GTAconsultants

Jacksons Creek Road Crossing
PSP 1075 - Lancefield Road
Options Assessment & Development

Client // Metropolitan Planning Authority
Office // VIC
Reference // 14M1881000
Date // 13/10/14

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Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By	Signed
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1. Introduction

1.1 Background

The Lancefield Road Precinct Structure Plan (PSP 1075) is located in the Sunbury-Diggers Rest Growth Corridor, northeast of the Sunbury Township.

The growth area is almost completely undeveloped, and has limited to no transport network, with the exception of the Sunbury train line that extends north-south along the eastern boundary of the growth area.

Previous studies have identified the opportunity to facilitate the development of the growth area, as well as a more flexible transport network for Sunbury, by providing additional opportunities to cross Jacksons Creek.

However, providing an additional road crossing over Jacksons Creek represents significant challenges, as the topography of the creek is very steep in places, as well as the general area along the creek having a high ecological and cultural heritage value. As such, the process by which the most appropriate road alignment is identified needs to be robust, transparent, and cognisant of a wide range of inputs.

On this basis, GTA Consultants (GTA) in partnership with Ecology & Heritage Partners and specialist input from Pitt & Sherry's bridge engineering team, have been commissioned by the Metropolitan Planning Authority (MPA) to develop a number of feasible road crossing options and assess them to identify the most appropriate alignment through the growth area.

This report documents the methodology in developing and assessing the options, and recommending a preferred outcome.

1.2 Purpose

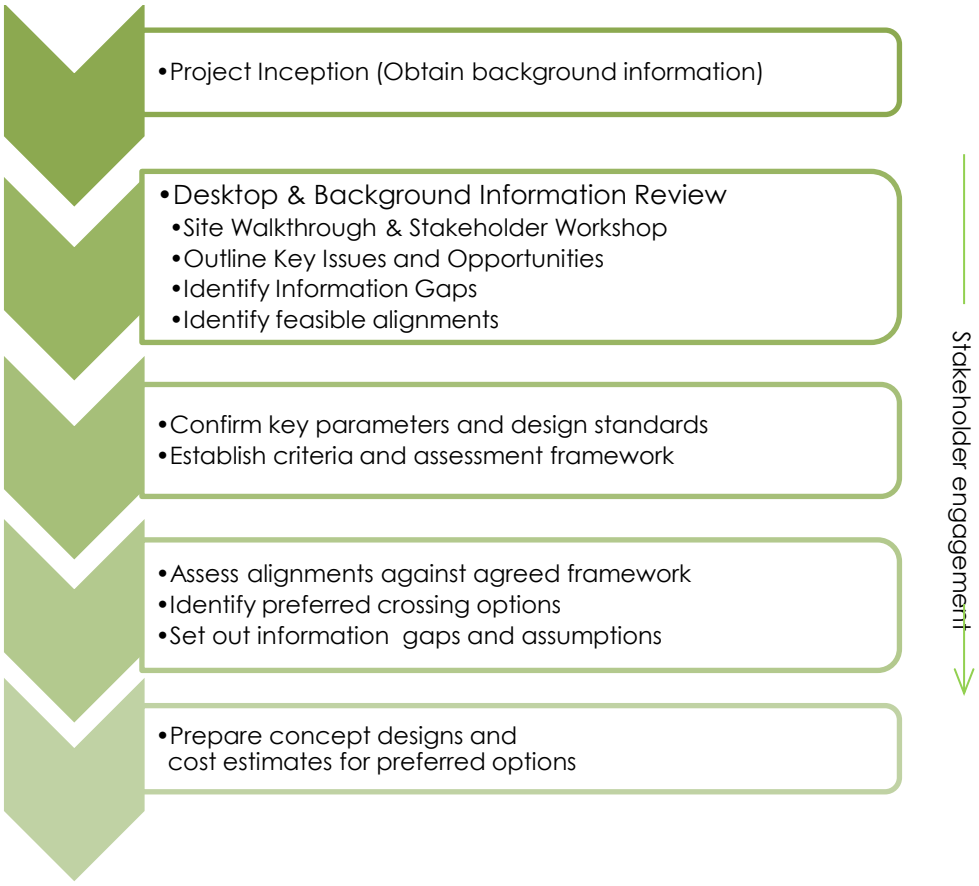
This report outlines the assessment of the feasible options and development of a preferred alignment within the Lancefield Road growth area. More specifically, the Report:

- builds on the desktop and background review undertaken to identify and select feasible alignment options
- summarises the existing issues, constraints and opportunities impacting the selection of potential feasible alignment options
- summarises the consultation activities undertaken and outcomes completed to date
- identifies information gaps, assumptions made and/or the risk associated with these
- outlines the feasible alignments being considered and the design characteristics of the two road types being considered
- sets out the decision criteria and assessment framework to help identify the preferred alignment
- determines the likely extent of works and impacts relating to the key decision criteria associated with each of the feasible alignments
- identification of the preferred alignment for each road type
- development of concept plans, broad level costing and next steps in progressing the implementation of the preferred alignments for the two road types.

1.3 Scope & Methodology

The scope and methodology for the overall project is shown graphically in Figure 1.1.

Figure 1.1: Project Methodology



1.4 Project Context

The assessment and development of a road crossing through the Lancefield Road growth area is expected to form a technical input into the development of the associated PSP. It is being carried out on the basis of '***should a road crossing be needed to be provided, where would the most appropriate location be?***' As such, the determination of specific need or transport demand for the road crossing is not part of the scope of this project, but is expected to be carried out as part of subsequent studies.

Notwithstanding the above, the project is expected to help identify the impacts of the road crossing and processes required to implement it. Only through documenting and quantifying these aspects of the proposal can it be suitably considered.

Further, this study does not include an assessment of whether the road crossings should be supported through preparation of a business case for funding, or whether it provides a net benefit to the area above what would be provided by upgrading existing roads.

The above matters will need to be resolved as part of the PSP process to suitably determine what level of development and/or transport infrastructure could be supported in the growth area.

2. Background Information

2.1 Preamble

GTA undertook a baseline review of the available background information and literature, in addition to visiting the Lancefield Road PSP area and attending early consultation activities. While a concise summary of these matters is provided below, comprehensive documentation of this initial stage of work is included at Appendix A in GTA's report titled *'Jacksons Creek Road Crossings - PSP 1074 & 1075 Growth Areas, North & South Sunbury, Baseline Report'*.

2.2 Strategic Planning Context

A number of documents are relevant and provide the strategic planning context for the potential crossing of Jacksons Creek, and include the following:

Growth Corridor and Land Use Plans

- Plan Melbourne: The Plan identifies Sunbury as an Activity Centre in the Northern Subregion of Melbourne. Overall, the Northern Subregion is anticipated to have a dwelling requirement for an additional 95,000 to 115,000 dwellings in its growth areas. The Plan indicates a road crossing over Jacksons Creek within the Lancefield Road PSP area.
- Sunbury & Diggers Rest Growth Corridor Plan: This Plan anticipates the Sunbury and Diggers Rest area to accommodate a population of some 71,000 residents and 10,000 jobs. The Plan shows the proposed Northern road crossings of Jacksons Creek for further investigation, including potential connections with proposed rail stations and new activity centres.
- Sunbury Higap Spatial Strategy: The Strategy contains the Jacksons Creek road crossings to create a proposed 'orbital loop' made via the extension of Elizabeth Drive eastwards to Lancefield Road (the 'Northern Link').
- Sunbury Higap Delivery & Infrastructure Strategy: Is the essential the strategy for implementation and delivery of the vision set out in the Sunbury Higap Spatial Strategy. In regards to the Northern road crossing of Jacksons Creek, the Strategy notes the Northern road crossing is prioritised as 'Required Infrastructure', with a timeframe of 15+ years. It is noted as an important connection to provide improved access to the Sunbury town centre and Calder Freeway for future communities in the northeast parts of Sunbury.

Previous Crossing Studies

- **Jacksons Creek Crossings (GHD, 2011):** The Jacksons Creek Crossings report was prepared for the Growth Areas Authority (GAA) as a high-level investigation of crossing opportunities. The scope of this report was to identify potentially feasible locations for crossings generally based on the topography of the area (with limited consideration of the future land use and urban structure, as well as of ecology and cultural heritage impacts). The report identified four potential crossing alignments for the Northern Crossing, including a preferred alignment (Option N1).

Precinct Structure Plan Assessment Reports

A number of studies have been commissioned by the MPA to inform the preparation of the Lancefield Road PSP. GTA has reviewed the available documentation where relevant, including the following:

- Arboricultural Assessment of Lancefield Road Precinct 1075 (draft) prepared by Treetec (November 2013).
- Land Capability Assessment for the Lancefield Road Precinct Structure Plan, prepared by Environmental Earth Sciences (draft, December 2013).
- Scattered Tree assessment, PSP 1075 Lancefield Road, prepared by Ecology and Heritage Partners (draft, April 2014).
- PSP 1075 Lancefield Road, High Level Utility Servicing Assessment prepared by (draft, November 2013).

The key themes and considerations of the above are explored in the Baseline Report provided as Attachment A.

Land Holder Reports

Villawood Properties are a major land holder within the Lancefield Road PSP area. GTA have reviewed the following documents provided on their behalf:

- Racecourse Rd, Sunbury – submission to Melbourne @ 5 Million, July 2009
- Sunbury Rd/Lancefield Rd – submission to Melbourne @ 5 Million, February 2009
- Framework Plan Submission prepared by Mesh Planning, on behalf of various parties, November 2010
- 'Sunbury – Rebirth of a township' report prepared by Villawood Properties, July 2008.

The above reports provide some indication of potential urban growth and development opportunities, however due to their historical nature and more recent changes to the Urban Growth Boundary, current intentions could differ.

2.3 Transport Network

2.3.1 Road Network

The road network within the study area is characterised by two key major north-south roads, these being Racecourse Road (two-lane connector road controlled by Council) and Lancefield Road (two-lane arterial road, controlled by VicRoads). Elizabeth Drive lies to the west of the study area and is proposed to be extended to the northeast as part of the northern road crossing of Jacksons Creek.

The existing road network between Racecourse Road and the Rail line is minimal; however some unsealed 'Unnamed' roads do exist at the southern end of the study area, and provide basic access to undeveloped land.

2.3.2 Public Transport

The following key items are noted in relation to public transport

- Sunbury is currently serviced by one central train station (including the metropolitan Melbourne Sunbury line and Bendigo V-line).

- In the future, the Sunbury Growth Corridor Plan indicates that a rail station will be located in the vicinity of the PSP area.
- The rail station north of Sunbury town centre will form part of the Bendigo V-Line.
- PTV is understood to be undertaking an infrastructure constraints analysis for the future Lancefield Road Rail Station.
- Bus routes through the PSP area are yet to be defined, however there exists an opportunity to increase the robustness of the overall public transport network and connectivity to the rest of Sunbury and the future rails station.
- In accommodating low platform bus services, vertical road profile grades are typically required to not exceed 9%. There may be an opportunity to marginally exceed this in places, especially between the areas of development proximate to Jacksons Creek, as no bus stops will be located there.

2.4 Ecology

A preliminary desk top assessment of the ecological opportunities and constraints within the Lancefield Road growth area has been undertaken by Ecology & Heritage Partners, which is documented in their letter dated 12 June 2014. The full detail of the preliminary assessment is provided as part of the Baseline Report in Appendix A, with the summary section reproduced below.

"The study area exists within a predominantly rural environment which is under increasing pressure from the effects of expanding development, including habitat fragmentation, the introduction and spread of weed and pest species and impacts on local waterways. Although much of the study area has been highly modified by agricultural activities and residential development, a number of significant ecological values persist and these should be referenced when siting and designing project infrastructure in order to avoid and minimise ecological impacts wherever possible.

The preliminary desktop review identified the following ecological values/ constraints within the study area:

- *Jacksons Creek and minor tributaries*
- *Time-stamped native vegetation and Scattered Trees*
- *Native vegetation not accounted for in the time-stamped data, particularly within the northern study area which hasn't been subject to a Biodiversity Assessment (e.g. patches identified through BioSite mapping)*
- *Habitat for significant flora and fauna species*
- *Conservation Areas 20.*

Based on the preliminary review, there are three key ecological constraints applicable to the study areas:

- ***Conservation Areas 20 and 21** lies within the study area. With respect to development within the BCS Conservation Reserve, close consultation will need to be undertaken with DEPI and potentially DotE regarding the approvals process. Based on past project experience, necessary works within the Conservation Areas may be permitted if works are supported by relevant management documents and suitable rehabilitation / offsetting arrangements. Relative to other key ecological constraints, the Conservation Areas are considered to be of **low-moderate consequence**, as there are established precedents and procedures in place to facilitate necessary development within these areas. Additionally, the section of Conservation Areas 20 and 21 potentially affected by*

the project is currently cropped. The conservation boundary was developed based on modelled data and it is likely to be revised allowing the completion of ground-truthing assessments recently commissioned by the landowner

- ***Time-stamped Native Vegetation and Scattered Trees:*** *the presence of time-stamped vegetation and scattered trees represents a* ***low-moderate constraint*** *in terms of project approval. The removal of this vegetation would trigger offset obligations under the BCS. In terms of ecological value, ground trothed native vegetation is of* ***high significance*** *and should be avoided where practical. It is noted that the time-stamped vegetation in each precinct is based on DEPI modelling rather than the results of field surveys.*

In assessing the ecological constraints and appropriately siting the alignment options, it is important to recognise the contrast between constraints relating to approvals under the BCS and those relating to MPA's objectives for impact avoidance and minimisation. The remaining ecological constraints, such as habitat for threatened species, Jacksons Creek etc., are of very high conservation significance but do not represent significant constraints in terms of project approvals under the BCS. Under the BCS, biodiversity obligations would be set according to the extent of time-stamped native vegetation and habitat for significant species within the development footprint. Within the Sunbury Growth Corridor, the following offset costs apply (in addition to those identified for native vegetation and scattered trees above):

- *Spiny Rice-flower - $7,937.00 per hectare of habitat removed*
- *Golden Sun Moth - $7,914.00 per hectare of habitat removed*
- *Growling Grass Frog - $7,529.00 per hectare of habitat removed*
- *Striped Legless Lizard - $350 per hectare of habitat removed (noting that salvage and translocation activities are required)."*

2.5 Cultural Heritage

A preliminary desk top assessment of cultural heritage constraints and opportunities within the Lancefield Road growth area has been undertaken by Ecology & Heritage Partners, which is documented in their report dated June 2014. The full detail of the preliminary assessment is provided as part of the Baseline Report in Appendix A, with the summary section reproduced below.

"The proposed crossing alignments intersect several places of Aboriginal and Historic Heritage. The density of Aboriginal places within proximity to the alignments, the presence of year-round water and the distinctive gorge and escarpment landforms, all suggest significant Aboriginal heritage and areas of archaeological potential occur with the study area. The known areas of archaeological heritage identify several areas considered to exhibit high archaeological sensitivity adjacent to the proposed creek crossings. These areas of known and potential archaeological heritage will need to be further assessed and mapped during forthcoming stages of the project and during the preparation of CHMPs for the road corridors. In addition, consultation with the Wurundjeri should be undertaken to identify any cultural values associated with archaeological places and cultural landscapes within the study area. The information in this report can be employed to assist consultation with the Wurundjeri during field inspection and preparation of additional heritage studies that can further refine alignment decisions based on identification of areas of (lower) Aboriginal heritage significance.

Given the incomplete archaeological understanding of the study area and the likelihood that additional surface and especially subsurface Aboriginal heritage occurs in the study area, it is

recommended that the proponents retain several crossing options during preparation of Cultural Heritage Management Plans for the crossing locations. Should significant subsurface heritage such as burials, earth rings or significant campsites be identified during assessment for the crossings; retention of alternative alignments would enable the proponent to avoid such highly significant places without re-engineering the entire road infrastructure or conducting extensive salvage excavations (and in keeping with Section 61 of the Aboriginal Cultural Heritage Due Diligence Assessment Report, Jacksons Creek Road Crossings, Sunbury, Victoria 23 Heritage Act 2006). Thus preparation of a CHMP is recommended at the earliest possible stage of the project following commissioning of the road."

2.6 Engineering Feasibility & Constructability

There are several important factors which affect the engineering feasibility and constructability of the proposed alignments, summarised below:

- **Geotechnical considerations:** A limited desktop review has been undertaken as part of the PSP land capability assessments. In this regard, there is an information gap, particularly the following below ground items:
  - groundwater considerations
  - slope stability assessments
  - geology and presence of rock unsuitable for significant excavation
  - quality of soil and feasibility of recycling cut materials for fill.

  Consideration of the known ground soils based on the Geotechnical Survey for Sunbury has been undertaken.
- **Proposed Grades:** The topography of the land significantly restricts the ability to provide feasibly low grade road cross sections. Furthermore, due to the undulating nature of the land in the study areas, wide road sections will require extensive batters or use of retaining walls.
- **Hydrology & Runoff:** With the expected changes to the current land form and construction of road surfaces, detailed hydrology modelling will need to be undertaken to understand what drainage treatments are required to minimise the potential for erosion and ponding. Also, specific treatments for the road surface runoff before it enters Jacksons Creek is expected to be required.
- **Bridge Structures:** It is apparent that there is a need for bridge structures to cross Jacksons Creek. The construction of which needs to consider its impact on the rich ecology and cultural heritage areas associated with Jacksons Creek.

These items are discussed further within the Baseline Report, which is provided in Appendix A.

2.7 Topography and Flood Levels

The study area generally has relatively adverse topography in terms of the ability to provide ideal geometric road alignments. Additionally, flood events along Jacksons Creek have the ability to impact road crossings, and determine the finished road and bridge levels. In this regard, GTA received 1m contour data, as well as flood level information in GIS format from Melbourne Water. An overview of the study area's topography and flood levels are documented as part of the Baseline Report provided as Appendix A, as well as being indicated on the alignment option plans discussed in Section 5 of this report.

3. Consultation

3.1 Aims

Throughout the course of the study, consultation has been undertaken with various stakeholders with the aim to:

- keep key stakeholders informed
- ensure stakeholders have an opportunity to provide input and voice on necessary considerations
- assist in the identification of issues and opportunities
- ensure that the alignment development process is transparent
- enable stakeholder input into the development of the assessment framework utilised in assessing alignment options.

The key stakeholders and the outcomes of consultation activities is documented below.

3.2 Stakeholders & Activities

Consultation with key stakeholders has been undertaken in the preparation of the Baseline Report and development of the decision framework, to bring them along for 'the journey', and to enable a two-way flow of information, ensure a transparent process, and identify key areas of interest and concern.

To this end, GTA has facilitated site walkthroughs and workshops with the following key stakeholders:

- Metropolitan Planning Authority
- Public Transport Victoria
- VicRoads
- Hume City Council
- key landowners and their representatives.

In addition, MPA and Council have chaired a workshop with a number of relevant community groups.

A copy of the workshop minutes is provided in Appendix B, with a summary of the consultation activities and the key emerging topics of discussion provided below.

3.3 Workshop Outcomes

Three workshops with various stakeholders where undertaken during the project, which are summarised below.

Workshop #1: 18 June 2014

GTA facilitated an initial workshop and attended a site walkthrough with key stakeholders, including MPA, PTV, VicRoads, Hume City Council, and various landowners. This workshop identified a number of emerging topics of discussion, which are briefly presented below:

- Preliminary work indicated there are significant constraints to achieving an arterial standard road cross section, and even constraints around the provision of a local road cross section. As such, a key input to the study to be agreed upon is the design characteristics of the road types to be tested.

- The adopted road type is expected to have implications on what funding sources will be able to be used. Clarity and confirmation on the funding models needs to be provided before a final discussion on which road type is to be implemented.
- There is an inter-relationship between the development of the Sunbury Growth Corridor, any future upgrades of the existing road network, and the need/benefit of providing an additional east-west road connection. While a transport modelling assessment is outside the scope of this study, it is highlighted as a potential future investigation in determining the overall business case approach for the road crossings.
- There is a need to resolve the future location and type of rail crossings to help resolve the preferred road alignment and urban structure of the Sunbury South PSP.

3.3.1 Workshop #2: 17 July 2014

GTA facilitated a workshop on 17 July 2014 at the Hume Council Offices in Sunbury with relevant authorities, landowners and their representatives to discuss the following:

- confirmation of project methodology, project objectives and key identified issues, opportunities and risks
- identification and agreement on evaluation criteria
- prioritisation and weighting of evaluation criteria
- assessment framework application.

From the workshop, the following key outcomes were reached and topics discussed:

- The preliminary assessment criteria were agreed to, with the only change being the broadening of the 'visual amenity' criterion to all amenity considerations.
- The aspects to be considered as part of each criterion were refined, so as to be more targeted on what impacts the selection of one option over another.
- Concern was raised around the level of uncertainty with the geotechnical conditions and potential for additional cultural heritage items being discovered in the study area. These risks, along with others, were considered to be typical for a project of this nature during the initial planning / feasibility stage of development.
- Attendees will be updated on what the resulting feasible alignment options are following application of the flood data and road design characteristics for the two road types (two and four lanes).
- Specific weightings for each criterion were not proposed given the subjective / qualitative nature of some criteria. Rather a priority order as follows was agreed:
    - engineering feasibility
    - ecology
    - amenity
    - transport network
    - development considerations.

    The other two criteria of cost and cultural heritage will be considered and applied as follows:

    - Cost criterion will be considered on a 'value for money' evaluation, to see what cost difference there is between the options and wherever improved performance is achieved for the additional cost.
    - Cultural heritage will be considered based on the known assets that have been identified and have the same level of priority as ecology, with further engagement with the Wurundjeri being undertaken by MPA in parallel.

- There wasn't an opportunity to discuss the specific application of the decision framework in comparing each option. However, through the workshop minutes, which were circulated to each attendee, the proposed approach to compare each option against the criteria was outlined and opportunity provided for feedback.

Following the meeting, all attendees were invited to provide further feedback on the proposed assessment framework outlined in the workshop minutes. Feedback was received from Department of Environment and Primary Industries, Hume City Council and Villawood. Their comments are summarised below.

Department of Environment and Primary Industries (DEPI)

- The critical consideration should be whether alignment options avoid and minimise impacts to biodiversity values within conservation Areas 20 and 21.
- With this critical area, Commonwealth approval for works within conservation Areas 20 and 21 will be required.
- The meeting minutes identify an action for Parks Victoria to provide information on proposed frog ponds. It was subsequently noted that identifying areas suitable for the creation of Growling Grass Frog wetlands is not DEPI's area of responsibility.

Hume City Council

- Concerned about there not being any geotechnical investigations being undertaken to support the alignment options. They also wanted noted that GTA indicated that they were not aware of any significant variation in the geotechnical conditions within the study areas that would influence the selection of a specific alignment over another and that allowance for additional likely construction costs are considered to be covered by contingency.
- Also raised concerns with there not being a Cultural Heritage Management Plan (CHMP) completed for both the PSPs. They also wanted noted that MPA indicated that CHMPs are not being completed as part of this study.

Mesh Consultants (on behalf of Villawood)

- Highlight that the study area has a high level of accessibility by the surrounding arterial road network, which also has significant improvements planned in the future.
- It is recommended that the assessments be undertaken against a 'base case' scenario, rather than purely against each other.
- Development considerations should have a higher level of importance in determining which road crossing is the most appropriate.
- Consideration of the impacts on developable land from significant cut and fills (i.e. level difference will restrict access, and large cut and fills will reduce the amount of available land to development.

3.3.2 Workshop #3: 24 July 2014

MPA and Council chaired a workshop on 24 July 2014 at the Sunbury Leisure and Aquatic Centre with a number of relevant community groups to discuss the assessment criteria and decision framework.

Prior to the workshop, attendees were provided with a PowerPoint presentation of the preliminary decision framework.

During the workshop there was limited feedback received, except for concerns regarding erosion and flooding within the study areas. However, attendees were asked to reflect on the presentation and send through their comments.

4. Issues, Opportunities, Information Gaps & Risks

From a review of the background information, site walkthrough, stakeholder consultation, and preliminary assessments, a summary of the identified key issues, opportunities, information gaps and risks (and actions on how to resolve them or assumptions made to minimise their impact) is summarised below in **Table 4.1**, with those items of high risk to the project indicated in **bold**.

Table 4.1: Issues, Opportunities, Information Gaps and Risks

Item	Issues, Opportunities, Information Gaps & Risks	Actions / Assumptions
Policy & Key Strategic Context Documents		
P1	Plan Melbourne acknowledges the potential for an Activity Centre in Sunbury South and the additional road crossings of Jacksons Creek.	-
P2	The Sunbury Growth Corridor Plan seeks to accommodate an additional 71,000 people.	-
P3	The Sunbury Growth Corridor shows potential rail stations in the northern and southern study areas.	Road alignments should integrate with rail stations to enhance directness of kiss & ride, park & ride etc.
P4	The Sunbury HiGap Spatial Strategy identifies a vision for future Activity Centres in the Lancefield Road PSP area.	-
P5	The Sunbury Growth Corridor identifies the 'Northern Link' as forming part of an overall cycling network.	-
P6	The Sunbury Higap Delivery & Infrastructure Strategy classifies the 'Northern Link' road crossing as 'required infrastructure' (+15years timeframe)	-
Land Use, Ownership and Development		
L1	**MPA, Council and various landowners' are understood to have contributed to the PSPs, which are at varying stages of development**	**Progress on the PSPs is reliant on the resolving of whether, where and what type of road crossings of Jacksons Creek will be provided**
Public Transport		
PT1	The proposed rail station to the north of Sunbury Township station is proposed to be on the Bendigo V-Line	-
PT2	**It is considered highly desirable to accommodate future bus routes on the road crossings, to improve transport connectivity between PSP's, Sunbury and the future rail stations.**	**Confirmation of the maximum acceptable gradient for future bus services is required from PTV**
Ecology		
E1	Conservation areas 20 and 21 lie within the study area, and relative to other key ecological constraints are considered to be of low-moderate consequence	The conservation boundary was developed based on modelled data and it is likely to be revised after the completion of ground-truthing assessments recently commissioned by the landowner
E2	Time-stamped vegetation and scattered trees represent a low-moderate constraint in terms of project approval. The removal of this vegetation would trigger offset obligations under the BCS. In terms of ecological value, ground trothed native vegetation is of high significance and should be avoided where practical	Ongoing stakeholder consultation regarding importance. Information gap: The existing information is based on modelling and has not been verified in field surveys. Liaise with MPA to determine if this is required.

Item	Issues, Opportunities, Information Gaps & Risks	Actions / Assumptions
E3	In assessing ecological constrains and siting alignment options, it is important to recognise the contrast between approval constraints under the BCS and those relating to MPAs objectives for impact avoidance and minimisation. Other habitats not discussed above (such as Jacksons Creek) are of very high conservation significance but do not represent a significant constraint in terms of project approvals under the BCS.	It is recommended that ecological values identified be further discussed during stakeholder consultation. Field data will also be used to further delineate the identified ecological constraints.
Cultural Heritage		
CH1	There are several places of Aboriginal and Historic Heritage within the study area. Various factors suggest other significant Aboriginal heritage and 'areas of archaeological potential' occur with the study area. Several areas will need to be further assessed and mapped in project development	The established information can be used to initiate consultation with the Wurundjeri to identify any cultural values associated with archaeological places and cultural landscapes within the study areas.
CH2	**The road construction will trigger the requirement to prepare a Cultural Heritage Management Plan** **Should significant subsurface heritage such as burials, earth rings or significant campsites be identified, re-alignment of extensive salvage excavations would be required (as per Section 61 of the Aboriginal Heritage Act 20006).**	**Given the incomplete archaeological understanding and likelihood that additional Aboriginal heritage occurs in the study area, Ecology and Heritage Partners recommend that several crossing options are retained at this time.** **Alternatively, GTA consider a CHMP could be prepared early on to fully inform the preferred alignment, based on prioritisation of areas and informed areas of lower value.**
Engineering Feasibility		
E1	**The design characteristics of the road cross section types will significantly affect alignments feasibility.**	**Design characteristics of the road cross section types to be decided and agreed too**
E2	**The bridge structures required, including their construction type, length, and height will have significant impacts on the road crossing feasibility.**	**Confirmation on what feasible lengths and or heights of the bridge crossings.**
E3	**Service assessment reports undertaken for the PSP indicate existing and proposed underground services.**	**Existing services and infrastructure have been sourced through Dial Before You Dig requests. Proposed services and infrastructure need to be investigated.**
Water - Flooding & Hydrology		
W1	**Hydrology analysis has not been undertaken or within the scope of this study, which will impact of drainage arrangements for the road crossings**	**Standard drainage arrangements have been adopted at this time**
W2	There is a Land Subject to Inundation Overlay (LSIO) present on a significant component of land in the northern study area. The LSIO coincides with the 100 year flood level indicated by Melbourne Water.	Works will be assumed to be constructed above the LSIO
Topography		
T1	**In conjunction will other influencing factors the steepness of the land may affect the ability to achieve compliant vertical grades**	**Localised flexibility in the road cross-section design characteristics will be sort**
Geotechnical		
G1	**No comprehensive geotechnical investigations have been undertaken to adequately inform the comparison of alignments from a geotechnical point of view.**	**Key information gap. MPA to advise wether geotechnical information is able to be provided**
G2	Desktop geotechnical reviews indicate that moderately to steeply undulating areas are likely to consist of exposed or shallow rock, resulting in difficult and more expensive excavation	-

Item	Issues, Opportunities, Information Gaps & Risks	Actions / Assumptions
G3	Desktop geotechnical reviews indicate potential for sub-surface erosion on steep sites, which may cause a problem during construction where deep excavation of greater than 3.0m are cut and exposed	A slope stability geotechnical investigation is recommended for development sites to assess potential failure modes (including potential for subsurface erosion).
Consultation		
C1	A number of emerging topics of discussion have been raised and documented	Further investigations outside the scope of this project are required to resolve these
C2	Consultation with the wider community or consultation in regard to the need for the additional road crossings of Jacksons Creek is proposed as part of this study	Only those identified by MPA and Council as having a vested interest in Jacksons Creek will be consulted as part of this project, and on the basis of which alignment is the most appropriate

5. Road Crossing Options

5.1 Road Types

As part of this project, the following two road types have been considered:

- Connector level road
- Arterial level road

Details on the design characteristics and their application within the study area is provided in the following sub sections, noting that further detail and discussion on the road characteristics is provided in the Baseline Report in Appendix A.

