across a very restricted area (less than 2,000 hectares). This can also be applied to a similarly limited sub-habitat that is disproportionately important for a wide-ranging rare or threatened species. Highly localised habitats have the highest habitat importance score (1) for all locations where they are present.

**Minimum strategic biodiversity score**

The minimum strategic biodiversity score is an attribute for a general offset.

The strategic biodiversity score of the offset site must be at least 80 per cent of the strategic biodiversity score of the native vegetation to be removed. This is to ensure offsets are located in areas with a strategic value that is comparable to, or better than, the native vegetation to be removed. Where a specific and general offset is required, the minimum strategic biodiversity score relates only to the habitat zones that require the general offset.

**Offset risk factor**

There is a risk that the gain from undertaking the offset will not adequately compensate for the loss from the removal of native vegetation. If this were to occur, despite obtaining an offset, the overall impact from removing native vegetation would result in a loss in the contribution that native vegetation makes to Victoria's biodiversity.

To address the risk of offsets failing, an offset risk factor is applied to the calculated loss to biodiversity value from removing native vegetation.

$$\boldsymbol{Risk\ factor\ for\ general\ offsets = 1.5}$$

$$\boldsymbol{Risk\ factor\ for\ specific\ offset = 2}$$

**Offset type**

The specific-general offset test determines the offset type required.

When the specific-general offset test determines that the native vegetation removal will have an impact on one or more rare or threatened species habitat above the set threshold of 0.005 per cent, a specific offset is required. This test is done at the permit application level.

A general offset is required when a proposal to remove native vegetation is not deemed, by application of the specific-general offset test, to have an impact on any habitat for any rare or threatened species above the set threshold of 0.005 per cent. All habitat zones that do not require a specific offset will require a general offset.

**Proportional impact on species**

This is the outcome of the specific-general offset test. The specific-general offset test is calculated across the entire proposal for each species on the native vegetation permitted clearing species list. If the proportional impact on a species is above the set threshold of 0.005 per cent then a specific offset is required for that species.

# Testing Clearing proposal (modelled)

**Specific offset amount**

The specific offset amount is calculated by multiplying the specific biodiversity equivalence score of the native vegetation to be removed by the risk factor for specific offsets. This number is expressed in specific biodiversity equivalence units and is the amount of offset that is required to be provided should the application be approved. This offset requirement will be a condition to the permit for the removal of native vegetation.

$$\boldsymbol{Risk\ adjusted\ specific\ biodiversity\ equivalence\ score} = \boldsymbol{specific\ biodiversity\ equivalence\ score\ clearing} \times \mathbf{2}$$

**Specific offset attributes**

Specific offsets must be located in the modelled habitat for the species that has triggered the specific offset requirement.

**Specific biodiversity equivalence score**

The specific biodiversity equivalence score quantifies the relative overall contribution that the native vegetation to be removed makes to the habitat of the relevant rare or threatened species. It is calculated for each habitat zone where one or more species habitats require a specific offset as a result of the specific-general offset test as follows:

$$\boldsymbol{Specific\ biodiversity\ equivalence\ score} = \boldsymbol{habitat\ hectares} \times \boldsymbol{habitat\ importance\ score}$$

**Strategic biodiversity score**

This is the weighted average strategic biodiversity score of the marked native vegetation. The strategic biodiversity score has been calculated from the *Strategic biodiversity map* for each habitat zone.

The strategic biodiversity score of native vegetation is a measure of the native vegetation's importance for Victoria's biodiversity, relative to other locations across the landscape. The *Strategic biodiversity map* is a modelled layer that prioritises locations on the basis of rarity and level of depletion of the types of vegetation, species habitats, and condition and connectivity of native vegetation.

**Total extent (hectares) for calculating habitat hectares**

This is the total area of the marked native vegetation in hectares.

The total extent of native vegetation is an input to calculating the habitat hectares of a site and in calculating the general biodiversity equivalence score. Where the marked native vegetation includes scattered trees, each tree is converted to hectares using a standard area calculation of 0.071 hectares per tree. This information has been provided by or on behalf of the applicant in the GIS file.

**Vicinity**

The vicinity is an attribute for a general offset.

The offset site must be located within the same Catchment Management Authority boundary or Local Municipal District as the native vegetation to be removed.

# Testing Clearing proposal (modelled)

This report provides biodiversity information associated with the proposed native vegetation clearing. PLEASE NOTE: This report used modelled condition scores. A habitat hectare assessment is required before the shapefiles are submitted to DELWP for processing.

**Date of issue:** 02/08/2017
**Time of issue:** 3:09 pm

**Ref: Scenario Testing**

| **Project ID** | EHP9353_Sale_SA2_VG94 |
|---|---|

## Summary of marked native vegetation

| | |
|---|---|
| **Risk-based pathway** | High |
| **Total extent** | 16.337 ha |
| Remnant patches | 16.337 ha |
| Scattered trees | 0 trees |
| Location risk | C |

| | |
|---|---|
| **Strategic biodiversity score of all marked native vegetation** | 0.770 |

## Offset requirements

If the marked vegetation was cleared, using modelled scores, the following offsets would be applicable.

| **Offset type** | **General offset** |
|---|---|
| **General offset amount (general biodiversity equivalence units)** | 1.728 general units |
| **General offset attributes** | |
| Vicinity | West Gippsland Catchment Management Authority (CMA) or Wellington Shire Council |
| Minimum strategic biodiversity score | 0.443[1] |
| **Offset type** | **Specific offset(s)** |
| **Specific offset amount (specific biodiversity equivalence units) and attributes** | 9.023 specific units of habitat for Rough-grain Love-grass |

NB: values presented in tables throughout this document may not add to totals due to rounding



[1] Minimum strategic biodiversity score is 80 per cent of the weighted average score across habitat zones where a general offset is required

# Testing Clearing proposal (modelled)

## Next steps

Any proposal to remove native vegetation must meet the application requirements of the high risk-based pathway and it will be assessed under the high risk-based pathway.