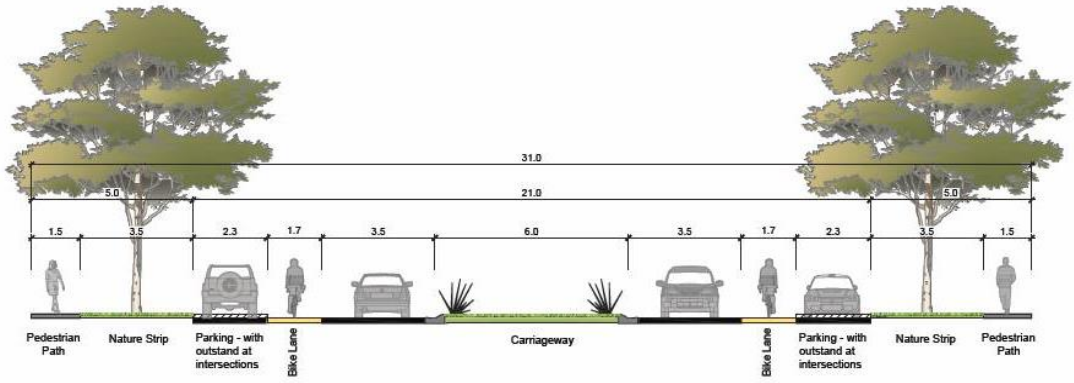
5.1.1 Connector Level Road

The connector level road is to be generally consistent with the design characteristics associated with a Boulevard Connect Street – Residential, as detailed in the Growth Areas Authority Engineering Design and Construction Manual (April 2011). The key design characteristics associated with the Boulevard Connect Street – Residential are as follows:

- Maximum operating speed – 50km/h
- Maximum grade (as advised by the bus operator) – 9%

The cross-sectional elements associated with the road type are presented in Figure 5.1

Figure 5.1: Boulevard Connector Street - Residential



Cross Section 6: BOULEVARD CONNECTOR STREET RESIDENTIAL, 31m, 7000 - 12000 VPD

However, not all of the above design characteristics for the Boulevard Connect Street – Residential cross-section will be applied over the entire section of Jacksons Creek. Rather a two-lane carriageway (7.0m wide) with 2.1m wide sealed shoulders with no kerbing will be provided between the proposed urban areas (i.e. the creek crossing).

There is also expected to be the following features over the creek crossing section of the connector road:

- an off-road 3.0m wide shared path provided on one side of the road
- 1:6 maximum grade swale type drainage arrangements (subject to hydrology analysis)
- 1:3 batters where cut or fill occurs (subject to geotechnical analysis)
- Bridge structure consists of an 11.0m wide deck with suitable safety barriers.

Away from Jacksons Creek and within the urban areas of the PSP the Boulevard Connect Street – Residential cross-section is expected to be adopted for this road type. The transition is expected to occur where urban / residential development occurs.

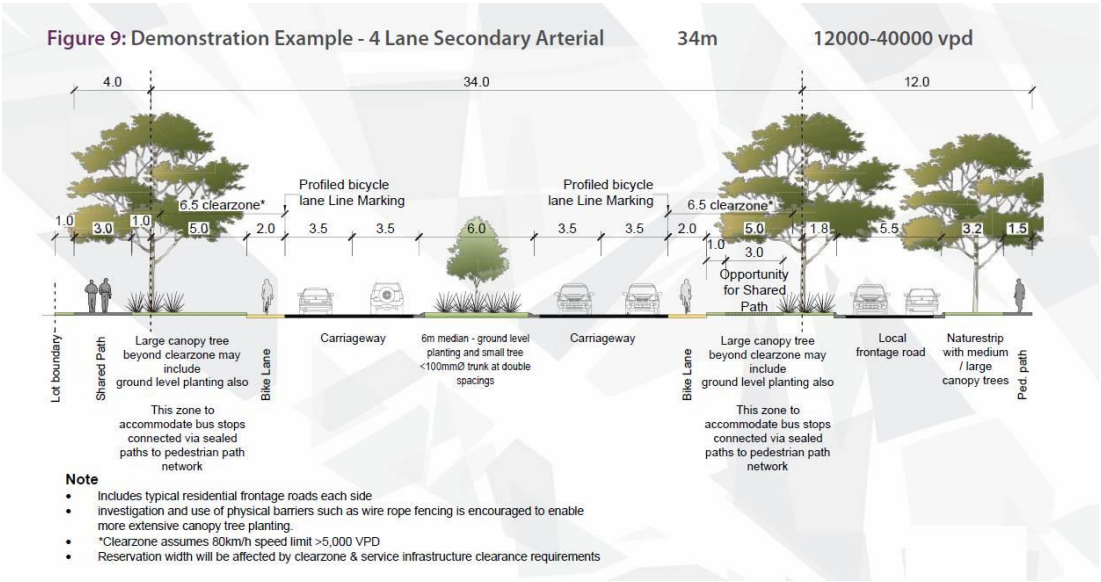
5.1.2 Arterial Level Road

The arterial level road is to be generally consistent with the design characteristics associated with a Boulevard Connect Street – Residential, as detailed in the Growth Areas Authority Engineering Design and Construction Manual (April 2011). The key design characteristics associated with a Four-Lane Secondary Arterial are listed as follows:

- Maximum operating speed – 80km/h (as specified by VicRoads)
- Maximum grade – 8%

The cross-sectional elements associated with such a road type are presented in Figure 5.2.

Figure 5.2: Four-Lane Secondary Arterial



However, not all of the above design characteristics for the Four-Lane Secondary Arterial will be applied over the entire section of Jacksons Creek. Rather a four-lane carriageway (14m wide) with 2.1m wide sealed shoulders with no kerbing will be provided between the proposed urban areas (i.e. the creek crossing). There is also expected to be the following features over the creek crossing section of the arterial road:

- an off-road 3.0m wide shared path provided on one side of the road
- 1:6 maximum grade swale type drainage arrangements (subject to hydrology analysis)
- 1:3 batters where cut or fill occurs (subject to geotechnical analysis)
- Bridge structure consists of a 20.0m wide deck with suitable safety barriers.

Away from Jacksons Creek and within the urban areas of the PSP the Four-Lane Secondary Arterial cross-section is expected to be adopted for this road type. The transition is expected to occur where urban / residential development occurs.

5.2 Feasible Alignments

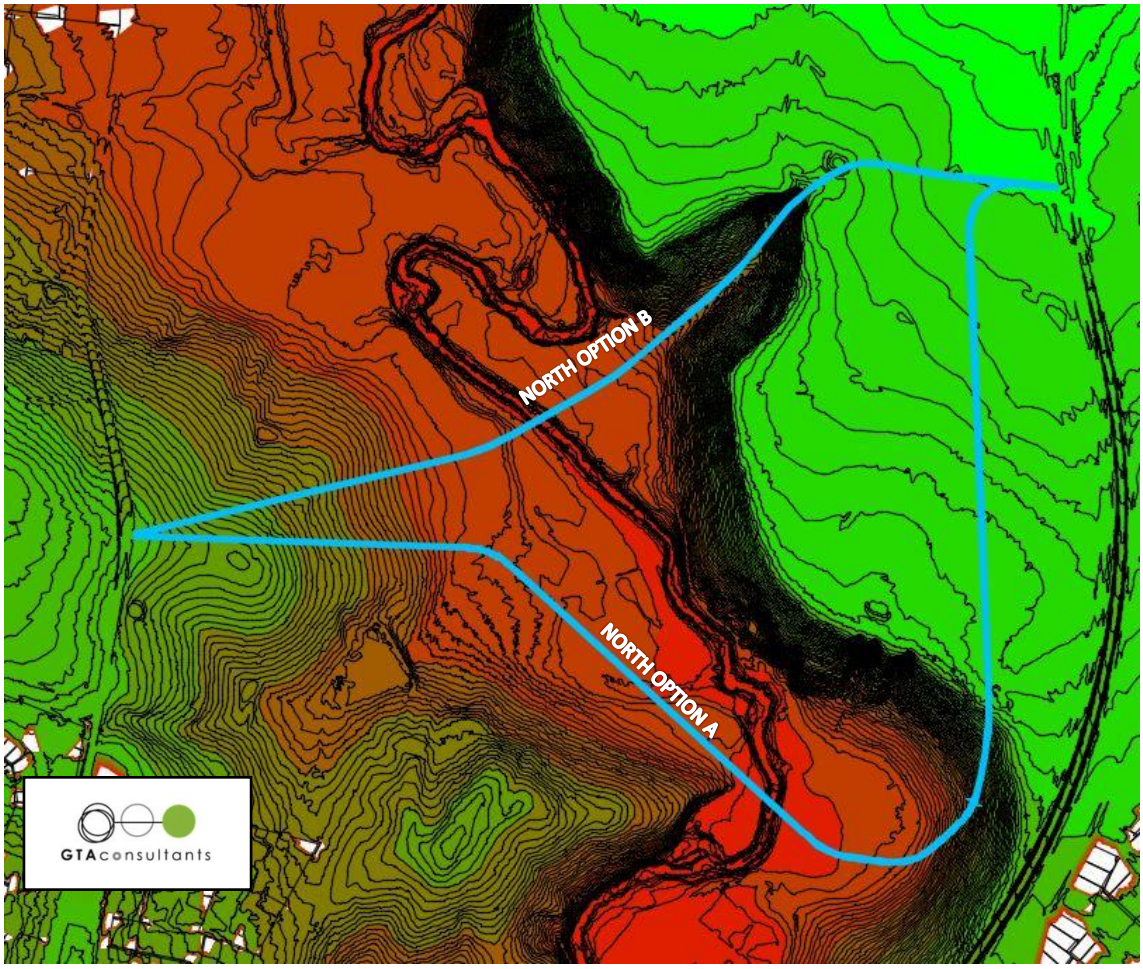
Based on the background information, site walkthrough, stakeholder consultation, consideration of the decision framework and preliminary assessments, there are considered to be two feasible alignment options within the study area for both road types.

For each of the identified feasible alignments and road types, road alignment modelling has been undertaken to provide an appreciation of the associated works required for each. A copy of the long-sections and plan views of the alignment options is provided in Appendix C. Furthermore, an outline of the associated bridge characteristics and costings are contained in Pitt & Sherry's draft Bridge Options Study Report (dated 26 September 2014), which provided in Appendix D.

An overview of the alignment options for each road type is provided below.

The two feasible road crossing alignments that have been identified in the study area are illustrated in Figure 5.3.

Figure 5.3: Feasible Alignments



For each of the feasible road crossing alignments indicated in Figure 5.3, the associated cut/fill and bridge lengths for the connector and arterial level roads are presented in Table 5.1.

Table 5.1: Earthworks and Bridge Length Estimates

Road Type	Option	Cut (m^3)	Fill (m^3)	Balance (m^3)	Total (m^3)	Bridge Length (m)
Connector	A	120,000	81,000	-39,000	201,000	65
	B	85,000	265,000	+180,000	350,000	100 [1]
Arterial	A	240,000	55,000	-185,000	295,000	80
	B	170,000	277,000	+107,000	447,000	100

[1] 70m bridge length (3 spans) plus 30m culvert length (10 cells)

It should be noted that these feasible road crossing alignments are proximate in nature, and are for the purposes of comparative assessment to identify the most appropriate alignment option for each road type.

This could include the potential to better balance cut and fill volumes. However, it is noted that the balancing would most likely need to occur on each side of Jacksons Creek, as the associated transportation of cut material is unlikely to out weight the cost of disposal or sourcing of extra material in a fill scenario on the other side. Also, with there expected to be additional works undertaken in the area with the development of the PSP, the cut/fill balance on each side of Jacksons Creek could potentially be achieved. As such, the minimisation of ground disturbance by following the existing ground profile as best as possible has been targeted with the development of the road crossing alignments.

6. Decision Framework

6.1 Preamble

The development of a decision framework has been focused on the overall project objective, which is to identify the most appropriate road crossing alignment for the Lancefield Road PSP, taking into account engineering feasibility, cost, cultural heritage, ecology, visual amenity, transport network and development considerations.

On this basis, the decision framework consists of a set of associated criterion, their priority and how each alignment option will be assessed against the criterion, which is set out below.

6.2 Evaluation Criteria

The decision framework is made up of a number of criteria. Each criterion is listed, defined and discussed below.

6.2.1 Engineering Feasibility

The Engineering Feasibility criterion relates to the comparative extent, methodology and approvals required to construct the road crossing options. These will be determined based on schematic concept level designs provided in Appendix C, information recorded while on-site and desktop assessments.

On this basis, the resulting factors for assessing this criterion relate to:

- constructability of road and bridge within Jacksons Creek
- impact on existing and proposed services where known
- ability for the alignments to go over and under the train line
- volume of earthworks (cut / fill) and length of bridge.

6.2.2 Cultural Heritage

The Cultural Heritage criterion relates to the comparative extent to which the options minimise impact on the following identified areas of cultural heritage value (in priority order):

- Sunbury Earth Rings
- river corridor
- Aboriginal cultural places
- heritage overlay / register items / inventory
- scarred trees
- artefacts / objects.

In addition, consideration will be given to:

- time and cost in gaining required approvals
- existing flexibility for the alignment to avoid future identified cultural heritage items
- minimising excavation of the existing land form as there is currently a requirement to filter excavated soil by hand in the area.

6.2.3 Ecology

The Ecology criterion relates to the comparative extent to which the options minimise impact on the following identified areas of ecological value (in priority order):

- potential habitat for significant species (Growling Grass Frog)
- field mapped remnant vegetation
- Conservation Areas 20 & 21
- time-stamped native vegetation
- bio sites
- scattered trees.

In addition, consideration will be given to:

- time and cost in gaining required approvals
- resulting fragmentation of key ecological areas and impacts on the movement of animals (both protected and unprotected species).

6.2.4 Amenity

The Amenity criterion relates to the comparative extent which the options impact the amenity of existing and potential community members in the area. It is expected that this criterion will consider the following factors:

- visual (impact on significant existing views, amount of cut / fill, bridge height / length)
- access between communities and to recreation opportunities (positive).

6.2.5 Transport Network

The Transport Network criterion relates to the comparative performance of the road crossing options in regard to the following considerations:

- the comparative travel time / distance of each crossing option
- provision of connectivity to the existing and proposed arterial road network
- being a viable alternate route to the Sunbury Township along Sunbury Road (i.e. whether the roads could be expected to perform a limited through traffic function, or more significant through traffic function in the case of the four-lane road)
- ability for the alignment to be upgraded to a four-lane road (or higher order two-lane road) in the future (two-*lane road option only*).

6.2.6 Development Considerations

The Development Considerations criterion relates to the comparative performance of the road crossing options in regard to supporting the level and type of development proposed within the Lancefield Road Growth Area (having regard for the relatively undeveloped nature of the structure planning for the area).

More specifically, they will give consideration to the following:

- the resulting road network and intersection spacing
- provision of an appropriate level of access to / around the proposed activity centres (ideally close to but not through)
- overall ability to support the social, economic and land use objectives of the Growth Plans and other strategic planning documents.

6.2.7 Cost

The Cost criterion relates to how the overall cost and required land acquisition of each road crossing option ranks against each other. The overall cost will consider the following considerations:

- broad level construction cost estimate
- cultural heritage ameliorative measures
- area of land acquisition

Given the unknown nature of the below ground geotechnical conditions, using cut material from the study area and likely transporting costs to move material each side of Jacksons Creek, the cost of earth works will be based on an absolute volume basis for each alignment. Consideration has been requested to provide a sensitivity assessment of the cost on a cut / fill balance volume basis as well. However, given the level of uncertainty this has not been completed at this time.

6.3 Prioritisation

With the level of qualitative assessment required with the comparative assessment of each alignment option against the above criteria, no specific weightings are proposed to be applied. Rather, the following prioritisation of the criteria will be used to help guide consideration on which alignment option is the most appropriate:

- engineering feasibility
- ecology
- amenity
- transport network
- development considerations.

The two other criteria being considered, of cost and cultural heritage, are proposed to be applied as follows:

- Cost criterion will be considered separately against the other criteria through a 'value for money' evaluation, to see what cost difference there is between the options and what improved performance you get for the additional cost.
- Cultural heritage will also be considered separately, and be guided by further engagement with the Wurundjeri (to be undertaken by MPA in parallel). However, initial assessment of the alignment options against the known cultural heritage values in the study area will be undertaken. This criterion is expected to be of similar importance in determining which alignment option is the most appropriate as the Ecology criterion.

6.4 Assessment Framework

Each road crossing option will be comparatively assessed against each other in the following way:

- Each alignment option will be ranked in order of how well they perform against the factors associated with each criterion.
- The middle ranked option(s) will be allocated to the middle category score of the five categories presented in Table 6.1, and the other options distributed over the five categories based on their relative level of performance compared with the middle ranked option(s). This could result in all options receiving a 'Neutral / Same Performance' score if the relative performance is generally similar.

Table 6.1: Five Categories of Performance

Level of Performance
Significant Higher Performance
Higher Performance
Neutral / Same Performance
Lower Performance
Significant Lower Performance

Quantitative measures will be used where possible, but in this instance and given the proposed comparative assessment process outlined above, there can be expected to be a level of professional judgement used to rank the relative performance of the feasible alignments against the various factors of each criterion and by how much.

An overall performance for each feasible alignment will be determined and ultimately used to rank the feasible options.

This has been supported by analysis and explanatory commentary to ensure that the resulting scores are transparent and able to be further interrogated and/or re-evaluated, as required through the subsequent planning and design stages as further information becomes available.

7. Options Impact & Assessment

7.1 Preamble

Based on the available background information and analysis presented in this report, a comparative assessment of the identified feasible road crossing alignments are set out in this section of the report. It is noted that the purpose of this assessment is to identify the most appropriate alignment and not whether it is needed or able to be approved and funded. Rather, this provides an initial indication of where a road crossing is considered to be most appropriate based on the available high level planning information.

There may be a need to re-run this assessment as additional information comes to light. As such, suitable commentary is provided below to enable this to occur in the future.

7.2 Decision Criteria Analysis

The assessment framework is executed below for the two connector and two arterial road crossing alignment options.

7.2.1 Engineering Feasibility

The Engineering Feasibility criterion relates to the comparative extent, methodology and approvals required to construct the road crossing options in the study area.

Based on the cut/fill volumes and bridge lengths presented in Table 5.1, as well as the schematic concept level designs provided in Appendix C and bridge structure characteristics provided in Appendix D, the relative performance of each alignment has been determined based on the following:

Connector Level Road

- ***Constructability*** – The creek corridor and the adjacent areas of significant grade (especially on the eastern side) are expected to have similar levels of difficulty to construct the two road crossings. As such, both options have the same level of performance in this regard.
- ***Impacts on services –*** No existing services within the creek area have been identified. In the future, there is expected to be drainage needs to be accommodated. This should be able to be accommodated with either option (length will have a cost function), so both options have the same level of performance in this regard.
- ***Grade separation of train line*** – The train line extends along the eastern side of the creek. It is set into the ground to the south of Raes Road and at-grade to the north. As such, Option A has the ability to go over the train line where it is already set into the ground, or travel to a point that is at-grade and pass under the train line. Option B is perpendicular to the train line and under heavy cut on approach to it, so it is not considered feasible to go under the train line, only over it. Option A provides the highest level of flexibility in crossing the train line, including potential to cross it where it is already set into the ground. As such, Option A is considered to perform better than Option B in this regard.

- ***Volume of earthworks (cut / fill)*** - Option B has about 40% less total cut/fill. However, the cut volume for Option B is 40% higher that Option A. As such, both options have the same level of performance in this regard.
- ***Bridge length*** - Option B has about 35% shorter bridge length. However, 30m of Option A's bridge is made up of culverts. On this basis, Option B does perform better than Option A but not significantly.

The comparative performance of the connector road alignment options for the Engineering Feasibility criterion is summarised in Table 7.1.

Table 7.1: Engineering Feasibility – Connector Level Road Summary

A	B
Constructability	
Neutral / Same Performance	Neutral / Same Performance
Impact on Services	
Neutral / Same Performance	Neutral / Same Performance
Grade Separation of Train Line	
Higher Performance	Lower Performance
Earthworks	
Neutral / Same Performance	Neutral / Same Performance
Bridge Length	
Lower Performance	Higher Performance

Table 7.1 indicates that from an Engineering Feasibility perspective the two alignments perform at the same level. The areas they differ in regard to their relative flexibility to cross the train line and their bridge lengths across Jacksons Creek. Given that both alignments can still cross the train line and the difference in the bridge length relates to a section of culverts, both options are considered to perform the same from an Engineering Feasibility perspective.

Arterial Level Road

- ***Constructability*** – The creek corridor and the adjacent areas of significant grade (especially on the eastern side) are expected to have similar levels of difficulty to construct the two road crossings. As such, both options have the same level of performance in this regard.
- ***Impacts on services*** – No existing services within the creek area have been identified. In the future, there is expected to be drainage needs to be accommodated. This should be able to be accommodated with either option (length will have a cost function), so both options have the same level of performance in this regard.
- ***Grade separation of train line*** – The train line extends along the eastern side of the creek. It is set into the ground to the south of Raes Road and at-grade to the north. As such, Option A has the ability to go over the train line where it is already set into the ground, or travel to a point that is at-grade and pass under the train line. Option B is perpendicular to the train line and under heavy cut on approach to it, so it is not considered feasible to go under the train line, only over it. Option A provides the highest level of flexibility in crossing the train line, including potential to cross it where it is already set into the ground. As such, Option A is considered to perform better than Option B in this regard.

- ***Volume of earthworks (cut / fill)*** - Option B has about 35% less total cut/fill. However, the cut volume for Option B is 40% higher that Option A. As such, both options have the same level of performance in this regard.
- ***Bridge length*** - Option B has about 35% shorter bridge length. However, 30m of Option A's bridge is made up of culverts. On this basis, Option B does perform better than Option A but not significantly.

The comparative performance of the arterial road alignment options for the Engineering Feasibility criterion is summarised in Table 7.2.

Table 7.2: Engineering Feasibility – Arterial Level Road Summary

A	B
Constructability	
Neutral / Same Performance	Neutral / Same Performance
Impact on Services	
Neutral / Same Performance	Neutral / Same Performance
Grade Separation of Train Line	
Higher Performance	Lower Performance
Earthworks	
Neutral / Same Performance	Neutral / Same Performance
Bridge Length	
Lower Performance	Higher Performance

Table 7.2 indicates that from an Engineering Feasibility perspective the two alignments perform at the same level. The areas they differ are in regard to their relative flexibility to cross the train line and their bridge lengths across Jacksons Creek. Given that both alignments can still cross the train line and the difference in the bridge length relates to a section of culverts, both options are considered to perform the same from an Engineering Feasibility perspective.

7.2.2 Cultural Heritage

It has been indicated in Section 0 that Cultural Heritage considerations with the proposed alignment options will be considered separately, and be guided by further engagement with the Wurundjeri (to be undertaken by MPA in parallel). However, an initial assessment of the alignment options against the known cultural heritage values in the study area has been undertaken and presented below.

In this regard, the Cultural Heritage criterion relates to the comparative extent to which the options minimise impact on the identified areas of cultural heritage value in the study area, as well as the likely approval and remediation requirements.

The assessment of cultural heritage criteria has been undertaken by Ecology and Heritage Partners and is documented in their report provided at Appendix E.

A summary of the analysis and results for each of the road types is provided as follows:

Connector Level Road

- ***Sunbury Earth Rings*** – The Sunbury Rings are considered to have the highest cultural heritage value in the area, and are located to the south of the study area. Given that Option B is proximate to the Sunbury Rings, it is considered to perform worse than Option A in this regard.

- ***River corridor*** – the impact of each alignment option is similar in nature and extent. As such, they are both considered to perform the same.
- ***Aboriginal cultural places*** – At this time there is a large Aboriginal Place (VAHR 7822-0697) that Option B would run through. However, this is a diffuse scatter and is likely to extent throughout the low flood plain areas along the creek corridor. As such, there is not expected to be any difference in the relative performance of the two alignments in this regard.
- ***Heritage overlay / register items / inventory*** –Option B runs through a Heritage Overlay (HO366) and a Heritage Inventory (H7822-2291), whilst Option A does not impact any heritage sites. As such, Option A performers better than Option B in this regard.
- ***Scarred trees*** – there are no scarred trees directly impacted by the two alignment options.
- ***Artefacts / objects*** – as indicated with the Aboriginal Place (VAHR 7822-0697) that Option B would run through, this is likely to extend throughout the low flood plain areas along the creek corridor that both alignments extent. As such, they are both considered to both perform the same.
- ***Time and cost in gaining required approvals*** – On the basis that the Aboriginal Place (VAHR 7822-0697) extends throughout the low flood plain areas along the creek corridor, the two options are expected to have similar requirements in terms of gaining required cultural heritage approvals.
- ***Flexibility for the alignments*** – With the majority of the likely unknown Aboriginal values expected to be located within the low flood plain areas along the creek corridor and the alignments are generally flexible where they specifically need to be, they are both considered to perform the same in this regard. If, however, there are significant cultural heritage values found on the steep graded areas on the eastern side of the creek, there is only limited ability to modify the alignment of Option B.
- ***Minimising excavation due to hand filtering requirements*** – The majority of the likely unknown Aboriginal values are expected to be located within the low flood plain areas along the creek corridor and the alignments having similar excavation levels through this area, they are both considered to perform the same in this regard.

Given the above, the comparative performance of the connector road alignment options for the Cultural Heritage criterion is summarised in Table 7.3.

Table 7.3: Cultural Heritage – Connector Level Road Summary

A	B
Sunbury Earth Rings	
Significant Lower Performance	Significant Higher Performance
River Corridor	
Neutral / Same Performance	Neutral / Same Performance
Aboriginal cultural places	
Neutral / Same Performance	Neutral / Same Performance
Heritage Overlay / Register Items / Inventory	
Higher Performance	Lower Performance

Scarred Trees	
Neutral / Same Performance	Neutral / Same Performance
Artefacts / Objects	
Neutral / Same Performance	Neutral / Same Performance
Time and Cost for Approvals	
Neutral / Same Performance	Neutral / Same Performance
Alignment Flexibility	
Neutral / Same Performance	Neutral / Same Performance
Minimising Excavation	
Neutral / Same Performance	Neutral / Same Performance

Table 7.3 indicates that from a Cultural Heritage perspective the two alignments generally perform the same, except in regards of Option B being proximate to the Sunbury Rings and Option A extending through two heritage listed sites. Given that the Sunbury Rings are of very high Aboriginal value, Option B is considered to perform better than Option A in this regard.

Arterial Level Road

- ***Sunbury Earth Rings*** – The Sunbury Rings are considered to have the highest cultural heritage value in the area, and are located to the south of the study area. Given that Option B is proximate to the Sunbury Rings, it is considered to perform worse than Option A in this regard.
- ***River corridor*** – the impact of each alignment option is similar in nature and extent. As such, they are both considered to perform the same.
- ***Aboriginal cultural places*** – At this time there is a large Aboriginal Place (VAHR 7822-0697) that Option B would run through. However, this is a diffuse scatter and is likely to extent throughout the low flood plain areas along the creek corridor. As such, there is not expected to be any difference in the relative performance of the two alignments in this regard.
- ***Heritage overlay / register items / inventory*** –Option B runs through a Heritage Overlay (HO366) and a Heritage Inventory (H7822-2291), whilst Option A does not impact any heritage sites. As such, Option A performers better than Option B in this regard.
- ***Scarred trees*** – there are no scarred trees directly impacted by the two alignment options.
- ***Artefacts / objects*** – as indicated with the Aboriginal Place (VAHR 7822-0697) that Option B would run through, this is likely to extend throughout the low flood plain areas along the creek corridor that both alignments extent. As such, they are both considered to both perform the same.
- ***Time and cost in gaining required approvals*** – On the basis that the Aboriginal Place (VAHR 7822-0697) extends throughout the low flood plain areas along the creek corridor, the two options are expected to have similar requirements in terms of gaining required cultural heritage approvals.
- ***Flexibility for the alignments*** – With the majority of the likely unknown Aboriginal values expected to be located within the low flood plain areas along the creek corridor and the alignments are generally flexible where they specifically need to be, they are both considered to perform the same in this regard. If, however, there are significant cultural heritage values found on the steep graded areas on the eastern side of the creek, there is only limited ability to modify the alignment of Option B.

- ***Minimising excavation due to hand filtering requirements*** – The majority of the likely unknown Aboriginal values are expected to be located within the low flood plain areas along the creek corridor and the alignments having similar excavation levels through this area, they are both considered to perform the same in this regard.

Given the above, the comparative performance of the arterial road alignment options for the Cultural Heritage criterion is summarised in Table 7.4.

Table 7.4: Cultural Heritage – Arterial Level Road Summary

A	B
Sunbury Earth Rings	
Significant Lower Performance	Significant Higher Performance
River Corridor	
Neutral / Same Performance	Neutral / Same Performance
Aboriginal cultural places	
Neutral / Same Performance	Neutral / Same Performance
Heritage Overlay / Register Items / Inventory	
Higher Performance	Lower Performance
Scarred Trees	
Neutral / Same Performance	Neutral / Same Performance
Artefacts / Objects	
Neutral / Same Performance	Neutral / Same Performance
Time and Cost for Approvals	
Neutral / Same Performance	Neutral / Same Performance
Alignment Flexibility	
Neutral / Same Performance	Neutral / Same Performance
Minimising Excavation	
Neutral / Same Performance	Neutral / Same Performance

Table 7.4 indicates that from a Cultural Heritage perspective the two alignments generally perform the same, except in regards of Option B being proximate to the Sunbury Rings and Option A extending through two heritage listed sites. Given that the Sunbury Rings are of very high Aboriginal value, Option B is considered to perform better than Option A in this regard.

7.2.3 Ecology

The Ecology criterion relates to the comparative extent to which the options minimise impact on the identified areas of ecological value in the study area.

The assessment of ecology based criteria has been undertaken by Ecology and Heritage Partners and is documented in their report provided at Appendix F.

A summary of the analysis and results for each of the road types is provided as follows:

Connector Level Road

- ***Significant areas for the Growling Grass Frog*** - based on the footprint extents of the alignment options that will impact areas identified to support proposed metapolulations and wetland construction activities, Option A impacts significantly more area than Option B (1.13Ha compared with 0.29Ha respectively).

- ***Field Mapped Remnant Patches*** - based on the footprint extents of the alignment options that will impact existing areas with native vegetation patches, Option B impacts significantly more area than Option A (0.17Ha compared with 0.05Ha respectively).
- ***Conservation Areas 20 and 21*** – based on the footprint extents of the alignment options that pass through these two conservation areas, Option A impacts significantly more area than Option B (3.76Ha compared with 1.30Ha respectively).
- ***Time-stamped native vegetation*** - based on the footprint extents of the alignment options that will impact existing areas of time-stamped native vegetation, Option B impacts significantly more area than Option A (1.12Ha compared with 0.10Ha respectively).
- ***Bio sites*** - based on the footprint extents of the alignment options that will impact existing areas with biological assets, Option A impacts significantly more area than Option B (2.40Ha compared with 0.10Ha respectively).
- ***Scattered trees*** – within the footprint extents of the alignment options the number of trees impacted is only one. The tree is associated with Option B, so it performs lower than Option A.
- ***Indicative offset costs*** – based on the footprint extents of the alignment options and what BCS biodiversity obligations they trigger, Option A would cost $85k, which is significantly better than Option B at $179k.
- ***Fragmentation*** – In terms of the key ecological areas and impacts on the movement of animals (both protected and unprotected species), this is considered to have been considered as part of the other aspects of the Ecology criteria, namely the impacts on Conservation Areas 20 and 21.

Given the above, the comparative performance of the connector road alignment options for the Ecology criterion is summarised in Table 7.5.

Table 7.5: Ecology – Connector Level Road Summary

A	B
Significant Areas for the GGF	
Significant Lower Performance	Significant Higher Performance
Field Mapped Remnant Patches	
Significant Higher Performance	Significant Lower Performance
Conservation *Areas 20 and 21*	
Significant Lower Performance	Significant Higher Performance
Time-stamped Native Vegetation	
Significant Higher Performance	Significant Lower Performance
Bio Sites	
Significant Lower Performance	Significant Higher Performance
Scattered Trees	
Higher Performance	Lower Performance
Field Mapped Remnant Patches	
Significant Higher Performance	Significant Lower Performance
Indicative Offset Costs	
Higher Performance	Lower Performance

Table 7.5 indicates that each option performs significantly better than the other for a similar number of the above considerations. However, given that Option A performs better in terms of the indicative costs for the off-set requirements it triggers under the BCS biodiversity obligations, it is considered to be the better performer from an ecology perspective.

Arterial Level Road

- ***Significant areas for the Growling Grass Frog*** - based on the footprint extents of the alignment options that will impact areas identified to support proposed metapolulations and wetland construction activities, Option A impacts significantly more area than Option B (1.42Ha compared with 0.32Ha respectively).
- ***Field Mapped Remnant Patches*** - based on the footprint extents of the alignment options that will impact existing areas with native vegetation patches, Option B impacts significantly more area than Option A (0.22Ha compared with 0.06Ha respectively).
- ***Conservation Areas 20 and 21*** – based on the footprint extents of the alignment options that pass through these two conservation areas, Option A impacts significantly more area than Option B (4.44Ha compared with 1.55Ha respectively).
- ***Time-stamped native vegetation*** - based on the footprint extents of the alignment options that will impact existing areas of time-stamped native vegetation, Option B impacts significantly more area than Option A (1.28Ha compared with 0.05Ha respectively).
- ***Bio sites*** - based on the footprint extents of the alignment options that will impact existing areas with biological assets, Option A impacts significantly more area than Option B (2.59Ha compared with 0.14Ha respectively).
- ***Scattered trees*** – within the footprint extents of the alignment options the number of trees impacted is only two. Both trees are associated with Option B, so it performs lower than Option A.
- ***Indicative offset costs*** – based on the footprint extents of the alignment options and what BCS biodiversity obligations they trigger, Option A would cost $96k, which is significantly better than Option B at $194k.
- ***Fragmentation*** – In terms of the key ecological areas and impacts on the movement of animals (both protected and unprotected species), this is considered to have been considered as part of the other aspects of the Ecology criteria, namely the impacts on Conservation Areas 20 and 21.

Given the above, the comparative performance of the arterial road alignment options for the Ecology criterion is summarised in Table 7.6.

Table 7.6: Ecology – Arterial Level Road Summary

A	B
Significant Areas for the GGF	
Significant Lower Performance	Significant Higher Performance
Field Mapped Remnant Patches	
Significant Higher Performance	Significant Lower Performance

Conservation *Areas 20 and 21*	
Significant Lower Performance	Significant Higher Performance
Time-stamped Native Vegetation	
Significant Higher Performance	Significant Lower Performance
Bio Sites	
Significant Lower Performance	Significant Higher Performance
Scattered Trees	
Higher Performance	Lower Performance
Field Mapped Remnant Patches	
Significant Higher Performance	Significant Lower Performance
Indicative Offset Costs	
Higher Performance	Lower Performance

Table 7.6 indicates that each option performs significantly better than the other for a similar number of the above considerations. However, given that Option A performs better in terms of the indicative costs for the off-set requirements it triggers under the BCS biodiversity obligations, it is considered to be the better performer from an ecology perspective.

7.2.4 Amenity

The Amenity criterion relates to the comparative extent which the options impact the amenity of existing and potential community members in the area. It is expected that this criterion will consider the following factors:

A summary of the analysis and results for each of the road types is provided as follows:

Connector Level Road

- **Visual amenity** - Option B is shorter than Option A and also comprises a narrower and shorter section of cut and fill extent east of the creek. However, Option B is located within a unique and naturally formed gully. As such, the two options are considered to have similar levels of visual amenity impacts.
- **Access** – Given that the grades are similar but the length of Option B is shorter, it is considered to give pedestrians and cyclists better access Jacksons Creek.

Given the above, the comparative performance of the connector road alignment options for the Amenity criterion is summarised in Table 7.7.

Table 7.7: Amenity – Connector Level Road Summary

A	B
Visual Amenity	
Neutral / Minimal Impact	Neutral / Minimal Impact
Access	
Lower Performance	Higher Performance

Table 7.7 indicates that visual amenity impacts for the two options are similar but access to Jacksons Creek for pedestrians and cyclists will be through Option B. As such, Option B is considered to perform better based on the amenity criterion.

Arterial Level Road

- **Visual amenity** - Option B is shorter than Option A and also comprises a narrower and shorter section of cut and fill extent east of the creek. However, Option B is located within a unique and naturally formed gully. As such, the two options are considered to have similar levels of visual amenity impacts.
- **Access** – Given that the grades are similar but the length of Option B is shorter, it is considered to give pedestrians and cyclists better access Jacksons Creek.

Given the above, the comparative performance of the arterial road alignment options for the Amenity criterion is summarised in Table 7.8.

Table 7.8: Amenity – Arterial Level Road Summary

1	2
Visual Amenity	
Neutral / Minimal Impact	Neutral / Minimal Impact
Access	
Lower Performance	Higher Performance

Table 7.8 indicates that visual amenity impacts for the two options are similar but access to Jacksons Creek for pedestrians and cyclists will be through Option B. As such, Option B is considered to perform better based on the amenity criterion.

7.2.5 Transport Network

The Transport Network criterion relates to the comparative performance of the proposed road crossing alignment options against key level of service parameters (and potentials) at a network level.

A summary of the analysis and results for each of the road types is provided as follows:

Connector Level Road

- **Travel time / distance -** The two alignment options have the same design characteristics and speed limits, so their length is the determining factor. On this basis, Option B is shorter than Option A, so performs better.
- **Connectivity to existing and proposed arterial network -** Both alignments have the same start and end points and are considered viable for completing an 'orbital route' following the extension of Elizabeth Drive through to Racecourse Road. As such, the two alignments are considered to perform the same in this regard.
- **Viability as a bypass route -** There is potential for the road crossings to be alternative routes for east-west trips across Sunbury, to going through the centre of town, which at times is congested. The attractiveness of the potential road crossings is considered to be on the basis of the associated travel time / distance and connectivity with the surrounding arterial road network. As this is assessed through the above two considerations, this is not considered further at this time.
- **Ability for future upgrade –** Should either of the two connector road alignments need to be upgraded at a future point in time to arterial level roads, there are no specific restrictions identified at this time, except that additional earthworks and bridge widths will be required. As such, the two alignments are considered to perform the same in this regard.

Given the above, the comparative performance of the connector road alignment options for the Transport Network criterion is summarised in Table 7.9.

Table 7.9: Transport Network – Connector Level Road Summary

A	B
Travel Time / Travel Length	
Significantly Lower Performance	Significantly Higher Performance
Connectivity to Existing and Proposed Arterial Network	
Neutral / Minimal Impact	Neutral / Minimal Impact
Ability for Future Upgrade	
Neutral / Minimal Impact	Neutral / Minimal Impact

Table 7.9 indicates that Option B is considered to perform better from a Network Transport perspective, as it is significantly shorter than Option A.

Arterial Level Road

- **Travel time / distance -** The two alignment options have the same design characteristics and speed limits, so their length is the determining factor. On this basis, Option B is shorter than Option A, so performs better.
- **Connectivity to existing and proposed arterial network -** Both alignments have the same start and end points and are considered viable for completing an 'orbital route' following the extension of Elizabeth Drive through to Racecourse Road. As such, the two alignments are considered to perform the same in this regard.
- **Viability as a bypass route -** There is potential for the road crossings to be alternative routes for east-west trips across Sunbury, to going through the centre of town, which at times is congested. The attractiveness of the potential road crossings is considered to be on the basis of the associated travel time / distance and connectivity with the surrounding arterial road network. As this is assessed through the above two considerations, this is not considered further at this time.

Given the above, the comparative performance of the arterial road alignment options for the Transport Network criterion is summarised in Table 7.10.

Table 7.10: Transport Network – Connector Level Road Summary

A	B
Travel Time / Travel Length	
Significantly Lower Performance	Significantly Higher Performance
Connectivity to Existing and Proposed Arterial Network	
Neutral / Minimal Impact	Neutral / Minimal Impact

Table 7.10 indicates that Option B is considered to perform better from a Network Transport perspective, as it is significantly shorter than Option A.

7.2.6 Development Considerations

The Development Considerations criterion relates to the comparative performance of the road crossing options in regard to supporting the level and type of development proposed within the Lancefield Road Growth Area (having regard for the relatively undeveloped nature of the structure planning for the area).

A summary of the analysis and results for each of the road types is provided as follows:

Connector Level Road

- ***Road network and intersection spacing*** – With the study area generally being undeveloped at this time, either alignment could be used and achieve suitable road network and intersection spacing. As such, the two alignments are considered to perform the same in this regard.
- ***Level of access -*** Option A will intersect the proximate area to where the proposed activity centre will be in a north-south direction. Option B will more at an east-west direction. However, there is ability to curve and connect with these roads to achieve the desired level of access with the proposed activity centre, which is currently proposed to be located between the train line and Lancefield Road.
- ***Support the social, economic and land use objectives*** - With the study area generally being undeveloped at this time, either alignment is considered to generally be able to achieve the relevant planning objectives for the area. However, one measureable consideration that can be made at this time is what impact on the developable areas will be caused by the alignment options. In this regard, Option A will be at-grade when entering the areas likely to be developed in the future, when Option B may still be coming out of a cut that requires adjacent developable land to provide suitable batters. As such, Option A is considered to perform better in this regard.

Given the above, the comparative performance of the connector road alignment options for the Development Considerations criterion is summarised in Table 7.11.

Table 7.11: Development Considerations – Connector Level Road Summary

A	B
Spacing of Road Network and Intersections	
Neutral / Minimal Impact	Neutral / Minimal Impact
Access to Activity Centres	
Neutral / Minimal Impact	Neutral / Minimal Impact
Ability to support social, economic and land use objectives	
Higher Performance	Lower Performance

Table 7.11 indicates that Option A is considered to perform better from a Development Considerations perspective, as it is expected to minimise the impact on the developable land in the area.

Arterial Level Road

- ***Road network and intersection spacing*** – With the study area generally being undeveloped at this time, either alignment could be used and achieve suitable road network and intersection spacing. As such, the two alignments are considered to perform the same in this regard.
- ***Level of access -*** Option A will intersect the proximate area to where the proposed activity centre will be in a north-south direction. Option B will more at an east-west direction. However, there is ability to curve and connect with these roads to achieve the desired level of access with the proposed activity centre, which is currently proposed to be located between the train line and Lancefield Road.
- ***Support the social, economic and land use objectives*** - With the study area generally being undeveloped at this time, either alignment is considered to generally be able to achieve the relevant planning objectives for the area. However, one measureable consideration that can be made at this time is what impact on the developable areas

will be caused by the alignment options. In this regard, Option A will be at-grade when entering the areas likely to be developed in the future, when Option B may still be coming out of a cut that requires adjacent developable land to provide suitable batters. As such, Option A is considered to perform better in this regard.

Given the above, the comparative performance of the arterial road alignment options for the Development Considerations criterion is summarised in Table 7.12.

Table 7.12: Development Considerations – Arterial Level Road Summary

A	B
Spacing of Road Network and Intersections	
Neutral / Minimal Impact	Neutral / Minimal Impact
Access to Activity Centres	
Neutral / Minimal Impact	Neutral / Minimal Impact
Ability to support social, economic and land use objectives	
Higher Performance	Lower Performance

Table 7.12 indicates that Option A is considered to perform better from a Development Considerations perspective, as it is expected to minimise the impact on the developable land in the area.

7.2.7 Costing

Broad level costing and the associated land acquisition extents for comparative purposes has been undertaken for the alignment options. These are being used to consider what value for money you get with each option (i.e. does the additional order of magnitude cost and/ or required land acquisition of one option over another proportionally account for difference in their performance).

As such, below is a summary of the known broad level costings and land acquisition areas for each option, which will be used in the summary discussion on which option is the most appropriate in Section 0.

For more detail on the earthworks and pavement construction costings refer to Appendix G, noting that costings for the Bridges are provided in Appendix D and Ecological off-sects are provided in Appendix F.

Connector Level Road

The broad level costings and land acquisition areas of the connector road alignment options are summarised in Table 7.15.

Table 7.13: Broad Level Costings – Connector Level Road

Option	Earthworks	Bridge	Ecological	Total	Land (m^2)
A	$36,368,750	$3,815,000	$84,855	$40,269,000	49,150
B	$21,344,000	$2,850,000	$178,776	$24,373,000	29,200

Table 7.15 indicates that Option B is expected to cost 40% less and require 40% less land than Option A over the creek crossing section.

Arterial Level Road

The broad level costings and land acquisition areas of the arterial road alignment options are summarised in Table 7.16.

Table 7.14: Broad Level Costings – Arterial Level Road

Option	Earthworks	Bridge	Ecological	Total	Land (m²)
A	$48,380,500	$8,000,000	$95,642	$56,476,000	51,950
B	$30,992,500	$6,400,000	$194,099	$37,587,000	33,850

Table 7.16 indicates that Option B is expected to cost 35% less and require 35% less land than Option A over the creek crossing section.

7.3 Summary of Options Assessment

Based on the above, a summary of the resulting relative performances for the two road types and two alignment options is presented below.

Connector Level Road

For the connector level road, a summary of the relative performance of the two options is provided in Table 7.15.

Table 7.15: Summary of Options Assessment – Connector Level Road

Criteria	Option	
	A	B
Engineering Feasibility	Neutral / Same Performance	Neutral / Same Performance
Cultural Heritage	Lower Performance	Higher Performance
Ecology	Higher Performance	Lower Performance
Amenity	Lower Performance	Higher Performance
Transport Network	Lower Performance	Higher Performance
Development Considerations	Higher Performance	Lower Performance

Table 7.15 indicates that overall the two connector road alignment options generally have a similar level of performance with the higher priority criterion of Engineering feasibility, Cultural Heritage and Ecology. However, over the lower priority criterion, Option B performs better than Option A.

Arterial Level Road

For the arterial level road, a summary of the relative performance of the two options is provided in Table 7.16.

Table 7.16: Summary of Options Assessment – Arterial Level Road

Criteria	Option	
	A	B
Engineering Feasibility	Neutral / Same Performance	Neutral / Same Performance
Cultural Heritage	Lower Performance	Higher Performance
Ecology	Higher Performance	Lower Performance
Amenity	Lower Performance	Higher Performance
Transport Network	Lower Performance	Higher Performance
Development Considerations	Higher Performance	Lower Performance

Table 7.16 indicates that overall the two connector road alignment options generally have a similar level of performance with the higher priority criterion of Engineering feasibility, Cultural Heritage and Ecology. However, over the lower priority criterion, Option B performs better than Option A.

7.4 Discussion of Findings (Value for Money)

The relative performance of the two alignment options indicates that Option B performs better. Option B is also estimated to have some 40% lower costs and land requirements for the connector level road, and some 35% lower costs and land requirements for the arterial level road, than Option A. As such, Option B is the most appropriate road crossing alignment option within the Lancefield Road growth area.

8. Preferred Alignment - TBC

To be completed following confirmation and feedback on the assessment of the alignment options.

Appendix A

Baseline Report

Jacksons Creek Road Crossings
PSP 1074 & 1075 Growth Areas
North & South Sunbury
Baseline Report

transportation planning, design and delivery

14M1881000 13/10/14

GTAconsultants

Jacksons Creek Road Crossings

PSP 1074 & 1075 Growth Areas, North & South Sunbury

Baseline Report

Issue: A 13/10/14

Client: Metropolitan Planning Authority
Reference: 14M1881000
GTA Consultants Office: VIC

Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By	Signed
A-Dr	01/07/14	Draft	Rory Rathborne	Alex Blackett / Tom Courtice	Reece Humphreys	Reece Humphreys
A	13/10/14	Final	Alex Blackett	Reece Humphreys	Reece Humphreys	

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1. Introduction

1.1 Background

The Lancefield Road and Sunbury South Precinct Structure Plans (PSP 1075 & 1074) cover two growth areas anticipated in the Sunbury-Diggers Rest Growth Corridor, located to the northeast and southeast of the Sunbury Township respectively.

These two growth areas are almost completely undeveloped, and have limited to no transport network, with the exception of the Sunbury train line that extends north-south through the two growth area precincts.

Various previous studies have identified the opportunity to facilitate the development of these two growth areas, as well as providing a more robust transport network for Sunbury by integrating it with the growth areas, providing additional opportunities to cross Jacksons Creek and relieve pressure from Sunbury Road, which goes through the Sunbury Township.

However, providing additional road crossings over Jacksons Creek represents a significant challenge, as the topography of the creek is vertical in places, as well as the general area along the creek having a high ecological and cultural heritage value. As such, the process by which the most appropriate road alignments are identified needs to be robust, transparent, and consider a wide range of inputs.

On this basis, GTA Consultants (GTA) in partnership with Ecology & Heritage Partners and with specialist input from Pitt & Sherry's bridge engineering team, have been commissioned by the Metropolitan Planning Authority (MPA) to develop a number of feasible road crossing options and assess them to identify the most appropriate alignment through the two growth areas.

1.2 Purpose

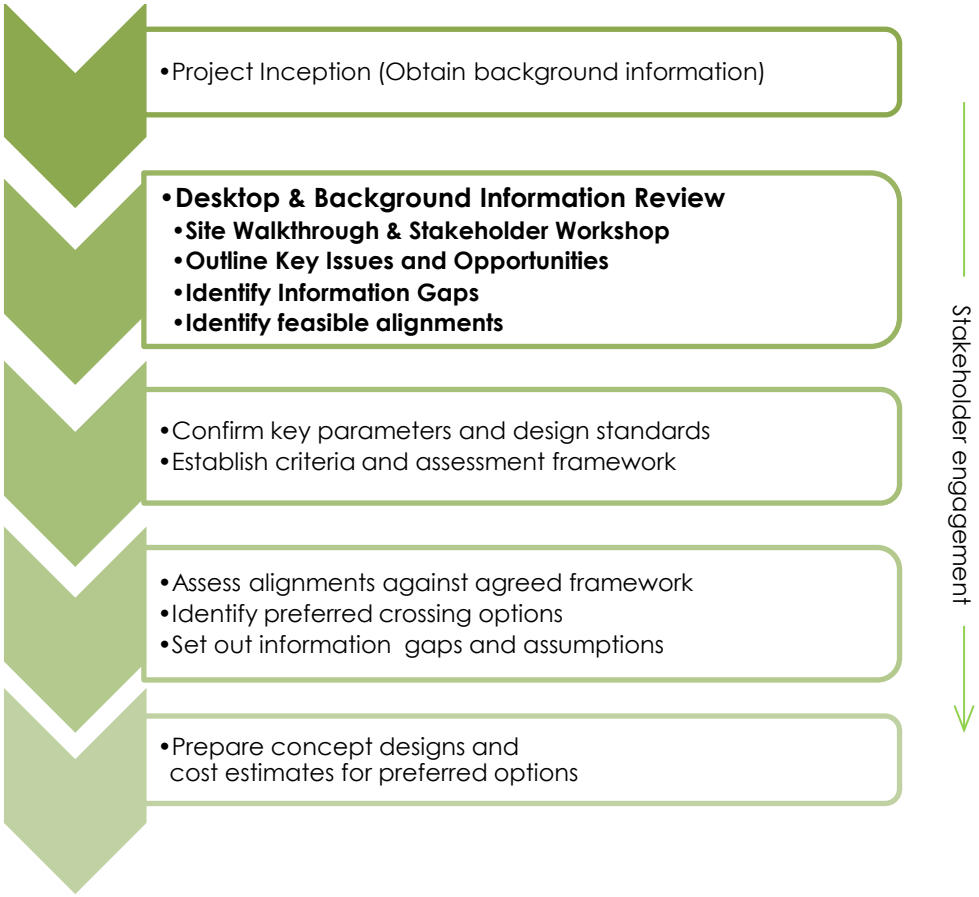
This report outlines the base line conditions within the two growth areas and identifies the key issues and opportunities that exist in identifying the most appropriate road crossing alignments. More specifically, the Baseline Report:

- reviews and summarises the previous available literature and work undertaken to date in relation to potential alignment options
- reviews and summarises the current and future land uses within and surrounding the growth areas
- outlines the current and proposed transport network in the area and the main access points to the two growth areas
- summarises the existing infrastructure, ecology, cultural heritage, drainage and flood levels, topography, land ownership, and other considerations impacting the selection of potential alignment options
- identifies the likely design characterises of the road crossings
- summarises the consultation activities and outcomes completed to date
- maps the existing issues, constraints and opportunities to identify where alignments could be feasibly located
- identifies information gaps, the process to obtain the required information and/or the risk associated with not having the information
- confirms the road crossing alignment options to be assessed further.

1.3 Scope & Methodology

The scope and methodology for the overall project is shown graphically in Figure 1.1, with the scope of the Baseline Report shown in **bold**.

Figure 1.1: Project Methodology



2. Strategic Planning Context

2.1 Growth Corridor and Land Use Plans

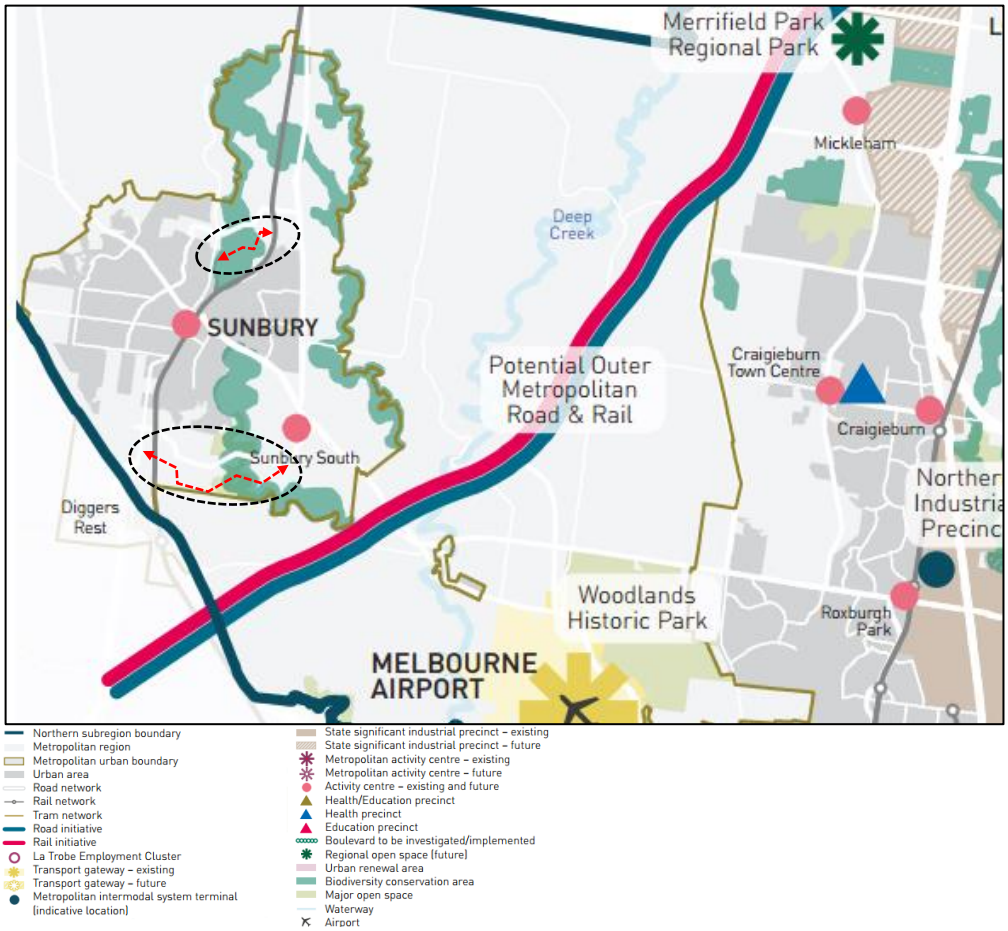
2.1.1 Plan Melbourne

The Victorian Government released the Metropolitan Planning Strategy, Plan Melbourne (The Plan) on 20 May 2014. The Plan is intended to guide Melbourne's housing, commercial and industrial development through to 2050.