If you wish to remove the marked native vegetation, you must complete the required habitat hectare assessment to determine the condition score of the native vegetation and then submit the related shapefiles to the Department of Environment, Land, Water and Planning (DELWP) for processing, by email to nativevegetation.support@delwp.vic.gov.au. DELWP will provide a Biodiversity impact and offset requirements report that is required to meet the permit application requirements.



## Biodiversity impact of removal of native vegetation

### Habitat hectares

Habitat hectares are calculated for each habitat zone within your proposal using the extent in the GIS data you provided and modelled condition scores.

| Habitat zone | Modelled condition score | Extent (ha) | Habitat hectares |
|---|---|---|---|
| 1-1-A | 0.665 | 0.208 | 0.138 |
| 2-2-A | 0.373 | 0.087 | 0.033 |
| 3-3-A | 0.570 | 0.060 | 0.034 |
| 4-4-A | 0.205 | 2.251 | 0.462 |
| 5-5-A | 0.487 | 1.000 | 0.487 |
| 6-6-A | 0.200 | 0.125 | 0.025 |
| 7-7-A | 0.200 | 0.250 | 0.050 |
| 8-8-A | 0.200 | 0.187 | 0.037 |
| 9-9-A | 0.200 | 1.000 | 0.200 |
| 10-10-A | 0.200 | 0.062 | 0.012 |
| 11-11-A | 0.200 | 0.125 | 0.025 |
| 12-12-A | 0.491 | 9.432 | 4.634 |
| 13-13-A | 0.200 | 0.035 | 0.007 |
| 14-14-A | 0.200 | 0.044 | 0.009 |
| 15-15-A | 0.200 | 0.054 | 0.011 |
| 16-16-A | 0.200 | 0.000 | 0.000 |
| 17-17-WL | 0.200 | 0.081 | 0.016 |
| 18-18-WL | 0.200 | 0.217 | 0.043 |
| 19-19-WL | 0.200 | 0.696 | 0.139 |
| 20-20-WL | 0.200 | 0.337 | 0.067 |
| 21-21-WL | 0.200 | 0.086 | 0.017 |

# Testing Clearing proposal (modelled)

| Habitat zone | Modelled condition score | Extent (ha) | Habitat hectares |
|---|---|---|---|
| TOTAL | | | 6.448 |

## Impacts on rare or threatened species habitat above specific offset threshold

The specific-general offset test was applied to your proposal. The test determines if the proposed removal of native vegetation has a proportional impact on any rare or threatened species habitats above the specific offset threshold. The threshold is set at 0.005 per cent of the total habitat for a species. When the proportional impact is above the specific offset threshold a specific offset for that species' habitat is required.

The specific-general offset test found your proposal has a proportional impact above the specific offset threshold for the following rare or threatened species' habitats.

| Species number | Species common name | Species scientific name | Species type | Area of mapped habitat (ha) | Proportional impact (%) |
|---|---|---|---|---|---|
| 501197 | Rough-grain Love-grass | Eragrostis trachycarpa | Highly Localised - model & points | 9.128 | 0.714 % |

## Clearing site biodiversity equivalence score(s)

Where a habitat zone requires specific offset(s), the specific biodiversity equivalence score(s) for each species in that habitat zone is calculated by multiplying the habitat hectares of the habitat zone by the habitat importance score for each species impacted in the habitat zone.

| Habitat zone | Habitat hectares | Habitat for rare or threatened species | | | | | Specific biodiversity equivalence score (SBES) |
|---|---|---|---|---|---|---|---|
| | | Proportion of habitat zone with specific offset | Species number | Species common name | Species scientific name | Habitat importance score | |
| 1-1-A | 0.138 | 100.000 % | 501197 | Rough-grain Love-grass | Eragrostis trachycarpa | 1.000 | 0.138 |
| 2-2-A | 0.033 | 53.306 % | 501197 | Rough-grain Love-grass | Eragrostis trachycarpa | 1.000 | 0.017 |
| 5-5-A | 0.487 | 100.000 % | 501197 | Rough-grain Love-grass | Eragrostis trachycarpa | 1.000 | 0.487 |
| 12-12-A | 4.634 | 83.484 % | 501197 | Rough-grain Love-grass | Eragrostis trachycarpa | 1.000 | 3.868 |

There are habitat zones in your proposal which are not habitat for the species above. A general offset is required for the(se) habitat zone(s).