The Plan identifies Sunbury as an Activity Centre in the Northern Subregion of Melbourne. Overall, the Northern Subregion is anticipated to have a dwelling requirement for an additional 95,000 to 115,000 dwellings in its growth areas, compared to 40,000 to 60,000 in established areas (Plan Melbourne p. 179). Notably, the Sunbury and Diggers Rest Growth Corridors (discussed in Section 2.1.2) are expected to accommodate a significant component of this growth, with an additional 71,000 dwellings.

The delivery of the Plan is now a central focus for the new Metropolitan Planning Authority (MPA), which was created in October 2013 alongside the release of the draft Plan Melbourne. An excerpt of the Northern Subregion implementation plan is shown below in Figure 2.1, and indicates road crossings over Jacksons Creek (highlighted through the dashed red lines).

Figure 2.1: Plan Melbourne - Northern Subregion Implementation Map (emphasis added)

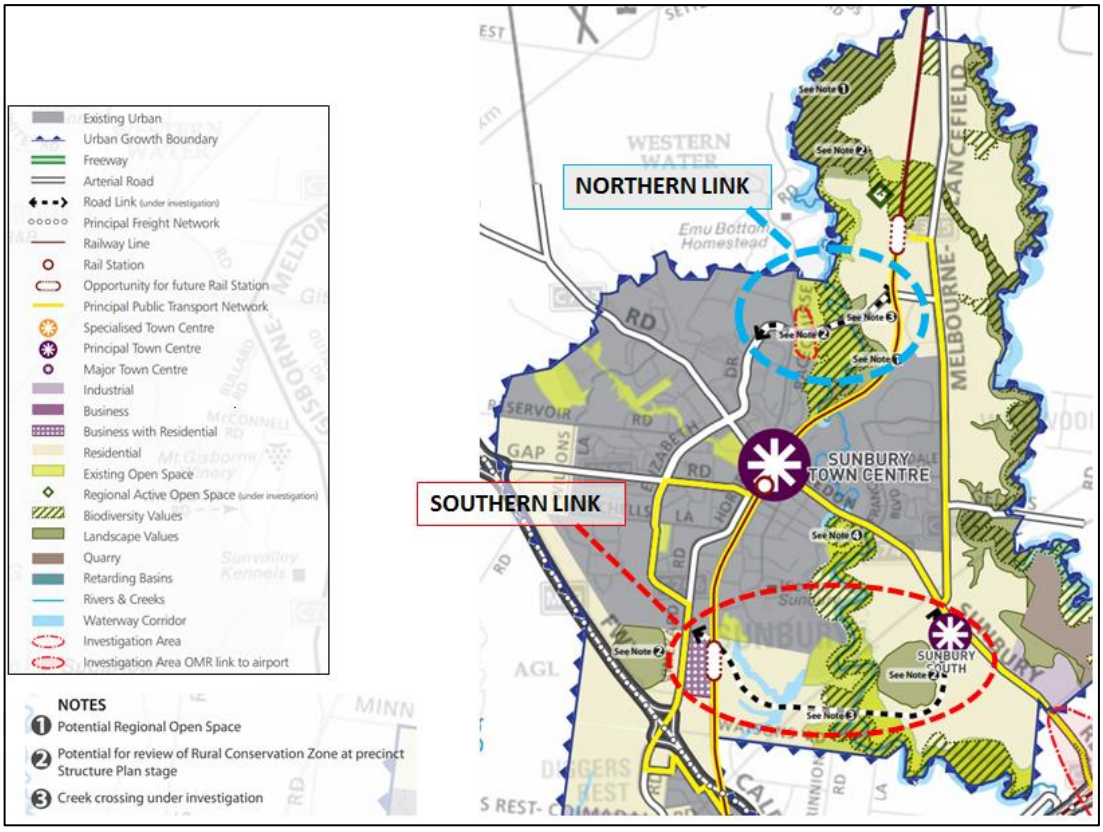


Source: Plan Melbourne

2.1.2 Sunbury & Diggers Rest Growth Corridor Plan

The Sunbury Growth Corridor Plan sets out the high level plan for the development of the growth areas. It aims to guide the delivery of housing, employment, and transport infrastructure for the next 30-40 years, and anticipates the area to accommodate a population of some 71,000 residents and 10,000 jobs. The plan is shown below in Figure 2.2.

Figure 2.2: Sunbury Growth Corridor Plan



Source: Metropolitan Planning Authority

The Plan annotates the proposed Northern and Southern road crossings of Jacksons Creek for further investigation. In addition, it is noted that:

- there are opportunities for the road crossings to connect with the proposed rail stations to the north and south of Sunbury
- an activity centre is expected to emerge in Sunbury South
- the Northern and Southern road crossings have potential to become part of the broader cycling network (Integrated Open Space Concept Plan, p. 102).

2.1.3 Sunbury Higap Spatial Strategy (Hume City Council, 2012)

The Higap Spatial Strategy was adopted by Hume City Council in July 2012. It is the culmination of a comprehensive review of planning for Sunbury by Council. It is Council's plan for the township, and aims to accommodate population growth, provide more employment and make it a liveable and affordable place to live, while retaining it as a self-contained and separate township from Melbourne.

Key outcomes in the strategy include a vision for Sunbury as a physically separate township with good transport links to Melbourne, and public transport, cycling and walking links between the town centre, new neighbourhood centres and adjoining residential and employment areas.

The Strategy contains the Jacksons Creek road crossings to create a proposed 'orbital loop' made via the extension of Elizabeth Drive eastwards to Lancefield Road (the Northern Link), and the connection of Vineyard Road to Sunbury Road/Macedon Street (the Southern Link).

The current and envisaged form of Sunbury, including transport connections is shown below in Figure 2.3 and Figure 2.4.

Figure 2.3: Current Sunbury

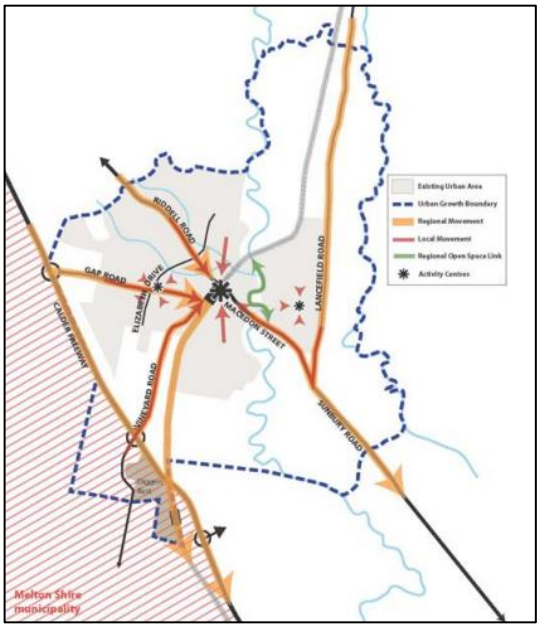
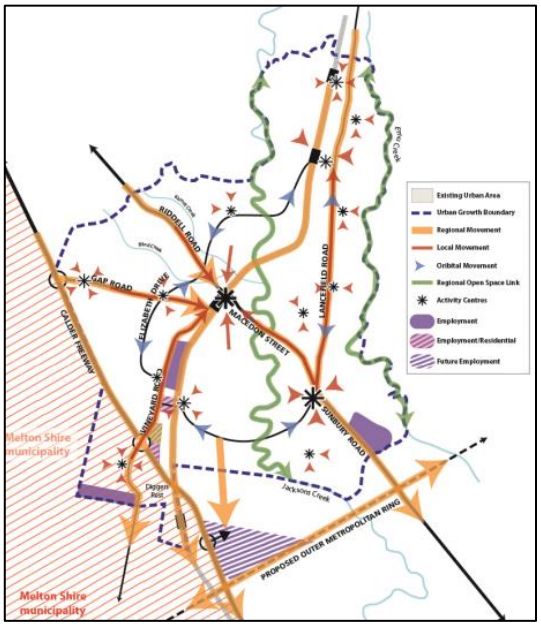


Figure 2.4: Future Sunbury



Other items of relevance include proposed satellite Activity Centres and a Regional Park with associated walking and cycling features along Jacksons Creek.

The Spatial Strategy notes that further work is to be undertaken to determine the most appropriate crossing locations of Jacksons Creek.

2.1.4 Sunbury Higap Delivery & Infrastructure Strategy (Hume City Council, 2012)

The Sunbury Higap Delivery & Infrastructure Strategy is essentially the strategy for implementation and delivery of the vision set out in the Sunbury Higap Spatial Strategy.

In regards to the Northern and Southern road crossings of Jacksons Creek, the Strategy notes the following:

- The Northern road crossing is prioritised as 'Required Infrastructure', with a timeframe of 15+ years. It is noted as an important connection to provide improved access to the Sunbury town centre and Calder Freeway for future communities in the northeast parts of Sunbury.
- The Southern road crossing is prioritised as 'Fundamental Infrastructure', with a required timeframe of 0-5 years. This link is noted as important to provide an orbital road and public transport connection, functioning as a bypass of the Sunbury town centre. It notes that the Southern road crossing will be particularly important in the short to

medium term to open up access to the southern part of Sunbury and to connect new communities on the eastern side of Sunbury to the Calder Freeway whilst the Bulla Bypass and upgrades to Sunbury Road are being constructed.

2.2 Previous Crossing Studies

2.2.1 Jacksons Creek Crossings (GHD, 2011)

The Jacksons Creek Crossings report was prepared by GHD for the Growth Areas Authority (GAA) as a high-level investigation of crossing opportunities of Jacksons Creek, north and south of the Sunbury Township. The scope of this report was to identify potential locations for crossings and whether they were technically feasible, generally based on the topography of the area.

Key Outcomes

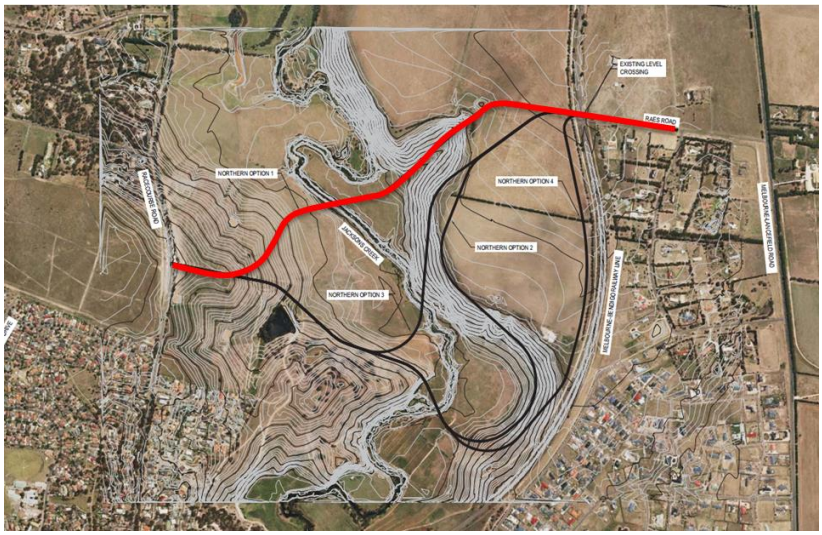
The report identified four potential northern crossing alignments and four potential southern crossing alignments. All eight crossing options were presented to GAA and its stakeholders for discussion. The following outcomes in terms of their feasibility were made:

Northern Crossing

Option 1 for the northern crossings was presented as the preferred, with other options being less feasible due to their additional bridge lengths and earthworks required.

The four options for the northern crossing is shown below, with Option 1 highlighted in red.

Figure 2.5: Northern Crossing Options (GHD report, 2011)

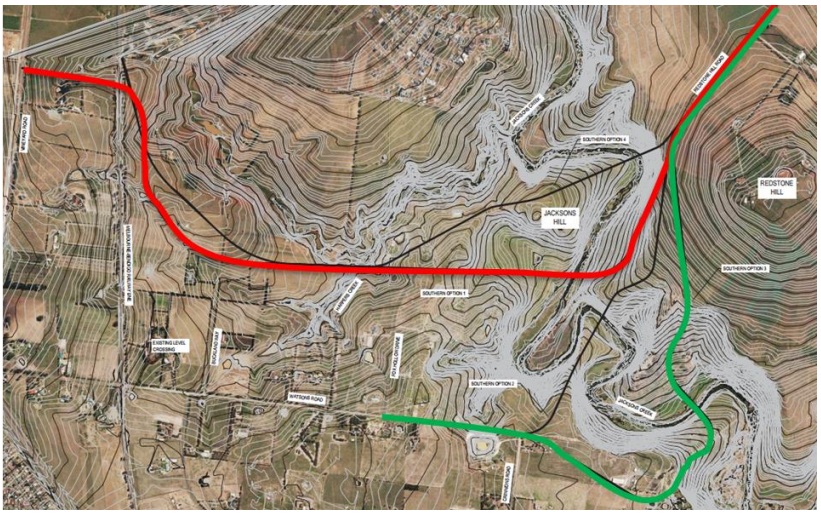


Southern Crossing

Options 1 and 3 for the southern crossings were presented as the preferred options, with land use outcomes expected to determine if a link is required through the central part of the growth area (Option 3) or along Watsons Road (Option 1).

The four options for the southern crossing are shown below, with Options 1 and 3 highlighted in red and green respectively.

Figure 2.6: Southern Crossing Options (GHD report, 2011)



Report Limitations

The key limitation of this report is that it was only a high-level analysis, based primarily on the engineering feasibility of constructing road crossings over Jacksons Creek (i.e. topographic constraints and road design requirements) to decide whether a more detailed investigation is warranted. There was limited consideration of the future land use and urban structure in the growth areas, as well as of ecology and cultural heritage impacts.

However, this report provides useful consideration of key topographic and constructability constraints in the area, and identifies a number of potential options for consideration as part of this project.

2.2.2 Precinct Structure Plan Assessment Reports

A number of studies have been commissioned by the MPA to inform the preparation of the Lancefield Road and Sunbury South PSP's. GTA has reviewed the available documentation where relevant, with a summary of key considerations provided in Table 2.1.

Table 2.1: Review of PSP Assessment Reports

Document	Key Themes
Arboricultural Assessment of Lancefield Road Precinct 1075 (draft) prepared by Treetec (November 2013). Arboricultural Assessment of Sunbury South Precinct 1074 (draft) prepared by Treetec (November 2013).	These reports identify and document those trees of high arboricultural retention value, and being justified as being worthy of and suitable for retention within an urban landscape. Consideration of the existing arboricultural values relevant to this study is discussed further in Section 3.3.
Land Capability Assessment for the Lancefield Road Precinct Structure Plan, prepared by Environmental Earth Sciences (draft, December 2013) Land Capability Assessment for the Sunbury South Precinct Structure Plan, prepared by Environmental Earth Sciences (draft, December 2013)	These reports primarily document land contamination issues that impact the ability for future habitation. However, they also provide a desktop review of potential geotechnical considerations by CivilTest Pty Ltd for works proximate to Jacksons Creek as an Appendix. These key considerations include the following: • Moderately to steeply undulating areas are likely to consist of exposed or shallow rock, resulting in difficult and more expensive excavation. • Works will be required to be constructed above the 'Land Subject to Inundation' overlay within the vicinity of Jacksons Creek, or accommodate creek flow through the works. • A comprehensive geotechnical investigation is recommended for the planning and design of any proposed bridge, road, or associated earthworks where creek crossings are concerned. • There is potential for sub-surface erosion on steep sites. These do not normally cause a problem during construction except where deep excavation of greater than 3.0m are cut and exposed. • A slope stability geotechnical investigation is recommended for development sites to assess potential failure modes (including potential for subsurface erosion).
Scattered Tree assessment, PSP 1075 Lancefield Road, prepared by Ecology and Heritage Partners (draft, April 2014) Scattered Tree assessment, PSP 1074 Sunbury South, prepared by Ecology and Heritage Partners (draft, April 2014)	Provides a scattered tree assessment for areas previously not assessed within the two PSP areas. These matters are considered further in Section 3.3 of this report.
PSP 1075 Lancefield Road, High Level Utility Servicing Assessment prepared by (draft, November 2013) PSP 1074 Sunbury South, High Level Utility Servicing Assessment prepared by (draft, October 2013)	Provides an assessment of the constraints and opportunities presented for the subject land in servicing new land development, including sewer, water, recycled water, gas mains supply, electricity and telecommunications. Amongst other things, the report maps both the existing and proposed servicing infrastructure within the PSP areas. For reference, these plans are included in Appendix E.

2.2.3 Villawood Properties

Villawood are a major land holder within both the Lancefield Road and Sunbury South PSP areas. GTA have reviewed the following documents they have provided:

- Racecourse Rd, Sunbury – submission to Melbourne @ 5 Million, July 2009
- Sunbury Rd/Lancefield Rd – submission to Melbourne @ 5 Million, February 2009
- Framework Plan Submission prepared by Mesh Planning, on behalf of various parties, November 2010
- 'Sunbury – Rebirth of a township' report prepared by Villawood Properties, July 2008
- concept plans for the proposed alignment of Jacksons Creek crossing – Sunbury South.

The potential urban growth and development opportunities are most clearly set out in the 'Sunbury – Rebirth of a Township' report, from which two excerpts are reproduced below in Figure 2.7 and Figure 2.8.

Figure 2.7: Potential Growth Opportunities

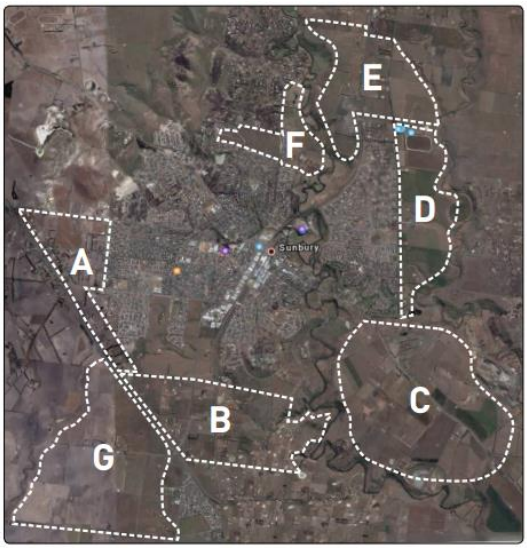
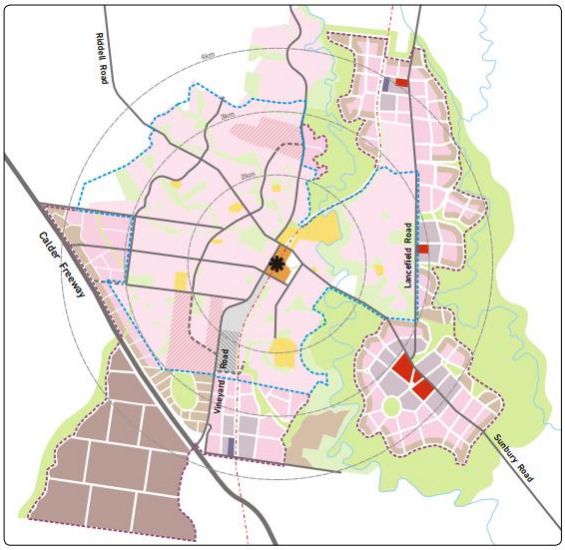


Figure 2.8: Existing and Proposed Land Use (2008)



Due to this historical nature of these documents and the changes to the Urban Growth Boundary since their preparation, the development intentions and potential urban form may differ from that shown in Figure 2.7 and Figure 2.8.

3. Existing & Future Conditions

3.1 Road Network

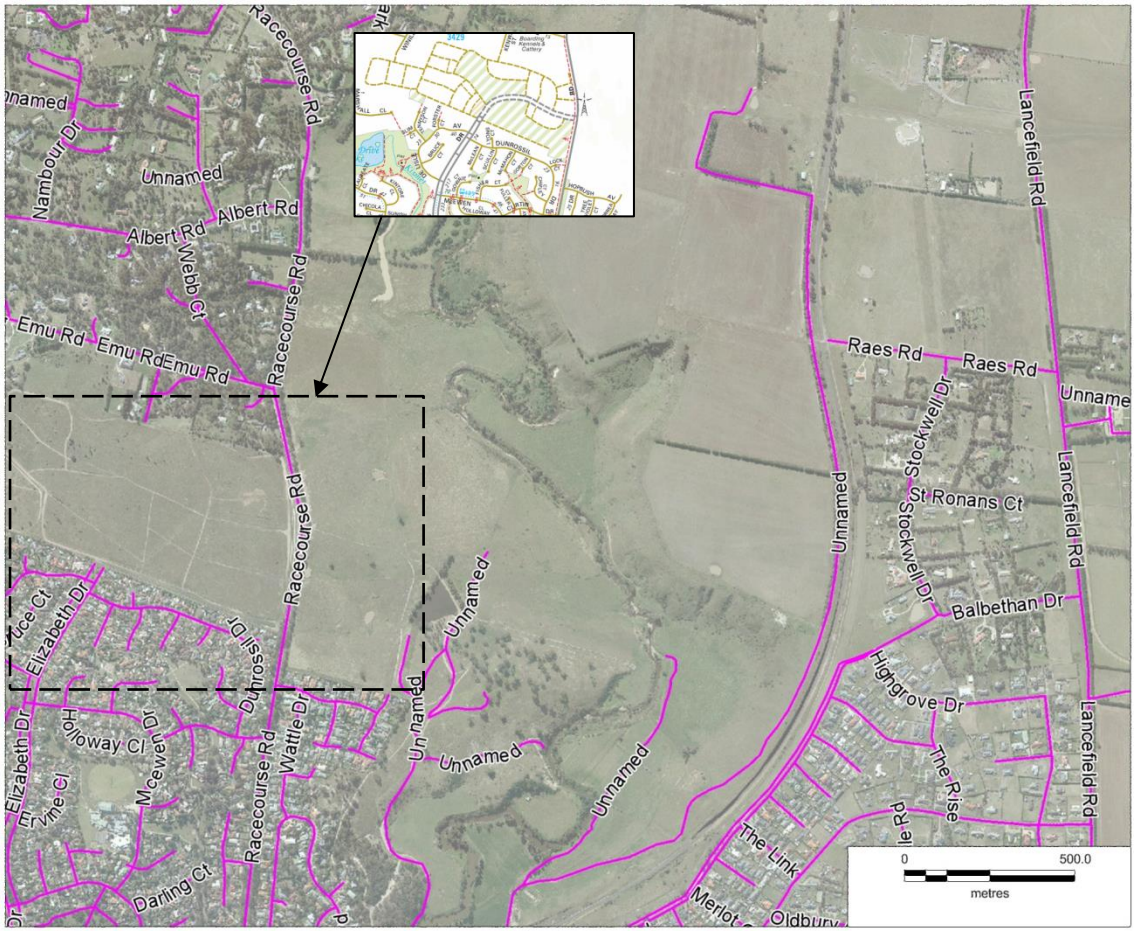
Northern Study Area

The road network in the northern study area is characterised by two key major north-south roads, these being Racecourse Road (two-lane collector road controlled by Council) and Lancefield Road (two-lane arterial road, controlled by VicRoads). Elizabeth Drive lies to the west of the study area and is proposed to be extended to the northeast as part of the northern road crossing of Jacksons Creek (with its potential alignment shown in the inset in Figure 3.1).

The existing road network between Racecourse Road and the Rail line is minimal; however some unsealed 'Unnamed' roads do exist at the southern end of the study area, and provide basic access to undeveloped land.

The existing road network in the northern study area is illustrated below in Figure 3.1, including an insert from Melways that indicates the proposed extension of Elizabeth Drive to Racecourse Road.

Figure 3.1: Existing Road Network –North Study Area



Southern Study Area

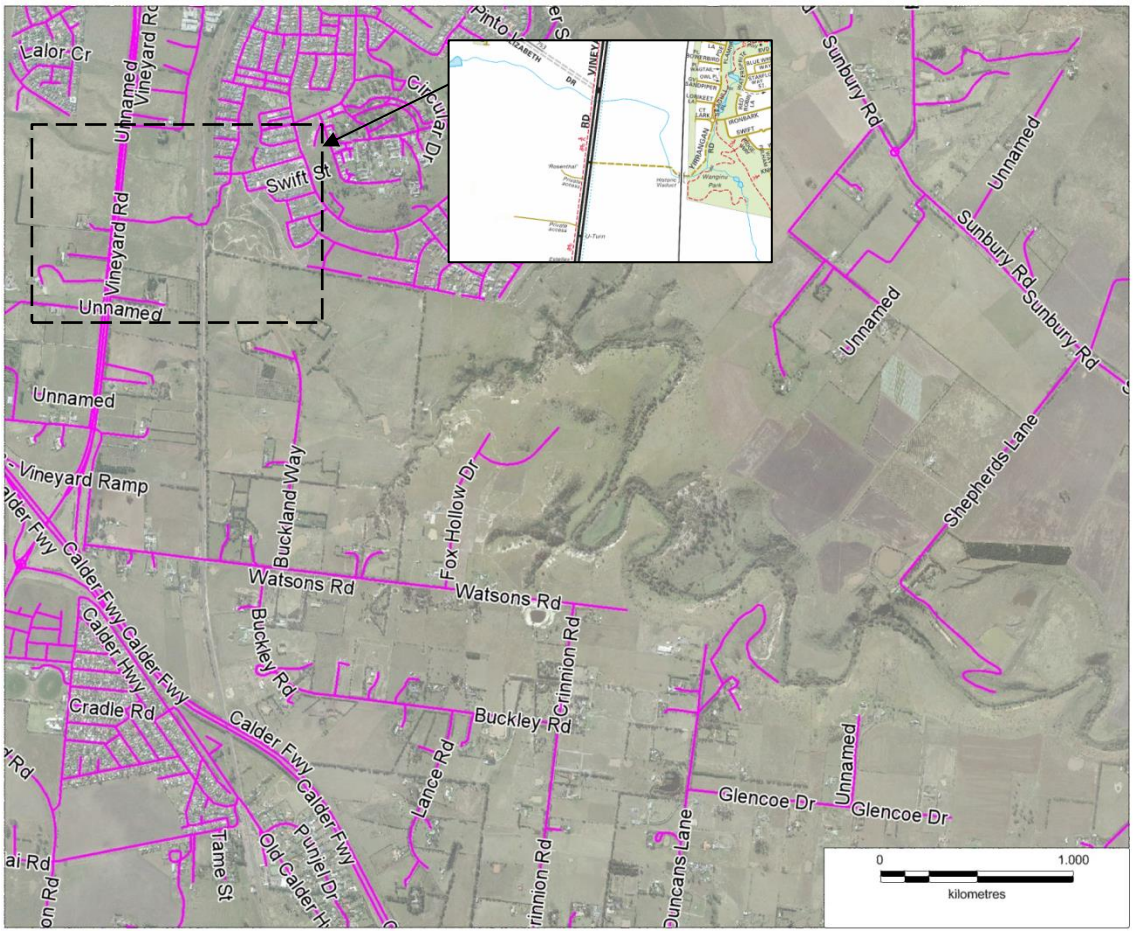
The road network in the southern study area is characterised by north-south connectivity through Vineyard Road (four-lane divided arterial carriageway, controlled by VicRoads). Vineyard Road provides the main access to Calder Freeway to the south and Sunbury Road (two-lane arterial road, controlled by VicRoads) to the north. Sunbury Road provides a southeast radial connection from Sunbury to Melbourne Airport and the Tullamarine Freeway.

Other roads within the southern study area include:

- Watsons Road, Buckland Way, Crinnon Road and Duncan's Lane, which are sealed local roads and fall under Councils control
- Fox Hollow Drive, Red Stone Hill Road and Shepherds Lane, which are local roads that are currently unsealed.

The existing road network in the southern study area is illustrated below in Figure 3.2, including an insert from Melways that indicates the proposed extension of Yirrangan Road, which is expected to provide a local connection between Vineyard Road and Ironbark Drive within the existing residential estate along the northern site of the study area.