The general biodiversity equivalence score for the habitat zone(s) is calculated by multiplying the habitat hectares by the strategic biodiversity score.

| Habitat zone | Habitat hectares | Proportion of habitat zone with general offset | Strategic biodiversity score | General biodiversity equivalence score (GBES) |
|---|---|---|---|---|
| 2-2-A | 0.033 | 46.694 % | 0.882 | 0.013 |
| 3-3-A | 0.034 | 100.000 % | 0.860 | 0.029 |

# Testing Clearing proposal (modelled)

| Habitat zone | Habitat hectares | Proportion of habitat zone with general offset | Strategic biodiversity score | General biodiversity equivalence score (GBES) |
|---|---|---|---|---|
| 4-4-A | 0.462 | 100.000 % | 0.527 | 0.244 |
| 6-6-A | 0.025 | 100.000 % | 0.677 | 0.017 |
| 7-7-A | 0.050 | 100.000 % | 0.664 | 0.033 |
| 8-8-A | 0.037 | 100.000 % | 0.643 | 0.024 |
| 9-9-A | 0.200 | 100.000 % | 0.763 | 0.153 |
| 10-10-A | 0.012 | 100.000 % | 0.764 | 0.010 |
| 11-11-A | 0.025 | 100.000 % | 0.722 | 0.018 |
| 12-12-A | 4.634 | 16.516 % | 0.712 | 0.545 |
| 13-13-A | 0.007 | 100.000 % | 0.506 | 0.004 |
| 14-14-A | 0.009 | 100.000 % | 0.373 | 0.003 |
| 15-15-A | 0.011 | 100.000 % | 0.103 | 0.001 |
| 16-16-A | 0.000 | 100.000 % | 0.100 | 0.000 |
| 17-17-WL | 0.016 | 100.000 % | 0.774 | 0.012 |
| 18-18-WL | 0.043 | 100.000 % | 0.428 | 0.019 |
| 19-19-WL | 0.139 | 100.000 % | 0.100 | 0.014 |
| 20-20-WL | 0.067 | 100.000 % | 0.100 | 0.007 |
| 21-21-WL | 0.017 | 100.000 % | 0.391 | 0.007 |



## Mapped rare or threatened species' habitats on site

This table sets out the list of rare or threatened species' habitats mapped at the site beyond those species for which the impact is above the specific offset threshold. These species habitats do not require a specific offset according to the specific-general offset test.

| Species number | Species common name | Species scientific name |
|---|---|---|
| 10212 | Australasian Shoveler | Anas rhynchotis |
| 10215 | Hardhead | Aythya australis |
| 10220 | Grey Goshawk | Accipiter novaehollandiae novaehollandiae |
| 10230 | Square-tailed Kite | Lophoictinia isura |
| 10238 | Black Falcon | Falco subniger |
| 10498 | Chestnut-rumped Heathwren | Calamanthus pyrrhopygius |
| 10598 | Painted Honeyeater | Grantiella picta |
| 12283 | Lace Monitor | Varanus varius |
| 13117 | Brown Toadlet | Pseudophryne bibronii |

# Testing Clearing proposal (modelled)

| Species number | Species common name | Species scientific name |
|---|---|---|
| 501084 | Purple Diuris | Diuris punctata var. punctata |

## Offset requirements

If a permit is granted to remove the marked native vegetation the permit condition will include the requirement to obtain a native vegetation offset.

To calculate the required offset amount required the biodiversity equivalence scores are aggregated to the proposal level and multiplied by the relevant risk multiplier.

Offsets also have required attributes:

- General offsets must be located in the same Catchment Management Authority (CMA) boundary or Local Municipal District (local council) as the clearing and must have a minimum strategic biodiversity score of 80 per cent of the clearing.[2]
- Specific offsets must be located in the same species habitat as that being removed, as determined by the habitat importance map for that species.

The offset requirements for your proposal are as follows:

| Offset type | Clearing site biodiversity equivalence score | Risk multiplier | Offset requirements | |
|---|---|---|---|---|
| | | | Offset amount (biodiversity equivalence units) | Offset attributes |
| Specific | 4.512 SBES | 2 | 9.023 specific units | Offset must provide habitat for 501197, Rough-grain Love-grass, Eragrostis trachycarpa |
| General | 1.152 GBES | 1.5 | 1.728 general units | Offset must be within West Gippsland CMA or Wellington Shire Council<br>Offset must have a minimum strategic biodiversity score of 0.443 |



[2] Strategic biodiversity score is a weighted average across habitat zones where a general offset is required

# Testing Clearing proposal (modelled)

## Images of marked native vegetation

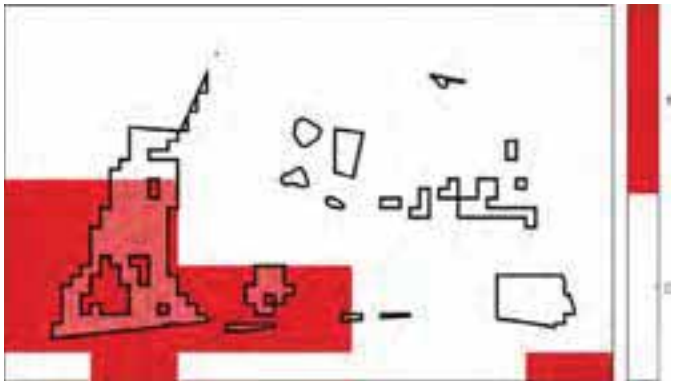
**1. Native vegetation location risk map**


**2. Strategic biodiversity score map**

# Testing Clearing proposal (modelled)

**3. Habitat importance maps**

Rough-grain Love-grass
*Eragrostis trachycarpa*
501197



# Testing Clearing proposal (modelled)

## Glossary

**Condition score**

This is the site-assessed condition score for the native vegetation. Each habitat zone in the clearing proposal is assigned a condition score according to the habitat hectare assessment method. This information has been provided by or on behalf of the applicant in the GIS file.