Figure 3.2: Existing Road Network – Southern Link



3.2 Public Transport

3.2.1 Train Services

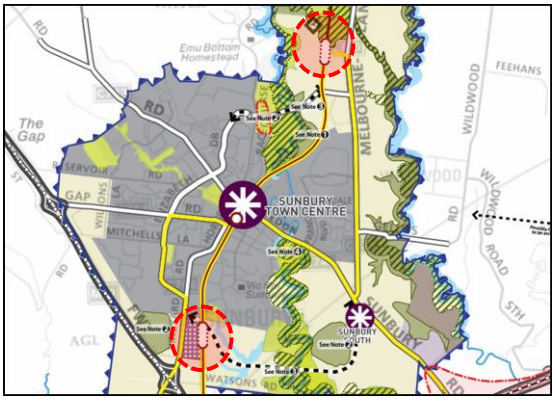
Sunbury is currently serviced by one central train station. It is the terminus stop on the metropolitan Melbourne Sunbury Line, which provides services to the city every 20 minutes during peak commuter periods (some are express services to Footscray) and 40 minutes outside of peaks. It is also on the Bendigo V-Line, with services stopping each hour in Sunbury.

In the future, the Sunbury Growth Corridor Plan indicates that a rail station will be located within each of the study areas, as shown in Figure 3.3.

It is noted that the proposed rail station south of the Sunbury town centre will form part of the electrified metropolitan Melbourne Sunbury Line, while the rail station to the north of the Sunbury town centre will form part of the Bendigo V-Line.

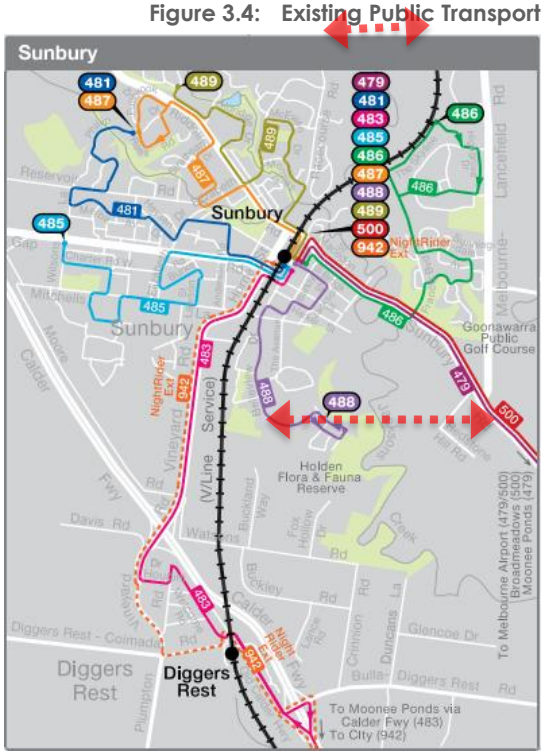
Public Transport Victoria (PTV) has undertaken a rail corridor and infrastructure constraints analysis for the future Sunbury South Rail Station, and is currently undertaking a similar assessment for the future Lancefield Road Rail Station to the north.

Figure 3.3: Potential Rail Stations



Source: Sunbury Growth Corridor Plans

Figure 3.4: Existing Public Transport



Source: PTV

3.2.2 Bus Services

Existing bus routes operate radially from the Sunbury town centre, with services operating along Vineyard Road and Sunbury Road, which boarder the southern study area. There is also a service currently operating to the southeast of the northern study area between Lancefield Road and the rail line, as shown in Figure 3.4, along with the indicative road crossing alignments (indicated through dashed red lines).

It is noted that bus routes through the growth areas are yet to be defined, however there exists a clear opportunity to increase the robustness of the overall public transport network through accommodating bus services along the proposed Jacksons Creek road crossings to improve connectivity with the rest of Sunbury and the future rail stations.

In accommodating low platform bus services, vertical road profile grades are typically required to not exceed 9%. There may be an opportunity to marginally exceed this in places, especially between the areas of development proximate to Jacksons Creek, as no bus stops will be located there.

3.3 Ecology

A preliminary desk top assessment of the ecological opportunities and constraints within the study areas has been undertaken by Ecology & Heritage Partners, which is documented in their letter dated 12 June 2014. The full detail of the preliminary assessment is provided in Appendix C, with the summary section reproduced below.

"The study areas exist within a predominantly rural environment which is under increasing pressure from the effects of expanding development, including habitat fragmentation, the introduction and spread of weed and pest species and impacts on local waterways. Although much of the study areas have been highly modified by agricultural activities and residential development, a number of significant ecological values persist and these should be referenced when siting and designing project infrastructure in order to avoid and minimise ecological impacts wherever possible.

The preliminary desktop review identified the following ecological values/ constraints within the study areas:

- *Jacksons Creek and minor tributaries*
- *Time-stamped native vegetation and Scattered Trees*
- *Native vegetation not accounted for in the time-stamped data, particularly within the northern study area which hasn't been subject to a Biodiversity Assessment (e.g. patches identified through BioSite mapping)*
- *Holden Flora Reserve (PSP 1074)*
- *Habitat for significant flora and fauna species*
- *Conservation Areas 20 and 21 (PSP 1074).*

Based on the preliminary review, there are three key ecological constraints applicable to the study areas:

- ***Holden Flora Reserve:** The Holden Flora reserve represents a **significant constraint** as it is established, has documented ecological values and is the focus of several community groups. Where possible, the alignment options should be refined to avoid and minimise impacts on the reserve and consultation should be initiated with Parks Victoria and DEPI regarding this issue.*
- ***Conservation areas 20 and 21** lie within the study area. With respect to development within the BCS Conservation Reserves, close consultation will need to be undertaken with DEPI and potentially DotE regarding the approvals process. Based on past project experience, necessary works within the Conservation Areas may be permitted if works are supported by relevant management documents and suitable rehabilitation / offsetting arrangements. Relative to other key ecological constraints, the Conservation Areas are considered to be of **low-moderate consequence**, as there are established precedents and procedures in place to facilitate necessary development within these areas. Additionally, the section of Conservation Area 20 potentially affected by the project is currently cropped. The conservation boundary was developed based on modelled data and it is likely to be revised allowing the completion of ground-truthing assessments recently commissioned by the landowner*
- ***Time-stamped Native Vegetation and Scattered Trees:** the presence of time-stamped vegetation and scattered trees represents a **low-moderate constraint** in terms of project approval. The removal of this vegetation would trigger offset obligations under the BCS. In terms of ecological value, ground trothed native vegetation is of **high significance** and should be avoided where practical. It is noted that the time-stamped*

vegetation in each precinct is based on DEPI modelling rather than the results of field surveys.

In assessing the ecological constraints and appropriately siting the alignment options, it is important to recognise the contrast between constraints relating to approvals under the BCS and those relating to MPA's objectives for impact avoidance and minimisation. The remaining ecological constraints, such as habitat for threatened species, Jacksons Creek etc., are of very high conservation significance but do not represent significant constraints in terms of project approvals under the BCS. Under the BCS, biodiversity obligations would be set according to the extent of time-stamped native vegetation and habitat for significant species within the development footprint. Within the Sunbury Growth Corridor, the following offset costs apply (in addition to those identified for native vegetation and scattered trees above):

- *Spiny Rice-flower - $7,937.00 per hectare of habitat removed*
- *Golden Sun Moth - $7,914.00 per hectare of habitat removed*
- *Growling Grass Frog - $7,529.00 per hectare of habitat removed*
- *Striped Legless Lizard - $350 per hectare of habitat removed (noting that salvage and translocation activities are required)*

It is recommended that the ecological values identified in this report are discussed during the forthcoming stakeholder workshop and that the results of stakeholder consultation and additional works are incorporated into the MCA Assessment Model and subsequent assessment reports. During the next phase of assessment, field verified data will be sourced wherever possible to further delineate the identified ecological constraints. This will involve further consultation with Parks Victoria Hume City Council, DEPI, Villawood Pty Ltd and MPA."

3.4 Cultural Heritage

A preliminary desk top assessment of cultural heritage constraints and opportunities within the study areas has been undertaken by Ecology & Heritage Partners, which is documented in their report dated June 2014. The full details of the assessment are provided in Appendix D, with the summary section reproduced below.

"The proposed crossing alignments intersect several places of Aboriginal and Historic Heritage (Maps 2-5). The density of Aboriginal places within proximity to the alignments, the presence of year-round water and the distinctive gorge and escarpment landforms, all suggest significant Aboriginal heritage and areas of archaeological potential occur with the study area. Maps 6 and 7 document the known areas of archaeological heritage and identify several areas considered to exhibit high archaeological sensitivity adjacent to the proposed creek crossings. These areas of known and potential archaeological heritage will need to be further assessed and mapped during forthcoming stages of the project and during the preparation of CHMPs for the road corridors. In addition, consultation with the Wurundjeri should be initiated to identify any cultural values associated with archaeological places and cultural landscapes within the study areas. The information in this report can be employed to assist consultation with the Wurundjeri during field inspection and preparation of additional heritage studies that can further refine alignment decisions based on identification of areas of (lower) Aboriginal heritage significance.

Given the incomplete archaeological understanding of the study area and the likelihood that additional surface and especially subsurface Aboriginal heritage occurs in the study area, it is recommended that the proponents retain several crossing options during preparation of Cultural Heritage Management Plans for the crossing locations. Should significant subsurface heritage such as burials, earth rings or significant campsites be identified during assessment for the crossings; retention of alternative alignments would enable the proponent to avoid such highly

significant places without re-engineering the entire road infrastructure or conducting extensive salvage excavations (and in keeping with Section 61 of the Aboriginal Cultural Heritage Due Diligence Assessment Report, Jacksons Creek Road Crossings, Sunbury, Victoria 23 Heritage Act 2006). Thus preparation of a CHMP is recommended at the earliest possible stage of the project following commissioning of the road."

3.5 Land Ownership

Land ownership on either side of Jacksons Creek within the northern and southern study areas is fragmented, with the major private land holdings belonging to Villawood. Along Jacksons Creek itself, land ownership generally belongs to Council and State, with there also being a section of Crown land that exists along the majority of the length of Jacksons Creek within the southern study area.

With the potential development of any road crossings over Jacksons Creek, consultation, negotiations, purchase and transfer of the associated land for a road corridor will need to be undertaken. Of the currently identified land owners in the study areas, the most challenging in terms of process is expected to relate to the Crown land within the southern study area. As it may be difficult to avoid the associated land, early investigations into the processes required to transfer ownership should be undertaken.

3.6 Topography

Northern Study Area

The topography of northern study area is dominated by a relatively steep gully which falls by 50-60m from east to west toward Jacksons Creek. Northeast of this gully and toward the rail line the terrain is relatively flat, falling gently to the southwest. From Racecourse Road, the land generally falls to the east toward Jacksons Creek, with an exception being where the land rises again around a hill situated at the southern end of the study area between the residential estate (east of Racecourse Road) and Jacksons Creek.

For reference, a topographic map of the northern study area is provided at Appendix A.

Southern Study Area

The study area is dominated by a relatively steep valley which runs along Jacksons Creek. Further east of the creek, the land is less steep rising east towards Redstone Hill, before falling back down towards Sunbury Road.

To the west of Jacksons Creek, the land generally falls to the east from Vineyard Road, and falls to the north from Watsons Road east of Buckland Way.

For reference, a topographic map of the southern study area is provided at Appendix A.

3.7 Flood Levels and Hydrology

Melbourne Water has provided the 100 year flood levels along Jacksons Creek. These flood levels are consistent with the Land Subject to Inundation Overlay (LSIO) incorporated within the Hume Planning Scheme.

The associated GIS spatial data provided for the LSIO has been draped onto the topographic map provided in Appendix B.

3.8 Engineering Feasibility & Constructability

There are several important factors which affect the engineering feasibility and constructability of the proposed alignments, summarised below:

3.8.1 Geotechnical Considerations

A limited desktop review has been undertaken as part of the PSP land capability assessments, with a review documented in Table 2.1. In this regard, there is an information gap particularly in regards to the following:

- groundwater considerations
- slope stability assessments
- geology and presence of rock unsuitable for significant excavation
- quality of soil and feasibility of recycling cut materials for fill.

Essentially the above relates to the below ground conditions, which will be unknown until suitable below ground investigations are undertaken. We are able to source the Geological Survey for Sunbury[1], which indicates the surface soil types. An extract of the geological survey is presented in Figure 3.5.

Figure 3.5: Geological Survey for Sunbury

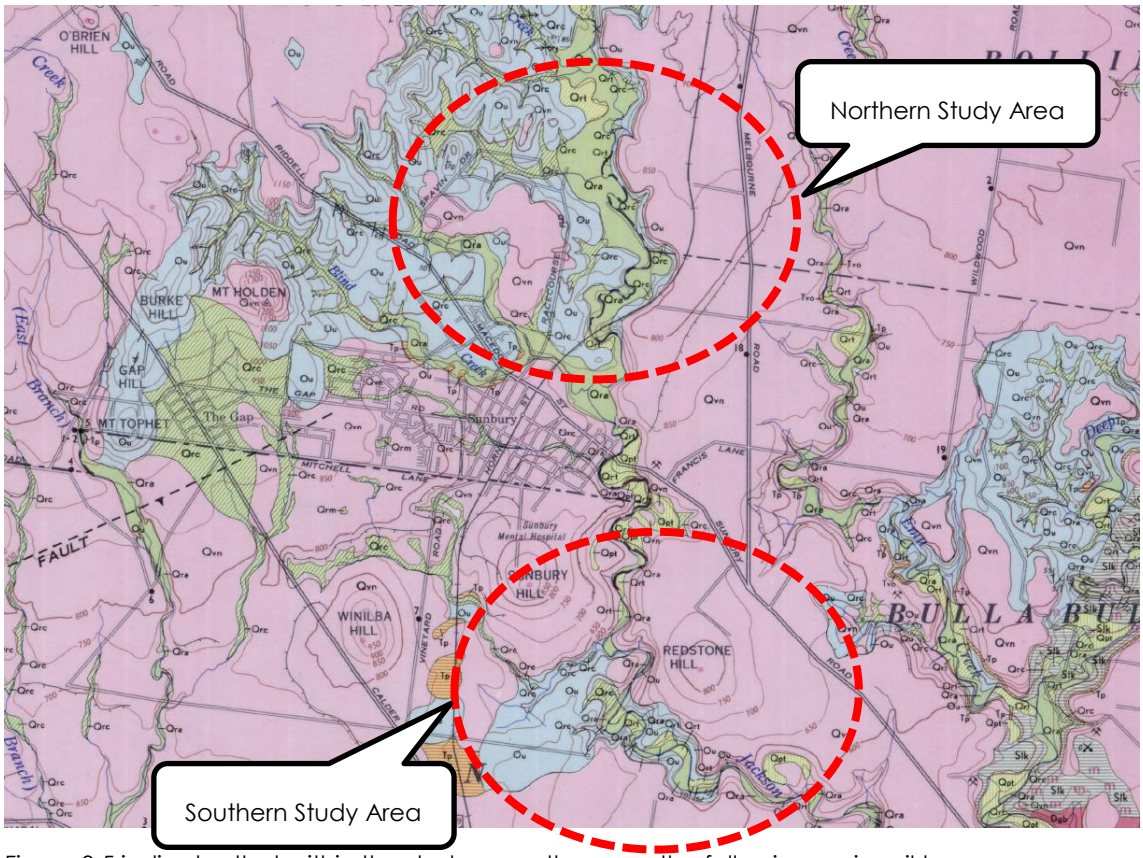


Figure 3.5 indicates that within the study areas there are the following main soil types:

- Q_{vn} = Olivine basalt, minor limburgite, trachy-andesite, scoria, thin imbedded sand, clay and tuff (indicated by the colour pink)

[1] Refer to http://dpistore.efirst.com.au/categories.asp?cID=33

- Q_U = Interbedded shale and greywacke, minor grit horizons (indicated by the colour blue)
- Q_{ra} = Alluvium sand, sandy silt, gravel (indicated by the colour green).

These soil types relate to three key land forms in the study areas, being the lava flows (Q_{vn}), sedimentary soils (Q_{ra}) and the creek beds (Q_U). Except for the lava flows, the other soils are considered to be highly erodible, which result in the natural escarpments and continuous movement of material down Jacksons Creek. The useability of any of these soils has been indicated to be low.

Consideration of the above broad level soils types will be undertaken as part of identifying the most feasible alignments in the study areas.

3.8.2 Proposed Grades:

The topography of the land significantly restricts the ability to provide feasibly low grade road cross sections. Furthermore, due to the undulating nature of the land in the study areas, wide road sections will require extensive batters and/or use of retaining walls.

The specific type, grade, etc. of the batters and/or retaining walls will be undertaken at a more detailed stage of the project. However, allowance for their future consideration will be made through the use of suitable batters along each feasible alignment.

3.8.3 Hydrology & Runoff:

With the expected changes to the current land form and construction of road surfaces, detailed hydrology modelling will need to be undertaken to understand what drainage treatments are required to minimise the potential for erosion and ponding. Also, specific treatments for the road surface runoff before it enters Jacksons Creek is expected to be required.

3.8.4 Bridge Structures:

It is apparent that there is a need for bridge structures to cross Jacksons Creek. The construction of which needs to consider its impact on the rich ecology and cultural heritage areas associated with Jacksons Creek.

4. Stakeholder Engagement

4.1 Consultation Summary

Consultation with key stakeholders has been undertaken in the preparation of the Baseline Report, to bring them along for 'the journey', enable a two-way flow of information, ensure a transparent process, and identify key areas of interest and concern.

To this end, GTA facilitated a workshop and attended a site walkthrough with key stakeholders on Wednesday 18 June 2014, including the following attendees:

- Metropolitan Planning Authority
- Public Transport Victoria
- VicRoads
- Hume City Council
- key landowners and their representatives.

A copy of the workshop minutes is provided in Appendix F, with a summary of the key emerging topics of discussion provided below.

4.2 Emerging Topics of Discussion

The consultation exercise to date has identified a number of emerging topics of discussion, which are briefly presented below for further consideration:

- Preliminary work indicates there are significant constraints to achieving an arterial standard road cross section, and even constraints around the provision of a local road cross section. As such, a key input to the study to be agreed upon is the design characteristics of the road types to be tested (this is discussed further in Section 6.1).
- The road type is expected to have implications on what funding sources will be able to be used. Clarity and confirmation on the funding models needs to be provided before a final decision on which road type is to be implemented.
- The benefit of, and need for, additional east-west routes against what future road upgrades are required for the existing Sunbury Road crossing of Jacksons Creek and the Sunbury Growth Corridor is developed is inter-related. While a transport modelling assessment is outside the scope of this study, it is highlighted as a potential future investigation in determining the overall business case approach for the road crossings.
- There is a strong need to resolve the future location and type of rail crossings, particularly in the northern study area, to help resolve the preferred road alignment and urban structure of the Lancefield Road PSP.

4.3 Next Steps

Further stakeholder consultation will continue over the course of the study. The next steps include:

- **Workshop #2 - Assessment Framework**
  This workshop will include stakeholders and various community groups with a vested interest in Jacksons Creek. It will focus on the key issues and opportunities to be considered, and seek to confirm the proposed assessment framework for identifying the preferred alignments.

- **Presentation #1 – Options Assessment**
  GTA will present the findings of the options assessment to MPA and other stakeholders as necessary.
- **Presentation #2 – Final Draft Report**
  GTA will present the final draft report to key agencies, which is expected to include MPA, Hume City Council, and VicRoads.

5. Issues, Opportunities, Information Gaps & Risks

From a review of the background information, site walkthrough, stakeholder consultation, and preliminary assessments, a summary of the identified key issues, opportunities, information gaps and risks (and actions on how to resolve them or assumptions made to minimise their impact) is summarised below in Table 5.1, with those items of high risk to the project indicated in **bold**.

Table 5.1: Issues, Opportunities, Information Gaps and Risks

Item	Issues, Opportunities, Information Gaps & Risks	Actions / Assumptions
Policy & Key Strategic Context Documents		
P1	Plan Melbourne acknowledges the potential for an Activity Centre in Sunbury South and the additional road crossings of Jacksons Creek.	-
P2	The Sunbury Growth Corridor Plan seeks to accommodate an additional 71,000 people.	-
P3	The Sunbury Growth Corridor shows potential rail stations in the northern and southern study areas.	Road alignments should integrate with rail stations to enhance directness of kiss & ride, park & ride etc.
P4	The Sunbury HiGap Spatial Strategy identifies a vision for future Activity Centres in both the Sunbury South and Lancefield Road PSPs.	-
P5	The Sunbury Growth Corridor identifies the northern and southern links as forming part of an overall cycling network.	-
P6	The Sunbury Higap Delivery & Infrastructure Strategy classifies the Northern road crossing as 'required infrastructure' (+15years) and the Southern road crossing as 'fundamental infrastructure (0-5years)a	-
Land Use, Ownership and Development		
L1	**MPA, Council and various landowners' are understood to have contributed to the PSPs, which are at varying stages of development**	**Progress on the PSPs is reliant on the resolving of whether, where and what type of road crossings of Jacksons Creek will be provided**
Public Transport		
PT1	The proposed rail station to the south of the Sunbury town centre is proposed as an electrified line of the metropolitan Melbourne Sunbury Line, while the northern station is proposed to be on the Bendigo V-Line	-
PT2	**It is considered highly desirable to accommodate future bus routes on the road crossings, to improve transport connectivity between PSP's, Sunbury and the future rail stations.**	**Confirmation of the maximum acceptable gradient for future bus services is required from PTV**
Ecology		
E1	**The Holden Flora reserve represents a significant constraint as it is established, has documented ecological values and is the focus of several community groups.**	**Where possible, the alignment options should avoid or at least minimise impacts on the reserve. Consultation should be initiated with Parks Victoria and DEPI regarding this issue and what processes will be required to resolve them.**
E2	Conservation areas 20 and 21 lie within the study area, and relative to other key ecological constraints are considered to be of low-moderate consequence	The conservation boundary was developed based on modelled data and it is likely to be revised after the completion of ground-truthing assessments recently commissioned by the landowner

Item	Issues, Opportunities, Information Gaps & Risks	Actions / Assumptions
E3	Time-stamped vegetation and scattered trees represent a low-moderate constraint in terms of project approval. The removal of this vegetation would trigger offset obligations under the BCS. In terms of ecological value, ground trothed native vegetation is of high significance and should be avoided where practical	Ongoing stakeholder consultation regarding importance. Information gap: The existing information is based on modelling and has not been verified in field surveys. Liaise with MPA to determine if this is required.
E4	In assessing ecological constrains and siting alignment options, it is important to recognise the contrast between approval constraints under the BCS and those relating to MPAs objectives for impact avoidance and minimisation. Other habitats not discussed above (such as Jacksons Creek) are of very high conservation significance but do not represent a significant constraint in terms of project approvals under the BCS.	It is recommended that ecological values identified be further discussed during stakeholder consultation. Field data will also be used to further delineate the identified ecological constraints.
Cultural Heritage		
CH1	There are several places of Aboriginal and Historic Heritage within the study area. Various factors suggest other significant Aboriginal heritage and 'areas of archaeological potential' occur with the study area. Several areas will need to be further assessed and mapped in project development	The established information can be used to initiate consultation with the Wurundjeri to identify any cultural values associated with archaeological places and cultural landscapes within the study areas.
CH2	**The road construction will trigger the requirement to prepare a Cultural Heritage Management Plan** **Should significant subsurface heritage such as burials, earth rings or significant campsites be identified, re-alignment of extensive salvage excavations would be required (as per Section 61 of the Aboriginal Heritage Act 20006).**	**Given the incomplete archaeological understanding and likelihood that additional Aboriginal heritage occurs in the study area, Ecology and Heritage Partners recommend that several crossing options are retained at this time.** **Alternatively, GTA consider a CHMP could be prepared early on to fully inform the preferred north and south alignments, based on prioritisation of areas and informed areas of lower value.**
Engineering Feasibility		
E1	**The design characteristics of the road cross section types will significantly affect alignments feasibility.**	**Design characteristics of the road cross section types to be decided and agreed too**
E2	**The bridge structures required, including their construction type, length, and height will have significant impacts on the road crossing feasibility.**	**Confirmation on what feasible lengths and or heights of the bridge crossings.**
E3	**Service assessment reports undertaken for the PSPs indicate existing and proposed underground services.**	**Existing services and infrastructure have been sourced through Dial Before You Dig requests. Proposed services and infrastructure need to be investigated**
Water - Flooding & Hydrology		
W1	**Hydrology analysis has not been undertaken or within the scope of this study, which will impact of drainage arrangements for the road crossings**	**Standard drainage arrangements have been adopted at this time**
W2	There is a Land Subject to Inundation Overlay (LSIO) present on a significant component of land in the northern study area. The LSIO coincides with the 100 year flood level indicated by Melbourne Water.	Works will be assumed to be constructed above the LSIO
Topography		
T1	**In conjunction will other influencing factors the steepness of the land may affect the ability to achieve compliant vertical grades**	**Localised flexibility in the road cross-section design characteristics will be sort**
Geotechnical		
G1	**No comprehensive geotechnical investigations have been undertaken to adequately inform the comparison of alignments from a geotechnical point of view.**	**Key information gap. MPA to advise wether geotechnical information is able to be provided**

Item	Issues, Opportunities, Information Gaps & Risks	Actions / Assumptions
G2	Desktop geotechnical reviews indicate that moderately to steeply undulating areas are likely to consist of exposed or shallow rock, resulting in difficult and more expensive excavation	-
G3	Desktop geotechnical reviews indicate potential for sub-surface erosion on steep sites, which may cause a problem during construction where deep excavation of greater than 3.0m are cut and exposed	A slope stability geotechnical investigation is recommended for development sites to assess potential failure modes (including potential for subsurface erosion).
Consultation		
C1	A number of emerging topics of discussion have been raised and documented	Further investigations outside the scope of this project are required to resolve these
C2	Consultation with the wider community or consultation in regard to the need for the additional road crossings of Jacksons Creek is proposed as part of this study	Only those identified by MPA and Council as having a vested interest in Jacksons Creek will be consulted as part of this project, and on the basis of which alignment is the most appropriate

6. Alignment Options

6.1 Road Crossing Types

It is understood that as part of this project two road crossing types will be considered. These are generally expected to consist of the following:

- Connector level road
- Arterial level road

Discussion on the potential design characteristics and their application within the study area is provided in this section of the Baseline Report. It is noted that no specific design characteristics have been confirmed as yet, and rather, this is provided for information purposes and to help inform the eventual design characteristics for each road type.

6.1.1 Design Considerations

Given the significant topography within the study areas that the road crossings are proposed to be accommodated, the setting and flexibility of the design characteristics of the road types is critical. The key considerations in this regard are discussed as follows:

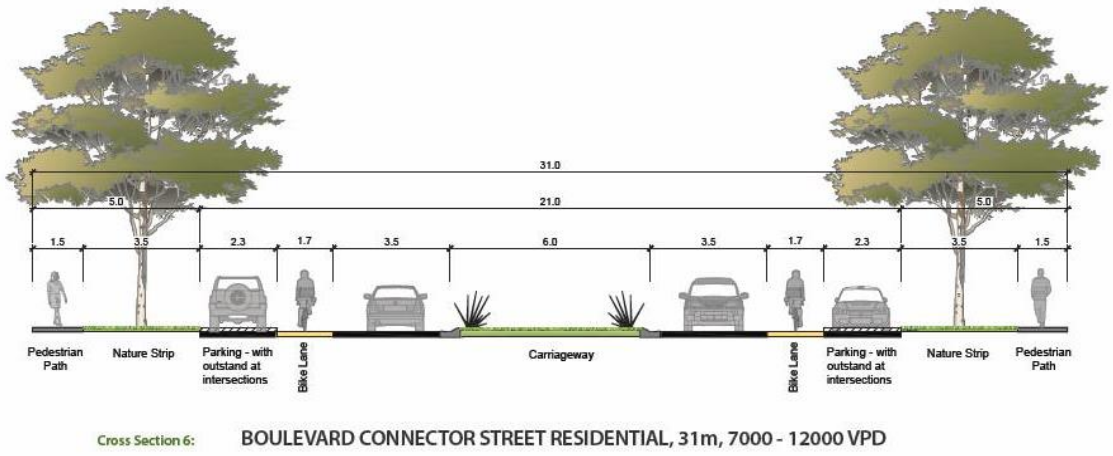
- **Grade:** The setting of a maximum grade will have impact on the profile of the road, especially in the ability for the road profile to overcome the steep grades located on each side of Jacksons Creek and localised grade variations due to the undulating nature of the area. The higher the maximum grade permitted, or ability to allow for localised flexibility in what grade can be adopted, will achieve more feasible alignments with less cross-sectional cut and/or fill extents. Should a low maximum grade be adopted, then the road side batters and retaining walls will be significant. However, this has to be weighted up against what vehicles are wanted to be accommodated, the desired level of service and impact on sight visibility between approaching vehicles, especially at intersections, property accesses and rail line crossings.
- **Width:** The wider the road the larger the cut and/or fill widths will be. Also, due to the undulating nature of the land in the area, the resulting batters and/or retaining walls can also be expected to increase significantly with increased width. As such, consideration should be given to whether there is a need for any more than two lanes with either road type, at least over the proximate length to Jacksons Creek between the proposed urban / residential areas of the PSPs. This is on the basis of the surrounding arterial roads in the area generally consisting of two lanes (except for Vineyard Road, which has a separated four lane cross-section). It is also noted that Austroads Guidelines[2] indicate that two lane mid-block sections of road have a daily capacity of 18,000 vehicle movements and VicRoads typically don't duplicate roads until they reach 20,000 vehicle movements a day.
- **Speed:** In setting the operating speed of the road, it will also set the maximum curvature of its bends and ability to follow gentler topographical alignments. While it is expected that the conditions of the road crossings most proximate to Jacksons Creek will be of a rural nature, the roads will be located within the urban environments of the PSPs shortly thereafter. As such, ability to adopt lower design speeds should be considered, noting that it may be difficult for drivers to maintain lower speeds when descending into Jacksons Creek.

[2] Road capacity scoured from Table 4.3 of the Austroads "Guide to Traffic Management – Part 3 Traffic Studies and Analysis" document

6.1.2 Connector Level Road

At this time, the connector level road has been advised to be generally consistent with the design characteristics associated with a Boulevard Connect Street – Residential. The cross-sectional elements associated with such a road type are presented in Figure 6.1.

Figure 6.1: Boulevard Connector Street - Residential



In terms of the other design characteristics associated with a Boulevard Connect Street – Residential, as indicated in the Growth Areas Authority Engineering Design and Construction Manual (April 2011), they are listed as follows:

- Maximum operating speed – 50km/h
- Maximum grade (to accommodate buses) – 10%

With adopting the above design characteristics for the connector level road, it is not expected that the Boulevard Connect Street – Residential cross-section will be applied over the section crossing and proximate to Jacksons Creek. Rather a two-lane carriageway (7.0m wide) with 2.1m wide sealed shoulders with no kerbing will be provided. There is expected to be an off-road 3.0m wide shared path provided on at least one side of the road, and swale type drainage arrangements (subject to hydrology analysis). With the bridge structure, it would be expected to consist of an approximate 11.0m wide deck and suitable safety barriers.

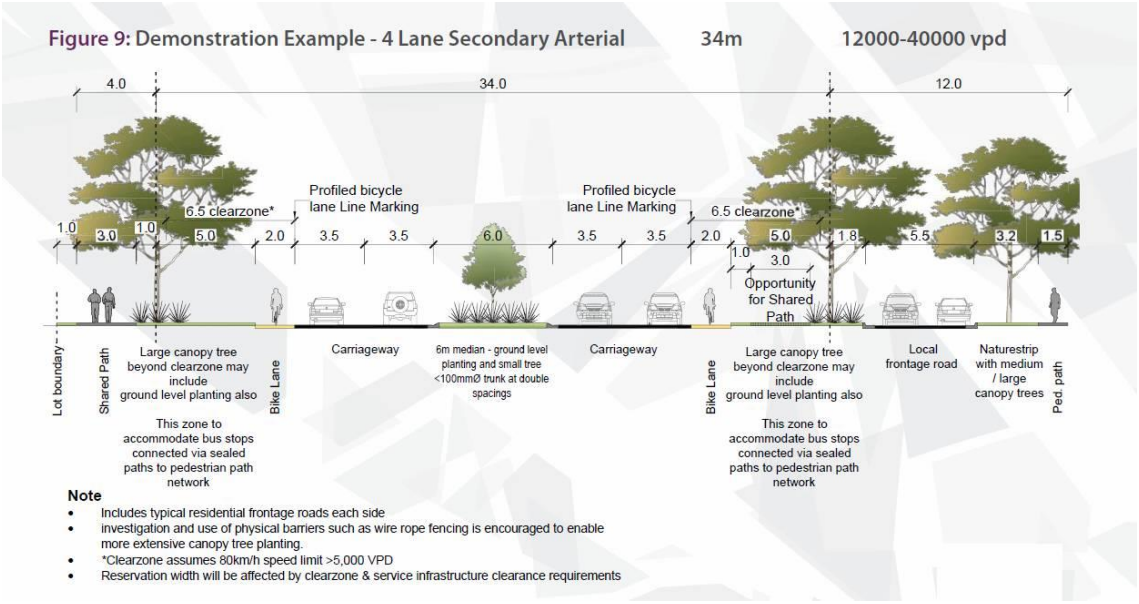
It is recommended that consideration be given to permitting higher maximum grades for the proximate section to Jacksons Creek, such as 12%, as no bus stops are expected to be provided. Also, an operating speed of 60km/h is likely to result in the down grade directions as the road descends into Jacksons Creek

Away from Jacksons Creek and within the urban areas of the PSPs the Boulevard Connect Street – Residential cross-section is expected to be adopted for this road type. The transition is expected to occur where urban / residential development occurs.

6.1.3 Arterial Level Road

At this time, the arterial level road has been advised to be generally consistent with the design characteristics associated with a Four-Lane Secondary Arterial. The cross-sectional elements associated with such a road type are presented in Figure 6.2.

Figure 6.2: Four-Lane Secondary Arterial



In terms of the other design characteristics associated with a Four-Lane Secondary Arterial, as indicated in the Growth Areas Authority Engineering Design and Construction Manual (April 2011), they are listed as follows:

- Maximum operating speed – 80km/h (as specified by VicRoads)
- Maximum grade – 8%

With adopting the above design characteristics for the arterial level road, it is not expected that the Four-Lane Secondary Arterial will be applied over the section crossing and proximate to Jacksons Creek. Rather a four-lane carriageway (14m wide) with 2.1m wide sealed shoulders with no kerbing will be accommodated. There is expected to be an off-road 3.0m wide shared path provided on at least one side of the road, and swale type drainage arrangements (subject to hydrology analysis). With the bridge structure, it would be expected to consist of an approximate 20.0m wide deck and suitable safety barriers.

It is recommended that consideration be given to permitting higher maximum grades for the proximate section to Jacksons Creek of 10%, and consideration be given to reducing it to two lanes (subject to modelling). This is on the basis that the associated section of road between the urban / residential areas will not have an intersection and limited property access points, so visibility concerns would be minimal.

Also, the bridge location and structure could be designed so that at a later date a second bridge or widening of the existing deck (so only one set of piles are constructed) could be provided to achieve four lanes of traffic should the need arise.

Away from Jacksons Creek and within the urban areas of the PSPs the Four-Lane Secondary Arterial cross-section is expected to be adopted for this road type. The transition is expected to occur where urban / residential development occurs.

6.2 Feasible Alignments

Based on the background information, site walkthrough, stakeholder consultation, and preliminary assessments, there are considered to be two and five feasible road crossing alignments within the northern and southern study areas, respectively.

For each of the identified feasible alignments, initial road alignment modelling has been undertaken to provide an appreciation of the associated works required for each. Moreover, it provides an opportunity to further refine which feasible alignments to proceed with as part of this study and help with setting the design characteristics for the two road types.

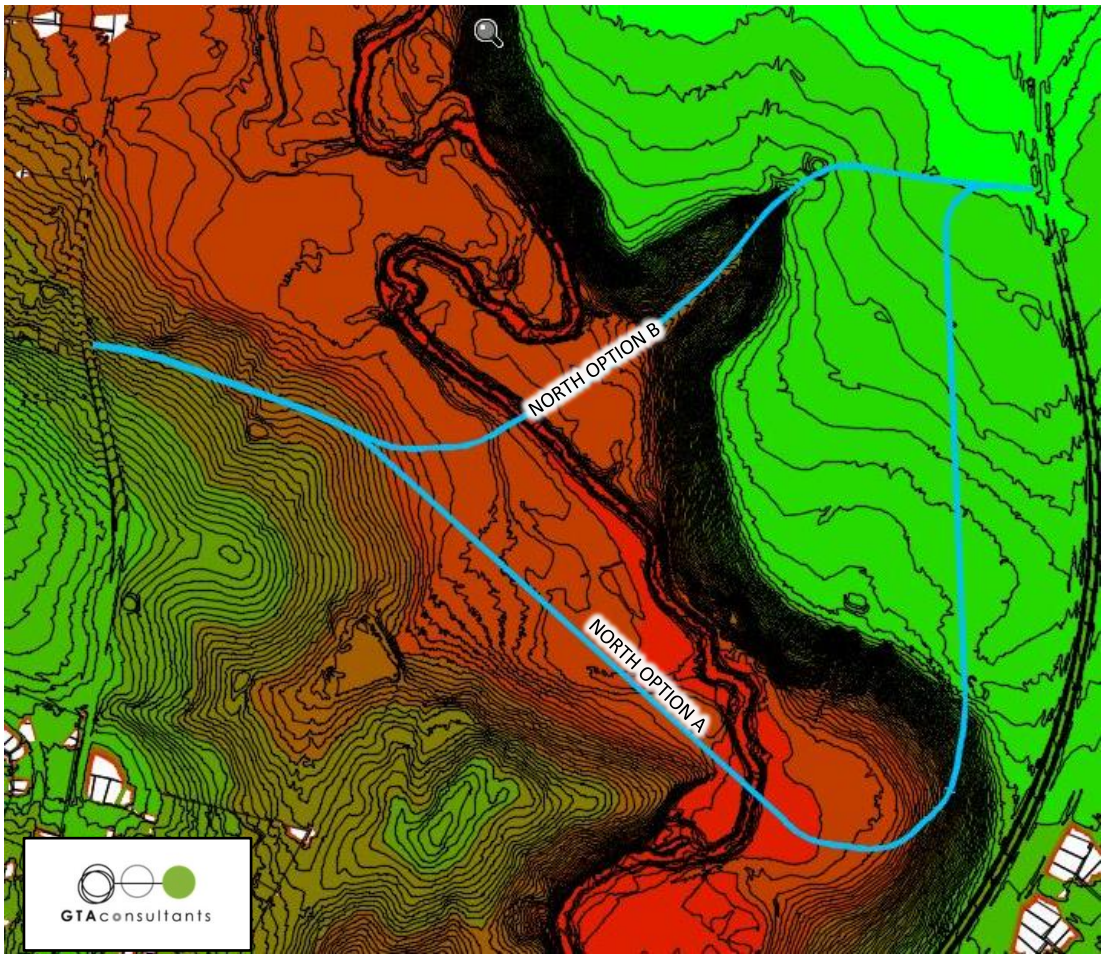
The design characteristics of the road types modelled for each of the identified feasible alignments are provided as follows:

- Number of lanes – two
- Road width – 11.2m
- Maximum operating speed – 60km/h
- Maximum grade – 10%

6.2.1 Northern Study Area

There are two feasible road crossing alignments that have been identified in the northern study area for further consideration. These are illustrated in Figure 6.3.

Figure 6.3: Feasible Alignments - Northern Study Area



For each of the feasible road crossing alignments indicated in Figure 6.3 long-sections have been prepared and are provided in Appendix G. Based on these the associated cut/fill and bridge lengths are presented in Table 6.1.

Table 6.1: Earthworks Estimates – North Alignments

Option #	Cut (m^3)	Fill (m^3)	Bridge Length (m)
North Alignment A	110,000	31,000	70
North Alignment B	115,000	90,000	40

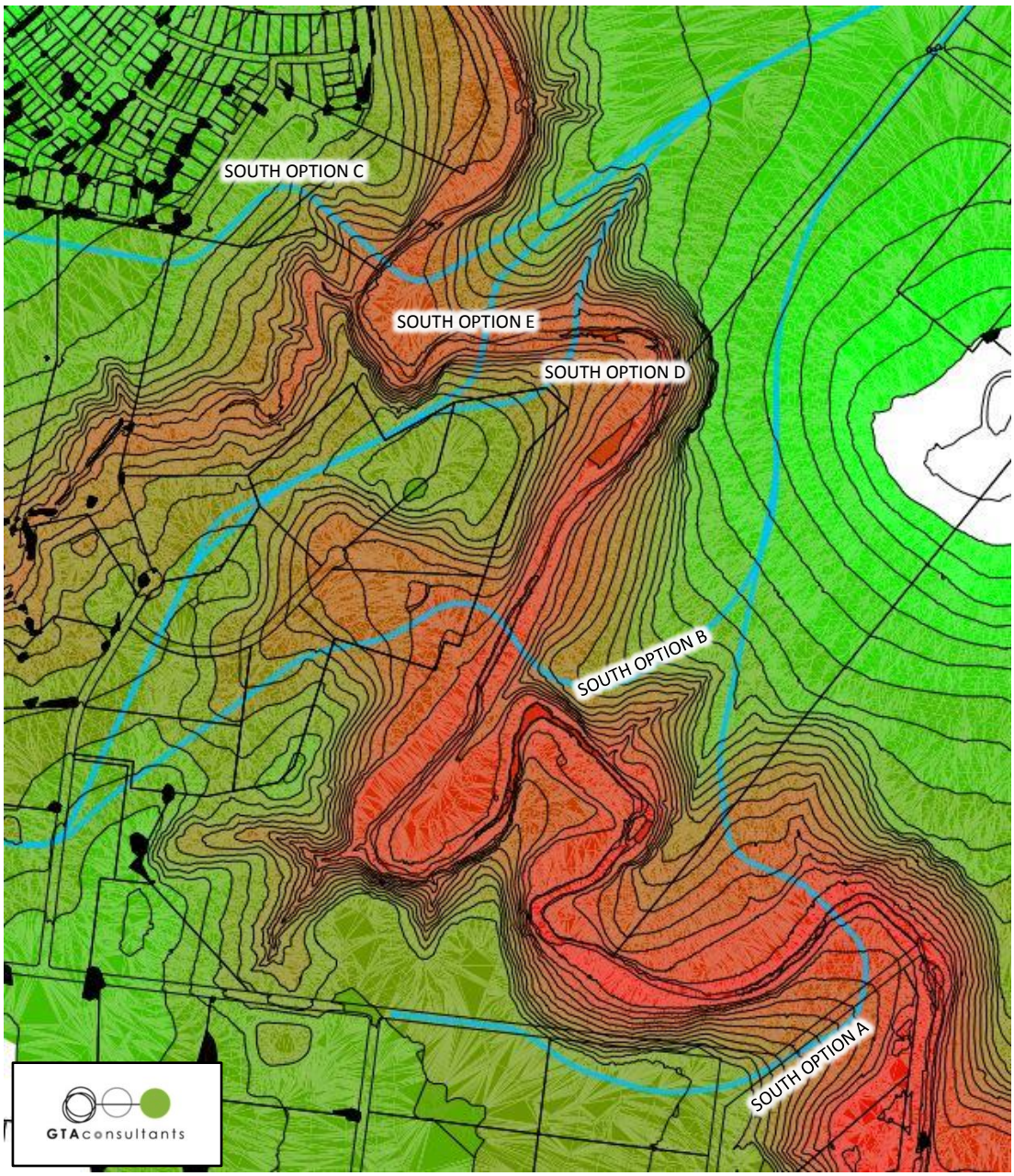
It should be noted that these feasible road crossing alignments are proximate in nature, and are expected to be modified as part of this project, as further information is provided and analysis undertaken.

This could include the potential to better balance cut and fill volumes. However, it is noted that the balancing would most likely need to occur on each side of Jacksons Creek, as the associated transporting of such cut material is unlikely to out weight the cost of disposal or sourcing of extra material in a fill scenario on the other side. Also, with there expected to be additional works undertaken in the area with the development of the PSPs, the cut/fill balance on each side of Jacksons Creek could be potentially achieved. As such, it is recommended that minimising ground disturbance by following the existing ground profile as best as possible should be targeted with the development of the road crossing alignments.

6.2.2 Southern Study Area

There are five feasible road crossing alignments that have been identified in the southern study area for further consideration. These are illustrated in and Figure 6.4.

Figure 6.4: Feasible Alignments – South Study Area



For each of the feasible road crossing alignments indicated in Figure 6.4 long-sections have been prepared and are provided in Appendix G. Based on these the associated cut/fill and bridge lengths are presented in Table 6.2.

Table 6.2: Earthworks Estimates – Southern Alignments

Option #	Cut (m^3)	Fill (m^3)	Bridge Length (m)
South Alignment A	220,000	22,000	120
South Alignment B	500,000	100,000	150
South Alignment C	800,000	100,000	97
South Alignment D	387,000	8,000	74
South Alignment E	58,300	81,300	170

It should be noted that these feasible road crossing alignments are proximate in nature, and are expected to be modified as part of this project, as further information is provided and analysis undertaken. This could include the potential to better balance cut and fill volumes on each side of Jacksons Creek.

6.3 Broad Level / Order of Magnitude Costs

In order to help inform the selection of the feasible alignments to consider further and develop the design characteristics of the road types to be adopted, the following broad level / order of magnitude costs are provided for the key items associated with the construction of the road crossings.

It is importantly noted that the broad level / order of magnitude costs are also for comparative cost assessment and initial high level planning purposes only, so must not be relied upon for final construction cost estimation or budgeting purposes.

Earthworks

Cost for earthworks is typically based on the balance of the cut and fill volumes and at a rate of $\$50/m^3$.

However, with each feasible alignment tending to need cut on one side and fill on the other side of Jacksons Creek, it is recommended to apply it to each value in this instance and for conservative purposes given the lack of geotechnical information and useability of any cut material.

Road Construction

Within an urban environment the cost of the two indicated road types in Section 6.1 are:

- Two-lane connector road - $1,800/m
- Four-lane secondary arterial road - $2,450/m

Proximate to Jacksons Creek between the PSP's the more rural type cross-section are:

- Two-lane rural road - $650/m
- Four-lane rural road - $950/m

Bridge Construction

The following costs are provided for two and four lane bridges with 25m spans:

- Two-lane bridge (11.0m wide) - $250,000/m
- Four-lane bridge (20.0m wide) - $350,000/m

Assumptions and Exclusions

The broad level / order of magnitude costs are based on costs obtained as part of previous work we have undertaken and suitable resources, such as Rawlinsons Australian Construction Handbook.

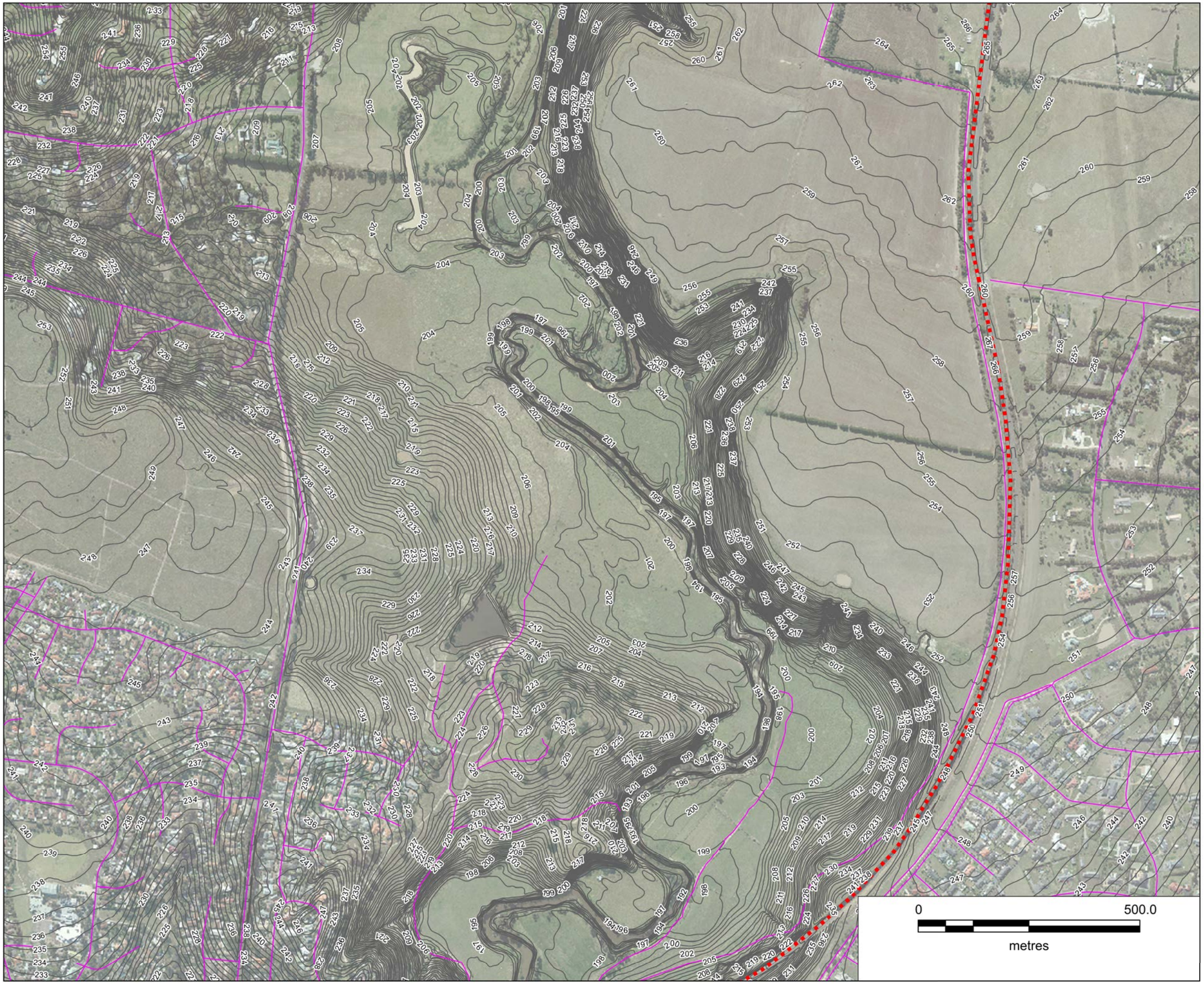
It should also be noted that the following likely costs also exist, but have not been considered at this stage:

i design and documentation fees or authority fees, charges, levies and overview including insurances and bank guarantees
ii retaining wall or any other protection works
iii storm water drainage works
iv public lighting works
v existing services relocations and facilitation including lowering or realignment thereof
vi cost for the protection of underground services during construction.

Appendix A

Topography

JACKSONS CREEK ROAD CROSSING ASSESSMENT



LEGEND

- Rail Line
- Existing Roads
- Contours (1m)

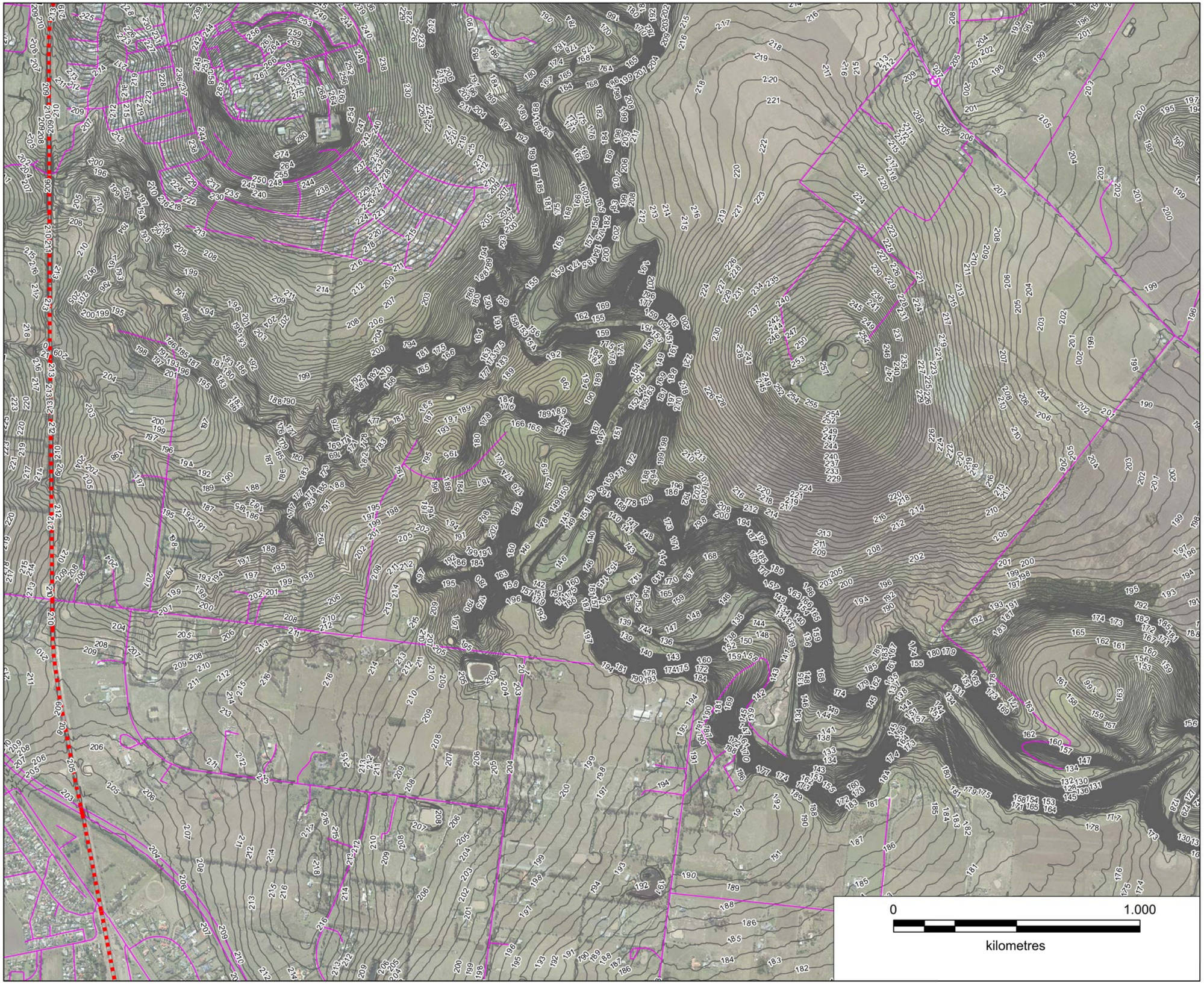
GTA REF: 14M1881000

NORTH CROSSING

CLIENT: MPA

GTAconsultants

JACKSONS CREEK ROAD CROSSING ASSESSMENT



LEGEND

- Rail Line
- Existing Roads
- Contours (1m)