**Dispersed habitat**

A dispersed species habitat is a habitat for a rare or threatened species whose habitat is spread over a relatively broad geographic area greater than 2,000 hectares.

**General biodiversity equivalence score**

The general biodiversity equivalence score quantifies the relative overall contribution that the native vegetation to be removed makes to Victoria's biodiversity. The general biodiversity equivalence score is calculated as follows:

$$\textbf{\textit{General biodiversity equivalence score}} = \textbf{\textit{habitat hectares}} \times \textbf{\textit{strategic biodiversity score}}$$

**General offset amount**

This is calculated by multiplying the general biodiversity equivalence score of the native vegetation to be removed by the risk factor for general offsets. This number is expressed in general biodiversity equivalence units and is the amount of offset that is required to be provided should the application be approved. This offset requirement will be a condition to the permit for the removal of native vegetation.

$$\textbf{\textit{Risk adjusted general biodiversity equivalence score}} = \textbf{\textit{general biodiversity equivalence score clearing}} \times \mathbf{1.5}$$

**General offset attributes**

General offset must be located in the same Catchment Management Authority boundary or Municipal District (local council) as the clearing site. They must also have a strategic biodiversity score that is at least 80 per cent of the score of the clearing site.

**Habitat hectares**

Habitat hectares is a site-based measure that combines extent and condition of native vegetation. The habitat hectares of native vegetation is equal to the current condition of the vegetation (condition score) multiplied by the extent of native vegetation. Habitat hectares can be calculated for a remnant patch or for scattered trees or a combination of these two vegetation types. This value is calculated for each habitat zone using the following formula:

$$\textbf{\textit{Habitat hectares}} = \textbf{\textit{total extent}}\ (\textbf{\textit{hectares}}) \times \textbf{\textit{condition score}}$$

**Habitat importance score**

The habitat importance score is a measure of the importance of the habitat located on a site for a particular rare or threatened species. The habitat importance score for a species is a weighted average value calculated from the habitat importance map for that species. The habitat importance score is calculated for each habitat zone where the habitat importace map indicates that species habitat occurs.

**Habitat zone**

Habitat zone is a discrete contiguous area of native vegetation that:

- is of a single Ecological Vegetation Class
- has the same measured condition.

# Testing Clearing proposal (modelled)

**Highly localised habitat**

A highly localised habitat is habitat for a rare or threatened species that is spread across a very restricted area (less than 2,000 hectares). This can also be applied to a similarly limited sub-habitat that is disproportionately important for a wide-ranging rare or threatened species. Highly localised habitats have the highest habitat importance score (1) for all locations where they are present.

**Minimum strategic biodiversity score**

The minimum strategic biodiversity score is an attribute for a general offset.

The strategic biodiversity score of the offset site must be at least 80 per cent of the strategic biodiversity score of the native vegetation to be removed. This is to ensure offsets are located in areas with a strategic value that is comparable to, or better than, the native vegetation to be removed. Where a specific and general offset is required, the minimum strategic biodiversity score relates only to the habitat zones that require the general offset.

**Offset risk factor**

There is a risk that the gain from undertaking the offset will not adequately compensate for the loss from the removal of native vegetation. If this were to occur, despite obtaining an offset, the overall impact from removing native vegetation would result in a loss in the contribution that native vegetation makes to Victoria's biodiversity.

To address the risk of offsets failing, an offset risk factor is applied to the calculated loss to biodiversity value from removing native vegetation.

$$\textit{Risk factor for general offsets} = 1.5$$

$$\textit{Risk factor for specific offset} = 2$$

**Offset type**

The specific-general offset test determines the offset type required.

When the specific-general offset test determines that the native vegetation removal will have an impact on one or more rare or threatened species habitat above the set threshold of 0.005 per cent, a specific offset is required. This test is done at the permit application level.

A general offset is required when a proposal to remove native vegetation is not deemed, by application of the specific-general offset test, to have an impact on any habitat for any rare or threatened species above the set threshold of 0.005 per cent. All habitat zones that do not require a specific offset will require a general offset.

**Proportional impact on species**

This is the outcome of the specific-general offset test. The specific-general offset test is calculated across the entire proposal for each species on the native vegetation permitted clearing species list. If the proportional impact on a species is above the set threshold of 0.005 per cent then a specific offset is required for that species.

**Specific offset amount**

The specific offset amount is calculated by multiplying the specific biodiversity equivalence score of the native vegetation to be removed by the risk factor for specific offsets. This number is expressed in specific biodiversity equivalence units and is the amount of offset that is required to be provided should the application be approved. This offset requirement will be a condition to the permit for the removal of native vegetation.

$$\textit{Risk adjusted specific biodiversity equivalence score} = \textit{specific biodiversity equivalence score clearing} \times 2$$

# Testing Clearing proposal (modelled)

**Specific offset attributes**

Specific offsets must be located in the modelled habitat for the species that has triggered the specific offset requirement.

**Specific biodiversity equivalence score**

The specific biodiversity equivalence score quantifies the relative overall contribution that the native vegetation to be removed makes to the habitat of the relevant rare or threatened species. It is calculated for each habitat zone where one or more species habitats require a specific offset as a result of the specific-general offset test as follows:

$$\textit{Specific biodiversity equivalence score} = \textit{habitat hectares} \times \textit{habitat importance score}$$

**Strategic biodiversity score**

This is the weighted average strategic biodiversity score of the marked native vegetation. The strategic biodiversity score has been calculated from the *Strategic biodiversity map* for each habitat zone.

The strategic biodiversity score of native vegetation is a measure of the native vegetation's importance for Victoria's biodiversity, relative to other locations across the landscape. The *Strategic biodiversity map* is a modelled layer that prioritises locations on the basis of rarity and level of depletion of the types of vegetation, species habitats, and condition and connectivity of native vegetation.

**Total extent (hectares) for calculating habitat hectares**

This is the total area of the marked native vegetation in hectares.

The total extent of native vegetation is an input to calculating the habitat hectares of a site and in calculating the general biodiversity equivalence score. Where the marked native vegetation includes scattered trees, each tree is converted to hectares using a standard area calculation of 0.071 hectares per tree. This information has been provided by or on behalf of the applicant in the GIS file.

**Vicinity**

The vicinity is an attribute for a general offset.

The offset site must be located within the same Catchment Management Authority boundary or Local Municipal District as the native vegetation to be removed.

# Testing Clearing proposal (modelled)

This report provides biodiversity information associated with the proposed native vegetation clearing. PLEASE NOTE: This report used modelled condition scores. A habitat hectare assessment is required before the shapefiles are submitted to DELWP for processing.

**Date of issue:** 02/08/2017
**Time of issue:** 3:02 pm

**Ref: Scenario Testing**

| **Project ID** | EHP9353_Sale_SA3_VG94 |
|---|---|

## Summary of marked native vegetation

| | |
|---|---|
| **Risk-based pathway** | Moderate |
| **Total extent** | 14.101 ha |
| Remnant patches | 14.101 ha |
| Scattered trees | 0 trees |
| Location risk | A |

| | |
|---|---|
| **Strategic biodiversity score of all marked native vegetation** | 0.111 |

## Offset requirements

If the marked vegetation was cleared, using modelled scores, the following offsets would be applicable.

| **Offset type** | **General offset** |
|---|---|
| **General offset amount (general biodiversity equivalence units)** | 0.471 general units |
| **General offset attributes** | |
| Vicinity | West Gippsland Catchment Management Authority (CMA) or Wellington Shire Council |
| Minimum strategic biodiversity score | 0.089[1] |

NB: values presented in tables throughout this document may not add to totals due to rounding



[1] Minimum strategic biodiversity score is 80 per cent of the weighted average score across habitat zones where a general offset is required

# Testing Clearing proposal (modelled)

## Next steps

Any proposal to remove native vegetation must meet the application requirements of the moderate risk-based pathway and it will be assessed under the moderate risk-based pathway.

If you wish to remove the marked native vegetation, you must complete the required habitat hectare assessment to determine the condition score of the native vegetation and then submit the related shapefiles to the Department of Environment, Land, Water and Planning (DELWP) for processing, by email to nativevegetation.support@delwp.vic.gov.au. DELWP will provide a Biodiversity impact and offset requirements report that is required to meet the permit application requirements.



## Biodiversity impact of removal of native vegetation

### Habitat hectares

Habitat hectares are calculated for each habitat zone within your proposal using the extent in the GIS data you provided and modelled condition scores.

| Habitat zone | Modelled condition score | Extent (ha) | Habitat hectares |
|---|---|---|---|
| 1-1-A | 0.200 | 0.000 | 0.000 |
| 2-2-A | 0.200 | 0.009 | 0.002 |
| 3-3-A | 0.200 | 7.221 | 1.444 |
| 4-4-A | 0.200 | 0.125 | 0.025 |
| 5-5-A | 0.200 | 0.125 | 0.025 |
| 6-6-A | 0.200 | 0.125 | 0.025 |
| 7-7-A | 0.200 | 0.062 | 0.012 |
| 8-8-A | 0.200 | 0.375 | 0.075 |
| 9-9-A | 0.200 | 0.125 | 0.025 |
| 10-10-B | 0.200 | 0.062 | 0.012 |
| 11-11-B | 0.200 | 0.062 | 0.012 |
| 12-12-B | 0.200 | 0.037 | 0.007 |
| 13-13-B | 0.200 | 0.249 | 0.050 |
| 14-14-B | 0.200 | 0.063 | 0.013 |
| 15-15-B | 0.200 | 0.063 | 0.013 |
| 16-16-B | 0.200 | 0.006 | 0.001 |
| 17-17-B | 0.200 | 5.162 | 1.032 |
| 18-18-WL | 0.200 | 0.083 | 0.017 |
| 19-19-WL | 0.200 | 0.093 | 0.019 |
| 20-20-WL | 0.200 | 0.054 | 0.011 |
| **TOTAL** | | | **2.820** |

# Testing Clearing proposal (modelled)

## Impacts on rare or threatened species habitat above specific offset threshold

The specific-general offset test was applied to your proposal. The test determines if the proposed removal of native vegetation has a proportional impact on any rare or threatened species habitats above the specific offset threshold. The threshold is set at 0.005 per cent of the total habitat for a species. When the proportional impact is above the specific offset threshold a specific offset for that species' habitat is required.