GTA REF: 14M1881000

SOUTH CROSSING

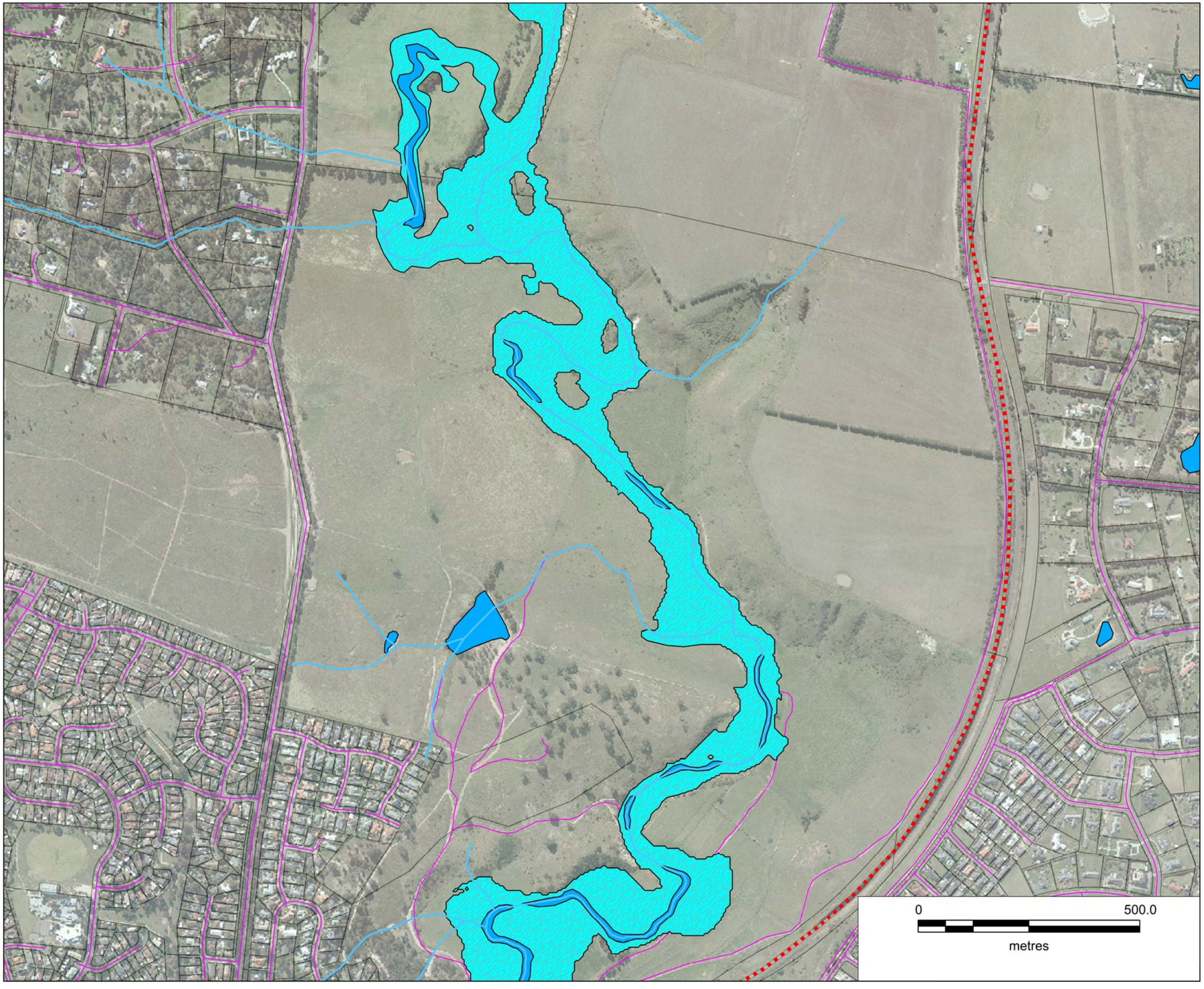
CLIENT: MPA

GTAconsultants

Appendix B

Hydrology and Flooding

JACKSONS CREEK ROAD CROSSING ASSESSMENT



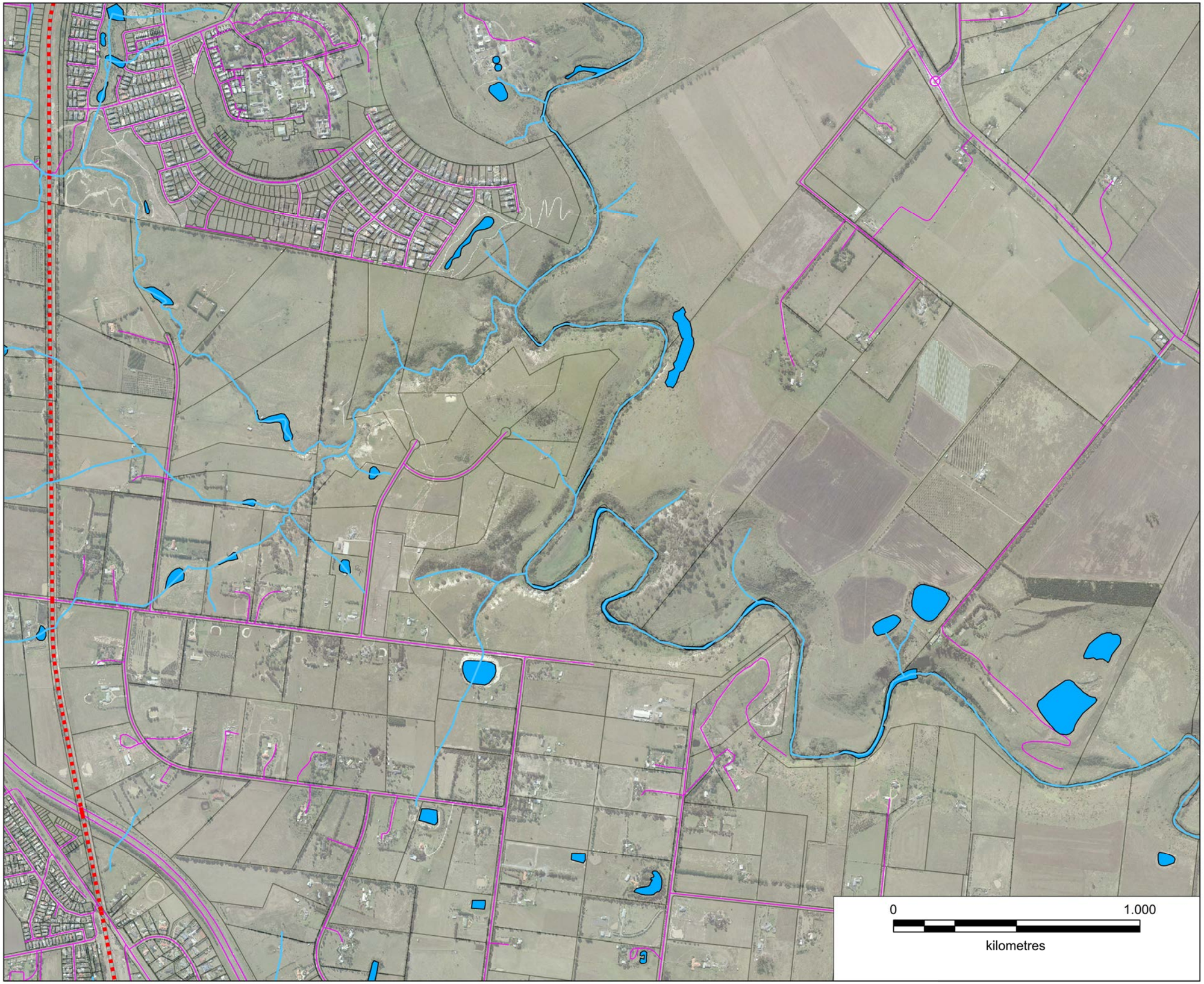
LEGEND

- Rail Line
- Existing Roads
- Cadastre Parcels
- Water Area
- Watercourse
- LSIO Overlay

GTA REF: 14M1881000
NORTH CROSSING
CLIENT: MPA

GTAconsultants

JACKSONS CREEK ROAD CROSSING ASSESSMENT



LEGEND

- Rail Line
- Existing Roads
- Cadastre Parcels
- Water Area
- Watercourse
- LSIO Overlay

GTA REF: 14M1881000
SOUTH CROSSING
CLIENT: MPA

GTAconsultants

Appendix C

Preliminary Ecological Assessment

Preliminary Opportunities and Constraints Analysis, Jacksons Creek Road Crossings - Options Assessment

Date: 12 June 2014

Our reference: 5808

Author: Chad Browning, Consultant Zoologist

1. Introduction

This letter report provides the results of a preliminary assessment of ecological opportunities and constraints within the broad project area adopted for the Jacksons Creek Road Crossing Project, located within the Lancefield Road (Precinct Structure Plan [PSP] 1075) and Sunbury South (PSP 1074) Precincts of the Sunbury Growth Corridor. The development works have been identified by the Metropolitan Planning Authority (MPA) as part of the precinct structure planning process and aim to connect communities either side of Jacksons Creek and facilitate community access to existing and planned infrastructure. As part of preliminary investigations, MPA have identified two indicative bridge crossing locations, one of which sits within the Sunbury South PSP ('the southern link') and the other within the Lancefield Road PSP ('the northern link'). Where appropriate, this assessment provides separate results for the concept alignments within both the northern and southern links, as provided by GTA Consultants Pty Ltd.

This preliminary ecological advice aims to assist GTA Consultants Pty Ltd during the early stages of project delivery and will inform discussion during the forthcoming stakeholder workshop and subsequent reporting. Specifically this report aims to:

- Provide a preliminary assessment of ecological values within the broad project areas, including native vegetation communities, threatened species and ecologically sensitive areas;
- Provide a preliminary review of opportunities to protect and enhance ecological values;
- Summarise the legislative implications associated with known and potential ecological values within the study areas; and,
- Refine the focus and scope of the stakeholder workshop, Baseline Report and draft/ final submissions.

Completion of the above noted scope of works will allow GTA and MPA to delineate preferred alignments, appropriately site and design the bridge structures, and develop indicative costings for both the northern and southern links, accounting for project approvals and biodiversity offset arrangements. It should be noted that this summary of ecological constraints and opportunities is based solely on a preliminary review of desk-based information. The findings of a detailed desktop assessment, stakeholder consultations and field surveys will be included in the Background Report, due for completion in July 2014.

2. Methods

Relevant literature, online-resources and numerous databases were reviewed to provide an up to date assessment of ecological values associated with the study areas and surrounding landscape, including:

- The Department of Environment and Primary Industries (DEPI) Biodiversity Interactive Map (DEPI 2014a) for:
    - Time-stamped data for remnant vegetation patches and habitat for significant species;
    - The extent of historic Ecological Vegetation Classes (EVCs);
    - Conservation Management Areas; and,
    - The location of sites of biological significance within the region.
- The Victorian Biodiversity Atlas (VBA) (DEPI 2014a; 2014b), Flora Information System (FIS) (Viridans 2012a) and Atlas of Victorian Wildlife (AVW) (Viridans 2012b) for previously documented flora and fauna records within the project locality (10 kilometres of each study area);
- The Commonwealth Department of the Environment (DotE) Protected Matters Search Tool (PMST) for matters of National Environmental Significance (NES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (DotE 2014);
- The Victorian Department of Transport, Planning and Local Infrastructure (DTPLI) Planning Maps Online to ascertain current zoning and environmental overlays (DTPLI 2014);
- Relevant federal and State legislation and policies, including the EPBC Act and *Flora and Fauna Guarantee Act 1988* (FFG Act);
- Aerial photography of the study area; and,
- Relevant reports, documents and literature, including the following:
    - *Biodiversity Conservation Strategy for Melbourne's Growth Corridors* (DEPI 2013a)
    - *Targeted Surveys for the Growling Grass Frog Litoria raniformis in Jacksons Creek, Sunbury* (Ecology and Heritage Partners 2010)
    - *Scattered Tree Assessment, PSP 1074 Sunbury South* (Ecology and Heritage Partners 2014a)
    - *Scattered Tree Assessment, PSP 1075 Lancefield Road* (Ecology and Heritage Partners 2014b)
    - *Biodiversity Assessment for Area 1074, Sunbury South, Victoria* (Ecology and Heritage Partners 2012)

A list of threatened flora and fauna species previously recorded, or predicted to occur within 10 kilometres of each study area is provided in Tables A1-A4, Attachment A.

3. Results

3.1. Biodiversity Conservation Strategy

The northern link study area lies entirely within the Lancefield Road PSP (1075) and the majority of the southern link is contained in the Sunbury South PSP (1074). Any development activities within the PSP areas will be subject to the provisions of the *Biodiversity Conservation Strategy for Melbourne's Growth Corridors* (BCS) (DEPI 2013a). The BCS (DEPI 2013a) and associated sub-regional species' strategies (DEPI 2013c; 2013d; 2013e) provide an alternative framework for biodiversity management within Melbourne's four Growth Corridors and were initiated through the Victorian Government's agreement with the Commonwealth Government to undertake a Strategic Impact Assessment (SIA) under the EPBC Act in June 2009 (DSE 2009).

The assessment of development projects and calculation of biodiversity offset obligations is streamlined under the BCS, with native vegetation assessed and time-stamped across entire PSP areas (Section 3.2.2), thereby avoiding incremental and potentially inconsistent vegetation surveys. Offset obligations associated with the removal of native vegetation and impacts on Matters of National Environmental Significance (NES) under the EPBC Act are calculated proportionally according to the extent of native vegetation/habitat removal. Through direct payment to DEPI, proponents avoid the requirement to source and secure individual offsets. In areas not subject to the BCS, proposals for vegetation removal and biodiversity offsets are managed in accordance with the 'Permitted clearing of native vegetation - Biodiversity assessment guidelines' (The Guidelines) (DEPI 2013b).

While the majority of the study areas are subject to the BCS and the streamlined assessment process, it is recognised that a key objective of the project is to avoid areas of key biodiversity value where possible. The following sections aim to inform the planning and design process and assist MPA in meeting their environmental management objectives.

3.2. Existing Environment

3.2.1. Setting

The study areas are located in the Victorian Volcanic Plain Bioregion, within the Management boundaries of the Port Phillip and Western Port Catchment Management Authority (CMA) and Hume City Council. The concept alignment options traverse areas subject to a variety of land uses, including agriculture (pasture), residential development (high density and rural) and conservation (Southern Link - Holden Flora Reserve).

The *Growth Corridor Plan* (Growth Areas Authority 2012) notes the following in regards to biodiversity values within the Sunbury Growth Corridor:

> *The Sunbury/Diggers Rest Growth Corridor includes areas of significant biodiversity values, particularly along Jacksons and Emu Creek, both of which provide important corridors for flora and fauna, including the Growling Grass Frog. The Holden Flora Reserve is an important asset and adjoins the Jacksons creek to the south of Sunbury.*

The project will involve the construction of bridge structures over Jacksons Creek and potentially road development within the Holden Flora Reserve.

Jacksons Creek begins near Gisborne and flows through Sunbury before joining Deep Creek near Melbourne Airport (Melbourne Water 2014). According to the most recent state-wide Index of Stream Condition (ISC) Assessment completed by DEPI, the reach of Jacksons Creek traversed by the study areas is in poor condition (DEPI 2013f). The ISC Assessment references data collected over the six year period between 2004 and 2010 and is based on the survey of five sub-indices. The sub-indices and results of the ISC assessment are provided in Table 1.

Table 1 Results of the Merri Creek ISC Assessment (DEPI 2013a)

Sub-indices and metrics	Score (Max. 10)
Hydrology refers to the amount of water that is within the river channel at a particular point in time at a particular location. A minimum of 15 years of monthly flow data is used	1
Physical form takes into account the river bank condition as well as instream habitat (logs or 'snags') and major barriers to fish migration, such as dams and artificial weirs	9
Streamside zone measures characteristics of the woody vegetation within 40 metres of the river's edge	5
Water quality is the quality of water in the river (Total Phosphorus, turbidity, Salinity and pH)	N/A – Not assessed
Aquatic life is based on the number and type of aquatic macroinvertebrates found within the river.	N/A – Not assessed

Additional waterbodies traversed by the concept alignments include unnamed minor tributaries of Jacksons Creek and Harpers Creek (southern link) (Figures 2a and 2b). There are no Ramsar or nationally significant wetlands within or immediately adjacent to the study areas.

The value of Jacksons Creek in providing habitat for the nationally significant Growling Grass Frog (*Litoria raniformis*) is evidenced by the classification of Conservation Area 21 under the BCS (Figures 2a and 2b). This conservation area is applied as a variable buffer along the entire length of Jacksons within the study areas and has been developed to protect important populations of *Litoria raniformis* and ensure connectivity between populations within the Sunbury Growth Corridor. The northern link study area also traverses Conservation Area 20, which has been applied by DEPI to protect areas of woodland within practically manageable areas. It is noted that Conservation Area 20 has been developed based on estimated data due to property access constraints and that detailed surveys have not been undertaken to determine which areas require protection for their biodiversity values (DEPI 2013a).

Holden Flora Reserve was created in 1989 to preserve the geology and flora/ fauna of the Keilor plains and encompasses 96 hectares that is largely managed by Parks Victoria (Friends of Holden Flora Reserve Inc. 2014). In addition to supporting remnant grassland/ grassy woodland and threatened flora species, the reserve is recognised for its high diversity of reptiles. The reserve is one of three locations in Victoria where the nationally significant Grassland Earless Dragon *Tympanocryptis pinguicolla* has been last recorded (< 1990).

A BioSite is a physical area of land or water containing biological assets with particular attributes, such as the presence of rare or threatened flora, fauna or habitat required for their survival and/or rare or threatened vegetation communities. The following BioSites are present within the vicinity of the study areas:

- Northern study area:
    - BioSite 3527: Northern Rail Reserve, north of Sunbury (Grass PPBU009)- Regional Significance
    - BioSite 4630: Jacksons Creek, Sunbury - State Significance
    - BioSite 5188: Salesian College Woodlands & Escarpment - Regional Significance
- Southern study area:
    - BioSite 3287: Holden Flora Reserve - National Significance
    - BioSite 3523: Sunbury - Diggers Rest Rail Reserve 2/5 (Grass PPBU0082) - Regional Significance
    - BioSite 3524: Sunbury - Diggers Rest Rail Reserve 3/5 (Grass PPBU0083) - Regional Significance
    - BioSite 5193: Watsons Road, Sunbury - Regional Significance

Although much of the study areas have been developed or highly modified by agricultural activities and residential development, a number of ecological values persist, including remnant vegetation and known/ potential habitat for threatened flora and fauna species. These values are further described in the following sections.

3.2.2. Vegetation Communities

A review of the DEPI Biodiversity Interactive Map (DEPI 2014a) indicated that prior to European settlement the study areas are likely to have supported six EVCs (Table 2). Native vegetation in the study areas has been previously assessed and time-stamped as part of the (former) Growth Areas Authority (GAA) mapping of properties within the Urban Growth Zone. Time-stamped vegetation within both the Sunbury South (PSP 1074) and Lancefield Road (PSP 1075) Precincts is derived from DEPI modelling and does not necessarily represent the actual extent and condition of native vegetation present.

According to the Biodiversity Interactive Map (DEPI 2014a), the northern and southern concept alignments traverse four and seven EVCs, respectively (Table 2 and Figures 2a and 2b). The time-stamped remnant patches are relatively fragmented, which can be attributed to historic land clearing, urban expansion and on-going agricultural activities.

Table 2. DEPI Mapped EVCs Traversed by the Alignment Options

Mapped EVC[1]	Bioregional Conservation Status	Northern Link	Southern Link	Northern Link	Southern Link
		Present pre-1750[1]		Time-stamped EVCs[1]	
Valley Grassy Forest (EVC 47)	Vulnerable	✓			
Plains Grassy Woodland (EVC 55)	Endangered	✓	✓		✓
Box Ironbark Forest (EVC 61)	Depleted			✓	✓
Creekline Grassy Woodland (EVC 68)	Endangered				✓
Plains Grassland (EVC 132)	Endangered		✓	✓	✓
Grassy Woodland (EVC 175)	Endangered		✓		✓
Riparian Woodland (EVC 641)	Endangered		✓		
Plains Woodland (EVC 803)	Endangered			✓	✓
Stream Bank Shrubland (EVC 851)	Endangered	✓	✓	✓	✓

Note: 1) DEPI 2014a

In 2014, Ecology and Heritage Partners were commissioned by MPA to undertake Scattered Tree Assessments within the Lancefield Road (PSP 1075) and Sunbury South (PSP 1074) Precincts. The surveys recorded 41 and five Scattered Trees within the vicinity of the northern and southern concept alignments, respectively (Ecology and Heritage Partners 2014a; 2014b). It is noted that the results of the scattered tree assessments are not exhaustive, as the surveys were constrained by property access, particularly those completed in PSP 1074. The recorded Scattered Trees are illustrated in Figures 2a and 2b, and attribute data is provided in Attachment B.

3.3. Threatened Biodiversity and Other Matters of Significance

This section outlines biodiversity matters of National, State and Regional significance. Table 3 outlines the significance criteria adopted for this assessment.

Table 3 Criteria for Defining Ecological Significance

National Significance
Flora and Fauna: National conservation status is based on the EPBC Act list of taxa considered threatened in Australia (i.e. Extinct, Critically Endangered, Endangered and Vulnerable).
State Significance
Flora: Species listed as threatened under the FFG Act. Species listed on the DSE Advisory List (DSE 2005) as Endangered, Vulnerable or Rare. **Fauna**: Species listed as threatened under the FFG Act. Species listed on the DSE Advisory List (DSE 2013) as Critically
Regional Significance
Flora: Species listed on the DSE Advisory List (DSE 2005) as Poorly Known in Victoria. **Fauna:** Species listed on the DSE Advisory List (DSE 2013) as Near Threatened of Data Deficient.

It is noted that the presence of ecological values which are not accounted for in the time-stamped vegetation dataset or Conservation Areas, such as threatened ecological communities and habitat for threatened species, is relatively negligible in terms of project approvals and offset calculations. While these implications are largely predetermined under the BCS, additional ecological values are discussed below in order to inform the selection of appropriate alignment options and meet MPA's objectives for environmental management.

3.3.1. Northern Link Study Area

Ecological values of the Lancefield Road Precinct (PSP 1075) have not been assessed on a precinct-wide scale, as a Biodiversity Assessment is yet to be commissioned by MPA. The results below are based on a review of relevant databases and literature listed in Section 2.

3.3.1.1. Matters of National Environmental Significance

Matters of NES are listed and protected under the EPBC Act. Those relating to biodiversity are discussed below in relation to the northern study area based on the results of the EPBC Act Protected Matters Search Tool (DotE 2014) and a preliminary desktop review.

Five significant ecological communities under the EPBC Act are known or predicted to occur within the project locality (within 10 kilometres of the study area) (DotE 2014) (Table 4). EVCs mapped within the study area potentially correspond with these communities.

Table 4 EPBC Act Listed Ecological Communities Predicted to Occur in the Project Locality

Threatened Ecological Community	EPBC Act Status	Potentially Corresponding EVCs
Grassy Eucalypt Woodland of the Victorian Volcanic Plain	Critically Endangered	Plains Grassy Woodland (EVC 55)
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Plains Grassy Woodland (EVC 55) Grassy Woodland (EVC 175)
Natural Temperate Grassland of the Victorian Volcanic Plain	Critically Endangered	Plains Grassland (EVC 132)
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland	Critically Endangered	Plains Grassy Wetland (EVC 125)
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native	Critically Endangered	Grassy Dry Forest (EVC 22) Valley Grassy Forest (EVC 47) Plains Grassy Woodland (EVC 55) Grassy Woodland (EVC 175)

Based on a review of the VBA (DEPI 2014b) and FIS (Viridans 2012a), two EPBC Act-listed flora species have been recorded in the project locality, none of which have been mapped within the vicinity of the concept alignments (Figure 3). The PMST (DotE 2014) nominated an additional nine nationally significant species which have not been recorded in the locality but have the potential to occur (Table A1, Attachment A).

The VBA (DEPI 2014c) and AVW (Viridans 2012b) indicate that eight EPBC Act-listed fauna species (three birds, one mammal, one reptile, one frog, one fish and one invertebrate) have been recorded in the project locality, none of which have been mapped within the vicinity of the concept alignments (Figure 4). The PMST (DotE 2014) nominated an additional eight nationally significant species which have not been recorded in the locality but have the potential to occur (Table A2, Attachment A).

Migratory species are protected under the international agreements to which Australia are a signatory, including JAMBA, CAMBA, RoKAMBA and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. A review of the VBA (DEPI 2014c), AVW (Viridans 2012a) and EPBC Act PMST (DotE 2014) indicated that several migratory species have been previously recorded or are predicted to occur within the study area (Table A2, Attachment A). While a small number of migratory species are likely to inhabit the study area on occasions, there is no 'important habitat' as defined under the EPBC Act *Policy Statement 1.1 Principal Significant Impact Guidelines* (DotE 2013).

3.3.1.2. Matters of State Significance

A review of the modelled FFG Act Communities data layer contained in the DEPI Biodiversity Interactive Map (DEPI 2014a) indicated that one FFG Act listed ecological community - Western Basalt Plains (River Red Gum) Grassy Woodland, is predicted to occur across the study area. No time-stamped EVCs within the study area have the potential to correspond with this ecological community.

Based on a review of the VBA (DEPI 2014b) and FIS (Viridans 2012a), 11 State significant flora species have been recorded in the project locality, none of which have been mapped within the vicinity of the concept alignments (Figure 3 and Table A1, Attachment A). The VBA (DEPI 2014c) and AVW (Viridans 2012b) indicate that 22 State significant fauna species (17 birds, two mammals, two frogs and one fish) have been recorded in the project locality, none of which have been mapped within the vicinity of the concept alignments (Figure 4 and Table A2, Attachment A).

3.3.1.3. Matters of Regional Significance

Based on a review of the VBA (DEPI 2014b) and FIS (Viridans 2012a), six regionally significant flora species and eight regionally significant fauna species (six birds, one mammal, and one fish) have been recorded in the project locality, none of which have been mapped within the vicinity of the concept alignments (Figure 3 and Tables A1/A2, Attachment A).

3.3.2. Southern Link Study Area

Ecological values have been assessed within the Sunbury South Precinct (PSP 1074) on a precinct-wide scale as part of the Biodiversity Assessment completed in 2012 (Ecology and Heritage Partners 2012). Where appropriate, the findings of the 2012 assessment have been incorporated within the following sections.

3.3.2.1. Matters of National Environmental Significance

Five significant ecological communities under the EPBC Act are known or predicted to occur within the project locality (DotE 2014) (Table 4). Field surveys undertaken as part of the precinct Biodiversity Assessment (Ecology and Heritage Partners 2012) recorded three EPBC Act listed ecological communities within the Sunbury South Precinct (PSP 1074):

- Grassy Eucalypt Woodland of the Victorian Volcanic Plain
- Natural Temperate Grassland of the Victorian Volcanic Plain
- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia

Natural Temperate Grassland of the Victorian Volcanic Plain) was recorded within only a few areas identified as Plains Grassland (EVC 132_61), and were mostly located on private land tenure. Vegetation that qualifies as Grassy Eucalypt Woodland of the Victorian Volcanic Plain and some areas of Grey Box (E. microcarpa) Grassy Woodlands and Derived Native Grasslands of South- Eastern Australia were primarily restricted to within the Holden Flora Reserve and along Jacksons Creek.

Based on a review of the VBA (DEPI 2014b) and FIS (Viridans 2012a), two EPBC Act-listed flora species have been recorded in the project locality (10 kilometres of the study area), none of which have been mapped within the vicinity of the concept alignments (Figure 3). The PMST (DotE 2014) nominated an additional eight nationally significant species which have not been recorded in the locality but have the potential to occur (Table A3, Attachment A). The precinct Biodiversity Assessment (Ecology and Heritage Partners 2012) notes that no EPBC Act listed flora species are likely to occur within the Sunbury South Precinct (PSP 1074).

The VBA (DEPI 2014c) and AVW (Viridans 2012b) indicate that 12 EPBC Act-listed fauna species (six birds, two mammals, two reptiles, one frog and one invertebrate) have been recorded in the project locality, none of which have been mapped within the vicinity of the concept alignments (Figure 4). The PMST (DotE 2014) nominated an additional seven nationally significant species which have not been recorded in the locality but have the potential to occur (Table A4, Attachment A). The precinct Biodiversity Assessment (Ecology and Heritage Partners 2012) notes that six EPBC Act listed fauna species have a moderate or high likelihood of occurrence within the Sunbury South Precinct (PSP 1074):

- Grey-headed Flying-fox *Pteropus poliocephalus*
- Swift Parrot *Lathamus discolor*
- Striped Legless Lizard *Delma impar*
- Grassland Earless Dragon *Tympanocryptis pinguicolla*
- *Litoria raniformis* (Note: A targeted survey completed in 2010 [Ecology and Heritage Partners 2010] recorded this species within Jacksons Creek immediately downstream of the southern concept alignments)
- Golden Sun Moth *Synemon plana*

A review of the VBA (DEPI 2014c), AVW (Viridans 2012a) and EPBC Act PMST (DotE 2014) indicated that several migratory species have been previously recorded or are predicted to occur within the study area (Table A4, Attachment A). While a small number of migratory species are likely to inhabit the study area on occasions, there is no 'important habitat' as defined under the EPBC Act *Policy Statement 1.1 Principal Significant Impact Guidelines* (DotE 2013).

3.3.2.2. Matters of State Significance

A review of the modelled FFG Act Communities data layer contained in the DEPI Biodiversity Interactive Map (DEPI 2014a) indicated that one FFG Act listed ecological community - Western Basalt Plains (River Red Gum) Grassy Woodland, is predicted to occur across the study area. Remnant patches of EVC 55 correspond with this community and it is noted that the state listings do not specify condition thresholds and therefore can include degraded patches that are excluded from the EPBC Act-listed ecological communities.

Based on a review of the VBA (DEPI 2014b) and FIS (Viridans 2012a), 27 State significant flora species have been recorded in the project locality, none of which have been mapped within the vicinity of the concept alignments (Figure 3 and Table A3, Attachment A). Field surveys undertaken as part of the precinct Biodiversity Assessment (Ecology and Heritage Partners 2012) recorded five State significant flora species across the Sunbury South Precinct (PSP 1074):

- Arching Flax-lily *Dianella* sp. aff. *longifolia* (Benambra)
- Fragrant Saltbush *Rhagodia parabolica*
- Melbourne Yellow-gum *Eucalyptus leucoxylon* subsp. *connata*
- Austral Tobacco *Nicotiana suaveolens*
- Coast Twin-leaf *Zygophyllum billardierei*

The 2012 Assessment notes that there is a low likelihood of additional State significant flora species occurring within the precinct, based on the lack of suitable habitat.