The specific-general offset test found your proposal does not have a proportional impact on any rare or threatened species' habitats above the specific offset threshold. No specific offsets are required. A general offset is required as set out below.

## Clearing site biodiversity equivalence score(s)

The general biodiversity equivalence score for the habitat zone(s) is calculated by multiplying the habitat hectares by the strategic biodiversity score.

| Habitat zone | Habitat hectares | Proportion of habitat zone with general offset | Strategic biodiversity score | General biodiversity equivalence score (GBES) |
|---|---|---|---|---|
| 1-1-A | 0.000 | 100.000 % | 0.100 | 0.000 |
| 2-2-A | 0.002 | 100.000 % | 0.100 | 0.000 |
| 3-3-A | 1.444 | 100.000 % | 0.100 | 0.144 |
| 4-4-A | 0.025 | 100.000 % | 0.100 | 0.003 |
| 5-5-A | 0.025 | 100.000 % | 0.706 | 0.018 |
| 6-6-A | 0.025 | 100.000 % | 0.100 | 0.003 |
| 7-7-A | 0.012 | 100.000 % | 0.100 | 0.001 |
| 8-8-A | 0.075 | 100.000 % | 0.100 | 0.008 |
| 9-9-A | 0.025 | 100.000 % | 0.100 | 0.003 |
| 10-10-B | 0.012 | 100.000 % | 0.100 | 0.001 |
| 11-11-B | 0.012 | 100.000 % | 0.100 | 0.001 |
| 12-12-B | 0.007 | 100.000 % | 0.100 | 0.001 |
| 13-13-B | 0.050 | 100.000 % | 0.441 | 0.022 |
| 14-14-B | 0.013 | 100.000 % | 0.100 | 0.001 |
| 15-15-B | 0.013 | 100.000 % | 0.100 | 0.001 |
| 16-16-B | 0.001 | 100.000 % | 0.100 | 0.000 |
| 17-17-B | 1.032 | 100.000 % | 0.100 | 0.103 |
| 18-18-WL | 0.017 | 100.000 % | 0.100 | 0.002 |
| 19-19-WL | 0.019 | 100.000 % | 0.100 | 0.002 |
| 20-20-WL | 0.011 | 100.000 % | 0.100 | 0.001 |

## Mapped rare or threatened species' habitats on site

# Testing Clearing proposal (modelled)

This table sets out the list of rare or threatened species' habitats mapped at the site beyond those species for which the impact is above the specific offset threshold. These species habitats do not require a specific offset according to the specific-general offset test.

| Species number | Species common name | Species scientific name |
|---|---|---|
| 10195 | Australian Little Bittern | Ixobrychus minutus dubius |
| 10215 | Hardhead | Aythya australis |
| 10230 | Square-tailed Kite | Lophoictinia isura |
| 10238 | Black Falcon | Falco subniger |
| 10598 | Painted Honeyeater | Grantiella picta |
| 12283 | Lace Monitor | Varanus varius |
| 501084 | Purple Diuris | Diuris punctata var. punctata |

## Offset requirements

If a permit is granted to remove the marked native vegetation the permit condition will include the requirement to obtain a native vegetation offset.

To calculate the required offset amount required the biodiversity equivalence scores are aggregated to the proposal level and multiplied by the relevant risk multiplier.

Offsets also have required attributes:

- General offsets must be located in the same Catchment Management Authority (CMA) boundary or Local Municipal District (local council) as the clearing and must have a minimum strategic biodiversity score of 80 per cent of the clearing.[2]

The offset requirements for your proposal are as follows:

| Offset type | Clearing site biodiversity equivalence score | Risk multiplier | Offset requirements | |
|---|---|---|---|---|
| | | | Offset amount (biodiversity equivalence units) | Offset attributes |
| General | 0.314 GBES | 1.5 | 0.471 general units | Offset must be within West Gippsland CMA or Wellington Shire Council<br>Offset must have a minimum strategic biodiversity score of 0.089 |

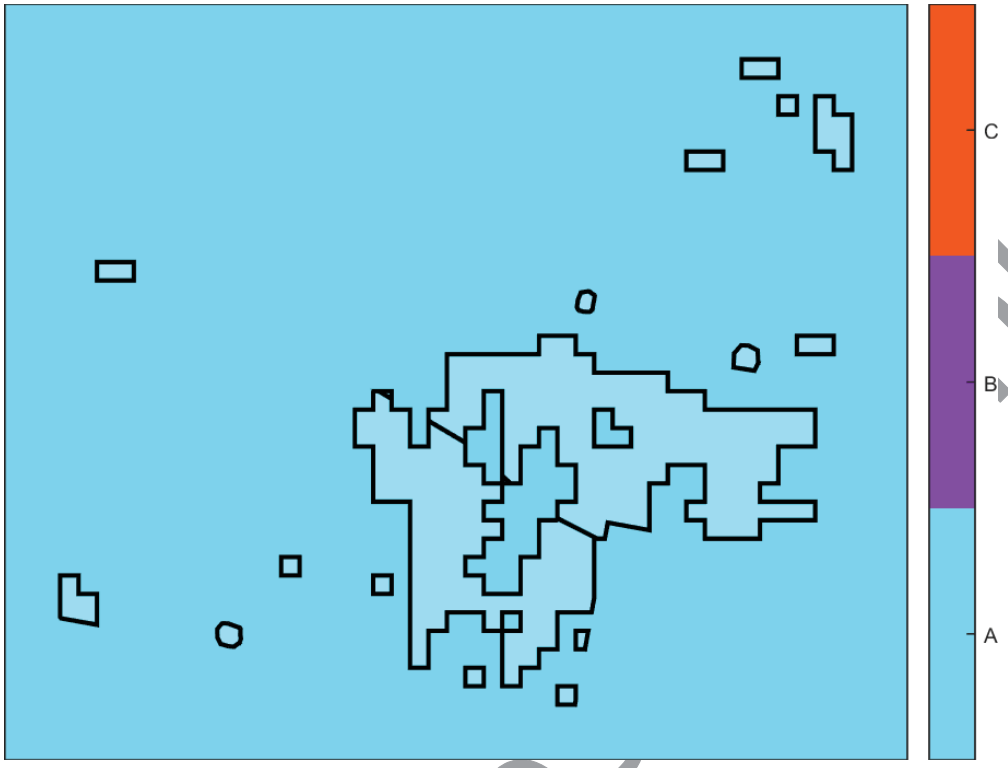


[2] Strategic biodiversity score is a weighted average across habitat zones where a general offset is required

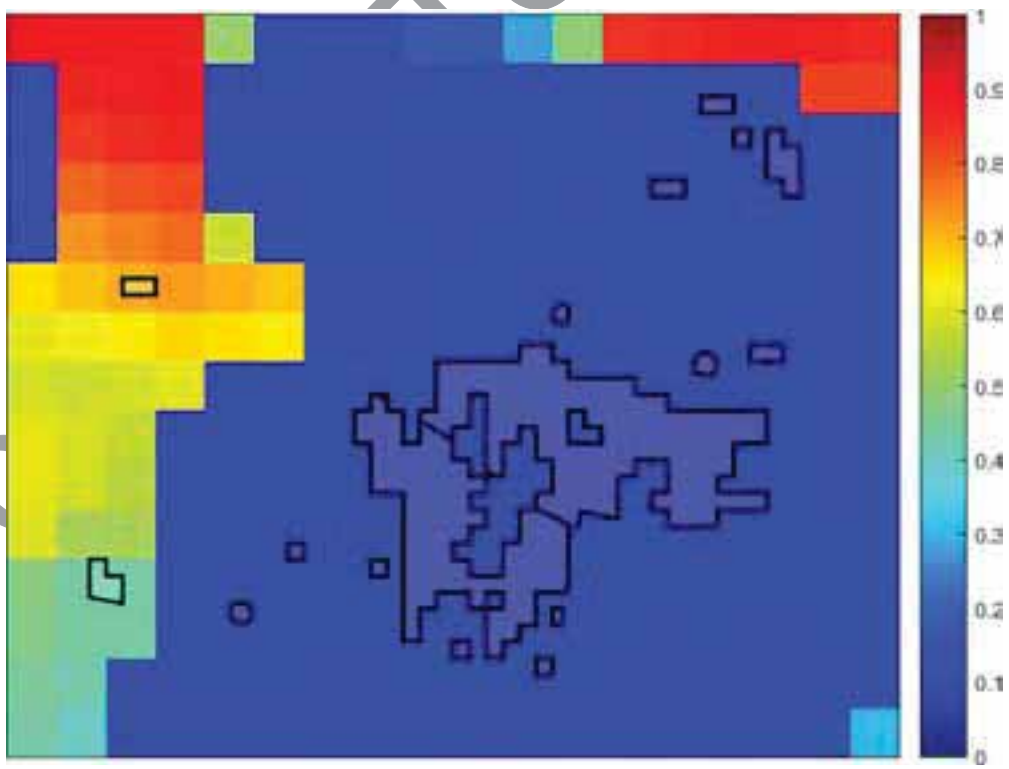
# Testing Clearing proposal (modelled)

## Images of marked native vegetation

**1. Native vegetation location risk map**




**2. Strategic biodiversity score map**



# Testing Clearing proposal (modelled)

## Glossary

**Condition score**

This is the site-assessed condition score for the native vegetation. Each habitat zone in the clearing proposal is assigned a condition score according to the habitat hectare assessment method. This information has been provided by or on behalf of the applicant in the GIS file.

**Dispersed habitat**

A dispersed species habitat is a habitat for a rare or threatened species whose habitat is spread over a relatively broad geographic area greater than 2,000 hectares.

**General biodiversity equivalence score**

The general biodiversity equivalence score quantifies the relative overall contribution that the native vegetation to be removed makes to Victoria's biodiversity. The general biodiversity equivalence score is calculated as follows:

$$\textit{General biodiversity equivalence score} = \textit{habitat hectares} \times \textit{strategic biodiversity score}$$

**General offset amount**

This is calculated by multiplying the general biodiversity equivalence score of the native vegetation to be removed by the risk factor for general offsets. This number is expressed in general biodiversity equivalence units and is the amount of offset that is required to be provided should the application be approved. This offset requirement will be a condition to the permit for the removal of native vegetation.

$$\textit{Risk adjusted general biodiversity equivalence score} = \textit{general biodiversity equivalence score clearing} \times 1.5$$

**General offset attributes**

General offset must be located in the same Catchment Management Authority boundary or Municipal District (local council) as the clearing site. They must also have a strategic biodiversity score that is at least 80 per cent of the score of the clearing site.

**Habitat hectares**

Habitat hectares is a site-based measure that combines extent and condition of native vegetation. The habitat hectares of native vegetation is equal to the current condition of the vegetation (condition score) multiplied by the extent of native vegetation. Habitat hectares can be calculated for a remnant patch or for scattered trees or a combination of these two vegetation types. This value is calculated for each habitat zone using the following formula:

$$\textit{Habitat hectares} = \textit{total extent}\ (\textit{hectares}) \times \textit{condition score}$$

**Habitat importance score**

The habitat importance score is a measure of the importance of the habitat located on a site for a particular rare or threatened species. The habitat importance score for a species is a weighted average value calculated from the habitat importance map for that species. The habitat importance score is calculated for each habitat zone where the habitat importace map indicates that species habitat occurs.

# Testing Clearing proposal (modelled)

**Habitat zone**

Habitat zone is a discrete contiguous area of native vegetation that:

- is of a single Ecological Vegetation Class
- has the same measured condition.

**Highly localised habitat**

A highly localised habitat is habitat for a rare or threatened species that is spread across a very restricted area (less than 2,000 hectares). This can also be applied to a similarly limited sub-habitat that is disproportionately important for a wide-ranging rare or threatened species. Highly localised habitats have the highest habitat importance score (1) for all locations where they are present.

**Minimum strategic biodiversity score**

The minimum strategic biodiversity score is an attribute for a general offset.

The strategic biodiversity score of the offset site must be at least 80 per cent of the strategic biodiversity score of the native vegetation to be removed. This is to ensure offsets are located in areas with a strategic value that is comparable to, or better than, the native vegetation to be removed. Where a specific and general offset is required, the minimum strategic biodiversity score relates only to the habitat zones that require the general offset.

**Offset risk factor**

There is a risk that the gain from undertaking the offset will not adequately compensate for the loss from the removal of native vegetation. If this were to occur, despite obtaining an offset, the overall impact from removing native vegetation would result in a loss in the contribution that native vegetation makes to Victoria's biodiversity.

To address the risk of offsets failing, an offset risk factor is applied to the calculated loss to biodiversity value from removing native vegetation.

$$\textbf{\textit{Risk factor for general offsets}} = 1.5$$

$$\textbf{\textit{Risk factor for specific offset}} = 2$$

**Offset type**

The specific-general offset test determines the offset type required.

When the specific-general offset test determines that the native vegetation removal will have an impact on one or more rare or threatened species habitat above the set threshold of 0.005 per cent, a specific offset is required. This test is done at the permit application level.

A general offset is required when a proposal to remove native vegetation is not deemed, by application of the specific-general offset test, to have an impact on any habitat for any rare or threatened species above the set threshold of 0.005 per cent. All habitat zones that do not require a specific offset will require a general offset.

**Proportional impact on species**

This is the outcome of the specific-general offset test. The specific-general offset test is calculated across the entire proposal for each species on the native vegetation permitted clearing species list. If the proportional impact on a species is above the set threshold of 0.005 per cent then a specific offset is required for that species.

# Testing Clearing proposal (modelled)

**Specific offset amount**

The specific offset amount is calculated by multiplying the specific biodiversity equivalence score of the native vegetation to be removed by the risk factor for specific offsets. This number is expressed in specific biodiversity equivalence units and is the amount of offset that is required to be provided should the application be approved. This offset requirement will be a condition to the permit for the removal of native vegetation.

$$\boldsymbol{Risk\ adjusted\ specific\ biodiversity\ equivalence\ score} = \boldsymbol{specific\ biodiversity\ equivalence\ score\ clearing} \times \mathbf{2}$$

**Specific offset attributes**

Specific offsets must be located in the modelled habitat for the species that has triggered the specific offset requirement.

**Specific biodiversity equivalence score**

The specific biodiversity equivalence score quantifies the relative overall contribution that the native vegetation to be removed makes to the habitat of the relevant rare or threatened species. It is calculated for each habitat zone where one or more species habitats require a specific offset as a result of the specific-general offset test as follows:

$$\boldsymbol{Specific\ biodiversity\ equivalence\ score} = \boldsymbol{habitat\ hectares} \times \boldsymbol{habitat\ importance\ score}$$

**Strategic biodiversity score**

This is the weighted average strategic biodiversity score of the marked native vegetation. The strategic biodiversity score has been calculated from the *Strategic biodiversity map* for each habitat zone.

The strategic biodiversity score of native vegetation is a measure of the native vegetation's importance for Victoria's biodiversity, relative to other locations across the landscape. The *Strategic biodiversity map* is a modelled layer that prioritises locations on the basis of rarity and level of depletion of the types of vegetation, species habitats, and condition and connectivity of native vegetation.

**Total extent (hectares) for calculating habitat hectares**

This is the total area of the marked native vegetation in hectares.

The total extent of native vegetation is an input to calculating the habitat hectares of a site and in calculating the general biodiversity equivalence score. Where the marked native vegetation includes scattered trees, each tree is converted to hectares using a standard area calculation of 0.071 hectares per tree. This information has been provided by or on behalf of the applicant in the GIS file.

**Vicinity**

The vicinity is an attribute for a general offset.

The offset site must be located within the same Catchment Management Authority boundary or Local Municipal District as the native vegetation to be removed.

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