The VBA (DEPI 2014c) and AVW (Viridans 2012b) indicate that 23 State significant fauna species (20 birds, one reptile, one frog and one fish) have been recorded in the project locality, none of which have been mapped within the vicinity of the concept alignments (Figure 4 and Table A4, Attachment A). The precinct Biodiversity Assessment (Ecology and Heritage Partners 2012) notes that seven State significant fauna species have a low-moderate likelihood of occurrence within the Sunbury South Precinct (PSP 1074):

- Hardhead *Aythya australis*
- Diamond Dove *Geopelia cuneata*
- Eastern Great Egret *Ardea modesta*
- Royal Spoonbill *Platalea regia*
- Black Falcon *Falco subniger*
- Barking Owl *Ninox connivens connivens*
- Brown Toadlet *Pseudophryne bibronii*

3.3.2.3. Matters of Regional Significance

Based on a review of the VBA (DEPI 2014b) and FIS (Viridans 2012a), eight regionally significant flora species have been recorded in the project locality, none of which are mapped as occurring in the vicinity of the concept alignments (Figure 3 and Table A3, Attachment A). Field surveys undertaken as part of the precinct Biodiversity Assessment (Ecology and Heritage Partners 2012) recorded 52 regionally significant flora species across the Sunbury South Precinct (PSP 1074).

The VBA (DEPI 2014c) and AVW (Viridans 2012b) indicate that 13 regionally significant fauna species (11 birds, one reptile, and one fish) have been recorded in the project locality, none of which have been mapped within the vicinity of the concept alignments (Figure 4 and Table A4, Attachment A). The precinct Biodiversity Assessment (Ecology and Heritage Partners 2012) notes that four regionally significant fauna species have a low-moderate likelihood of occurrence within the Sunbury South Precinct (PSP 1074):

- Brown Quail *Coturnix ypsilophora australis*
- Nankeen Night Heron *Nycticorax caledonicus hillii*
- Latham's Snipe *Gallinago hardwickii*
- Azure Kingfisher *Alcedo azurea*

The 2012 Assessment notes that due to the high level of modification of habitat across the precinct, the likelihood of occurrence for other regionally significant fauna species is considered low.

4. Conclusion and Recommendations

The study areas exist within a predominantly rural environment which is under increasing pressure from the effects of expanding development, including habitat fragmentation, the introduction and spread of weed and pest species and impacts on local waterways. Although much of the study areas have been highly modified by agricultural activities and residential development, a number of significant ecological values persist and these should be referenced when siting and designing project infrastructure in order to avoid and minimise ecological impacts wherever possible.

The preliminary desktop review identified the following ecological values/ constraints within the study areas:

- Jacksons Creek and minor tributaries
- Time-stamped native vegetation and Scattered Trees
- Native vegetation not accounted for in the time-stamped data, particularly within the northern study area which hasn't been subject to a Biodiversity Assessment (e.g. patches identified through BioSite mapping)
- Holden Flora Reserve (PSP 1074)
- Habitat for significant flora and fauna species
- Conservation Areas 20 and 21 (PSP 1074).

Based on the preliminary review, there are three key ecological constraints applicable to the study areas:

- Conservation Areas 20 and 21: With respect to development within the BCS Conservation Reserves, close consultation will need to be undertaken with DEPI and potentially DotE regarding the approvals process. Based on past project experience, necessary works within the Conservation Areas may be permitted if works are supported by relevant management documents (i.e. Growling Grass Frog Conservation Management Plan) and suitable rehabilitation/ offsetting arrangements. Relative to other key ecological constraints, the Conservation Areas are considered to be of Low-Moderate consequence, as there are established precedents and procedures in place to facilitate necessary development within these areas. Additionally, the section of Conservation Area 20 potentially affected by the project is currently cropped. The conservation boundary was developed based on modelled data and it is likely to be revised following the completion of ground-truthing assessments recently commissioned by the landowner, Villawood Pty Ltd.
- Holden Flora Reserve: The Holden Flora Reserve represents a Significant constraint as it is established, has documented ecological values and is the focus of several community groups. Where possible, the alignment options should be refined to avoid and minimise impacts on the reserve and consultation should be initiated with Parks Victoria and DEPI regarding this issue.
- Time-stamped Native Vegetation and Scattered Trees: The presence of time-stamped vegetation and scattered trees represents a Low-Moderate constraint in terms of project approval. The removal of this vegetation would trigger offset obligations under the BCS, with costs set at $95,075.00 per hectare cleared and $13,218.00 per scattered tree removed. In terms of ecological value, ground-truthed native vegetation is of high significance and should be avoided wherever practical. It is noted that the time-stamped vegetation in each precinct is based on DEPI modelling rather than the results of field surveys.

In assessing the ecological constraints and appropriately siting the alignment options, it is important to recognise the contrast between constraints relating to approvals under the BCS and those relating to MPA's objectives for impact avoidance and minimisation. The remaining ecological constraints, such as habitat for threatened species, Jacksons Creek etc., are of very high conservation significance but do not represent significant constraints in terms of project approvals under the BCS. Under the BCS, biodiversity obligations would be set according to the extent of time-stamped native vegetation and habitat for significant species within the development footprint. Within the Sunbury Growth Corridor, the following offset costs apply (in addition to those identified for native vegetation and scattered trees above):

- Spiny Rice-flower - $7,937.00 per hectare of habitat removed
- Golden Sun Moth - $7,914.00 per hectare of habitat removed
- Growling Grass Frog - $7,529.00 per hectare of habitat removed
- Striped Legless Lizard - $350 per hectare of habitat removed (noting that salvage and translocation activities are required)

It is recommended that the ecological values identified in this report are discussed during the forthcoming stakeholder workshop and that the results of stakeholder consultation and additional works are incorporated into the MCA Assessment Model and subsequent assessment reports. During the next phase of assessment, field verified data will be sourced wherever possible to further delineate the identified ecological constraints. This will involve further consultation with Parks Victoria Hume City Council, DEPI, Villawood Pty Ltd and MPA.

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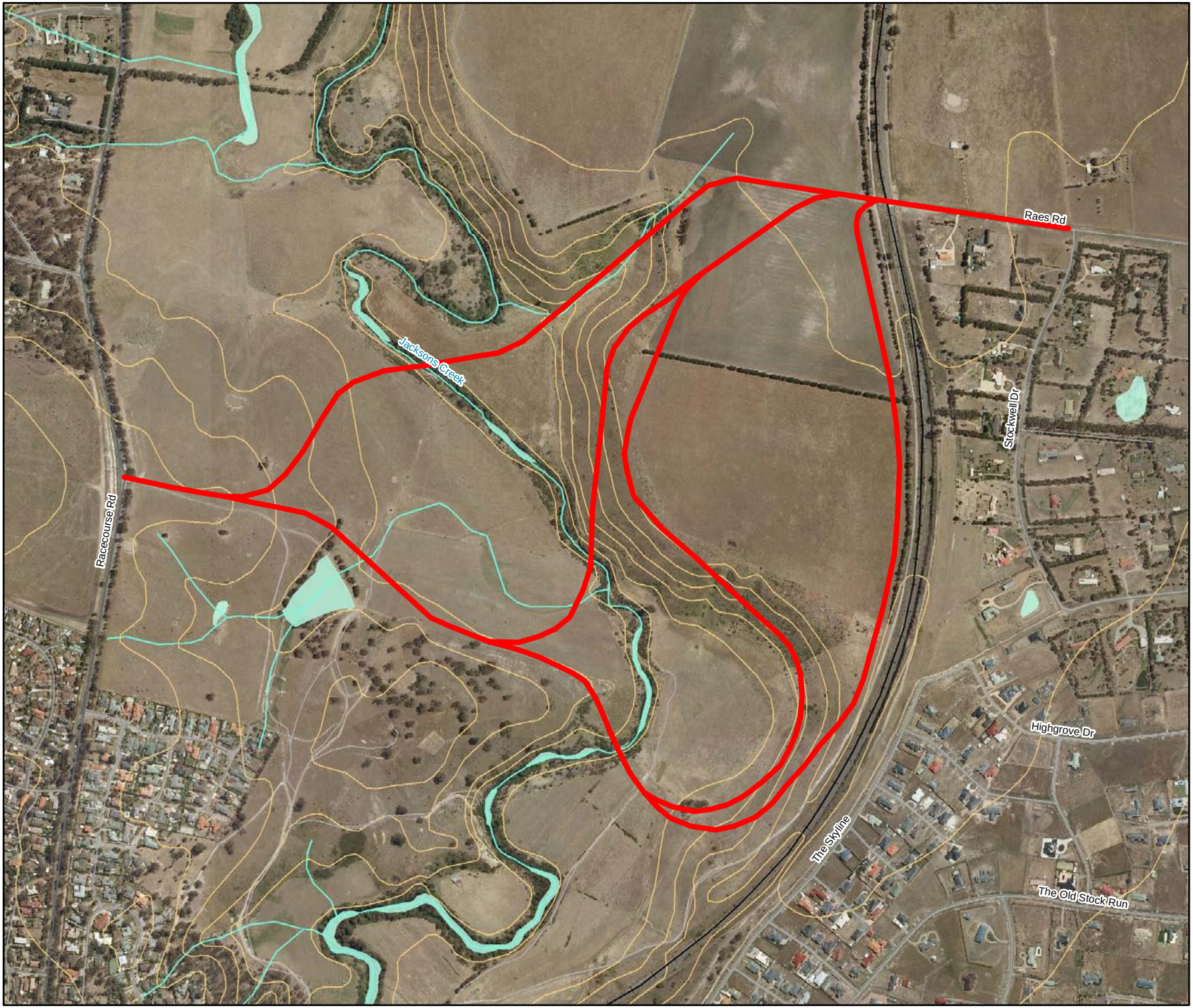
Figures



Legend

- Study Area
- Railway
- Collector Road
- Minor Road
- Minor Watercourse
- Permanent Waterbody
- Contour (10m)

Local Government: City of Hume
25k Mapsheet: Sunbury 7822-4-1
Coordinate System: MGA Zone 55 (GDA94)
Map Scale: 1:10,000

N

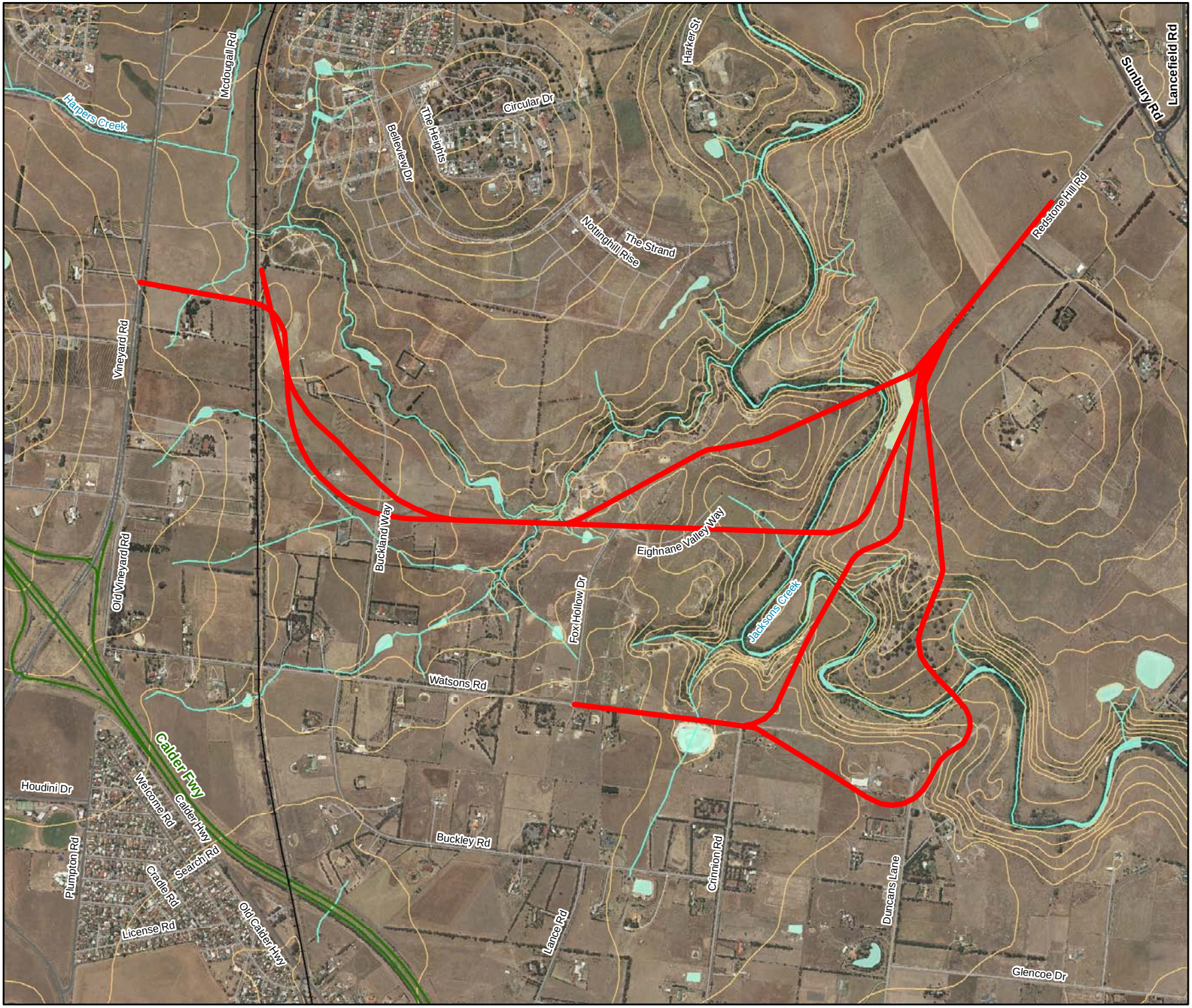
0 100 200
Metres

Figure 1a

Location of Study Area Northern Options

PSP 1074 and 1075 Jacksons Creek Road Crossings Project

ecology & heritage partners



Legend

- Study Area
- Railway
- Freeway
- Major Road
- Collector Road
- Minor Road
- Minor Watercourse
- Permanent Waterbody
- Land Subject to Inundation
- Contour (10m)

Local Government: City of Hume
25k Mapsheet: Sunbury 7822-4-1
Coordinate System: MGA Zone 55 (GDA94)
Map Scale: 1:20,000

N

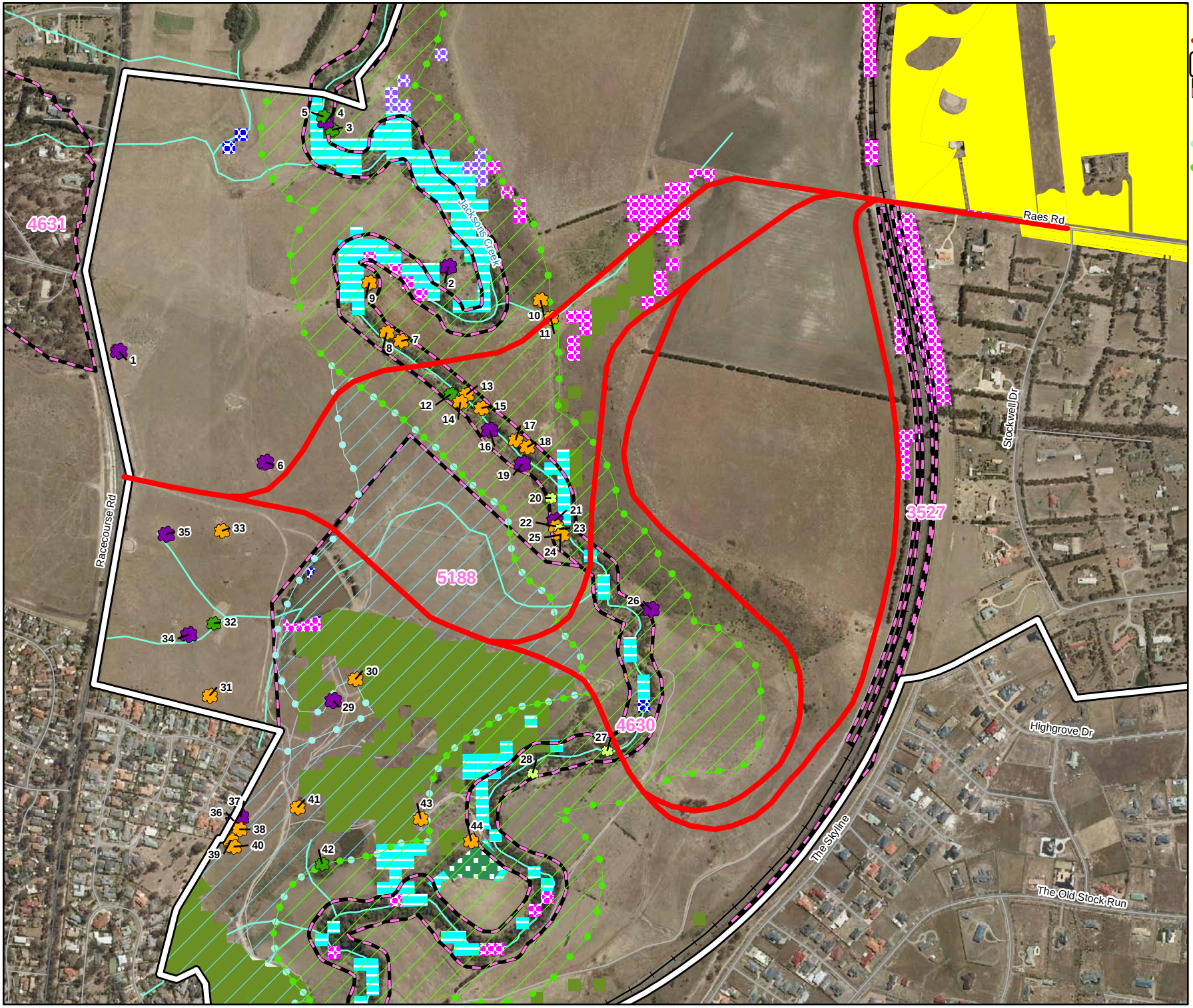
0 250 500
Metres

Figure 1b

Location of Study Area Southern Options

PSP 1074 and 1075 Jacksons Creek Road Crossings Project

ecology & heritage partners



Legend

- Study Area
- PSP Boundary
- BioSite Boundaries

Conservation Areas

- Area 20
- Area 21

Scattered Trees (not exhaustive)

- VLOT
- LOT
- MOT
- ST

Time-stamped Native Vegetation

- 125 Plains Grassy Wetland
- 132 Plains Grassland
- 47 Valley Grassy Forest
- 55 Plains Grassy Woodland
- 61 Box Ironbark Forest
- 641 Riparian Woodland
- 803 Plains Woodland
- 851 Stream Bank Shrubland

N

0 100 200
Metres

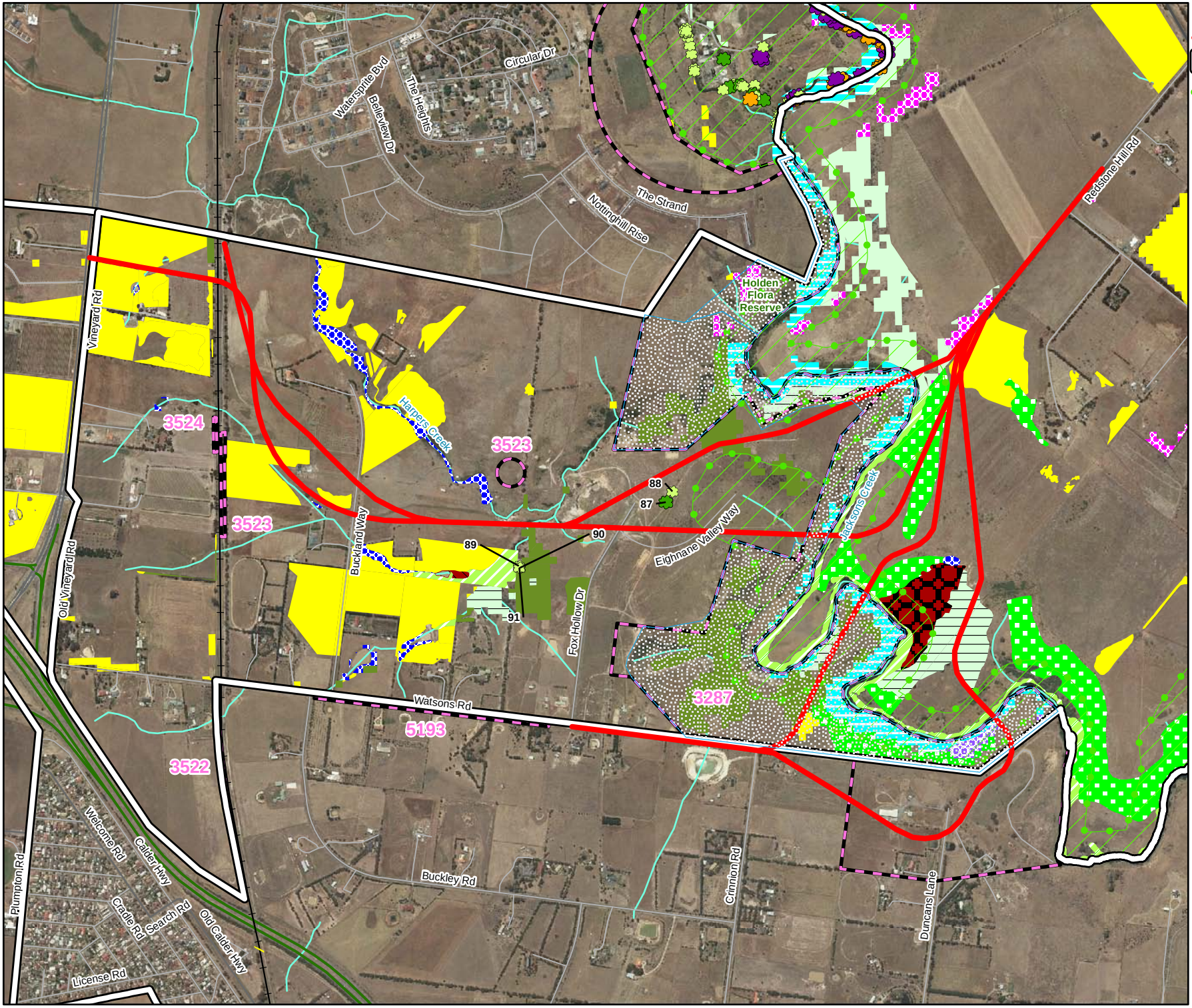
Figure 2a

Ecological Features Northern Options

PSP 1074 and 1075 Jacksons Creek Road Crossings Project

ecology & heritage partners

5808_NH_Map02a_Eco_NO 12/06/2014 cbrowning



Legend

- Study Area
- PSP Boundary
- Conservation Area 21
- BioSite Boundaries
- Holden Flora Reserve

Scattered Trees (not exhaustive)

- VLOT
- LOT
- MOT
- ST

Time-stamped Native Vegetation

- 125 Plains Grassy Wetland
- 132 Plains Grassland
- 175 Grassy Woodland
- 55 Plains Grassy Woodland
- 61 Box Ironbark Forest
- 64 Rocky Chenopod Woodland
- 641 Riparian Woodland
- 647 Plains Sedgy Wetland
- 68 Creekline Grassy Woodland
- 803 Plains Woodland
- 851 Stream Bank Shrubland
- 895 Escarpment Shrubland

N

0 180 360

Metres

Figure 2b

Ecological Features Southern Options

PSP 1074 and 1075 Jacksons Creek Road Crossings Project

ecology & heritage partners

5808_NH_Map02b_Eco_SO 12/06/2014 cbrowning

Legend

Study Areas

Significant Flora

- Arching Flax-lily
- Austral Tobacco
- Basalt Peppercress
- Black Roly-poly
- Fragrant Saltbush
- Large-headed Fireweed
- Matted Flax-lily
- Melbourne Yellow-gum
- Native Peppercress
- Plains Joyweed
- Rye Beetle-grass
- Slender Tick-trefoil
- Small Milkwort
- Spiny Rice-flower

Figure 3

Previously documented significant flora within 10km of the study areas

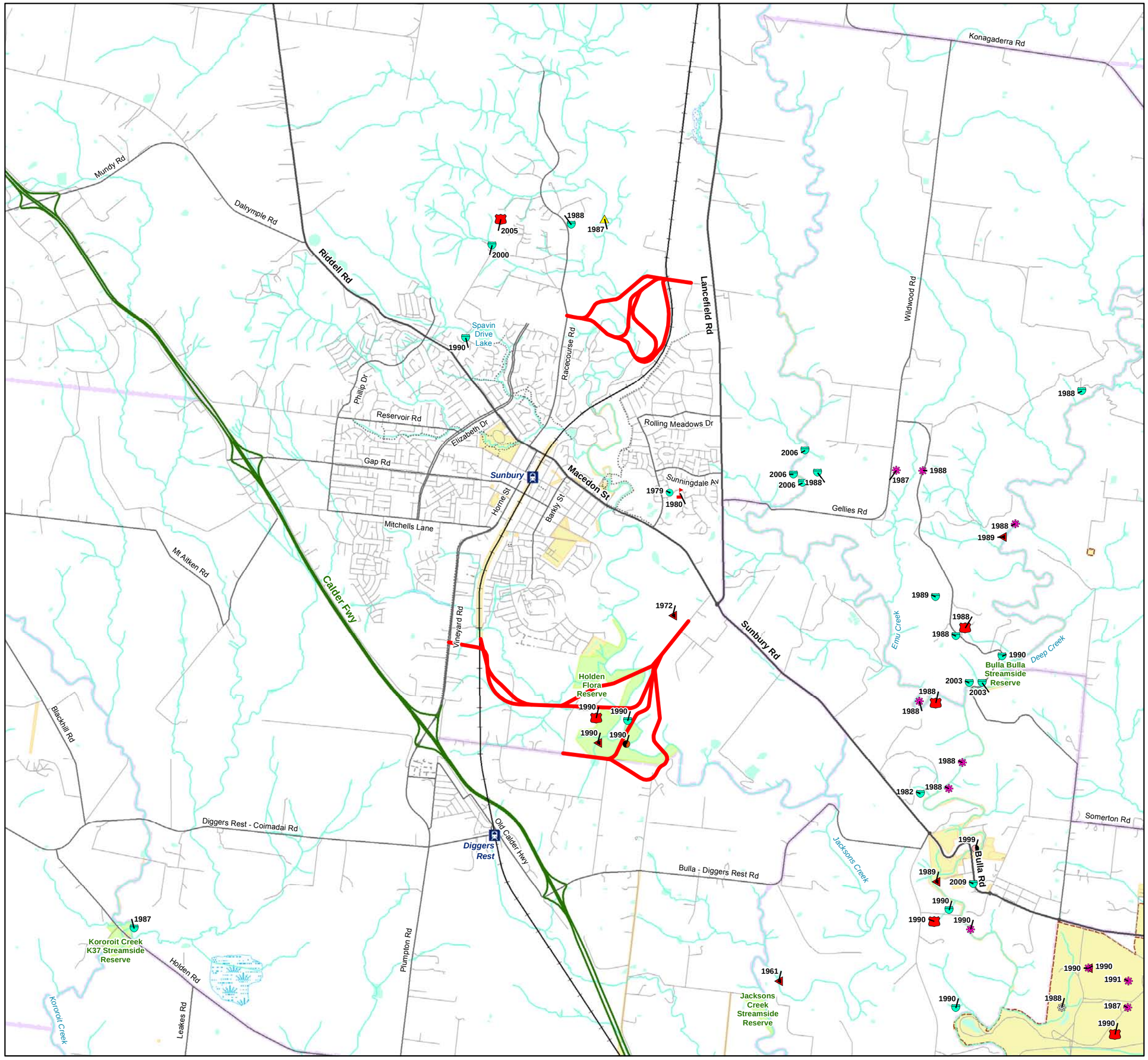
PSP 1074 and 1075 Jacksons Creek

N

0 1 2

Kilometres

ecology & heritage partners



Legend

- Study Areas

Significant Fauna

- Australasian Bittern
- Azure Kingfisher
- Black-eared Cuckoo
- Brown Toadlet
- Brown Treecreeper (south-eastern ssp.)
- Diamond Dove
- Diamond Firetail
- Eastern Barred Bandicoot
- Eastern Great Egret
- Fat-tailed Dunnart
- Golden Sun Moth
- Grassland Earless Dragon
- Growling Grass Frog
- Hooded Robin
- Latham's Snipe
- Lewin's Rail
- Nankeen Night Heron
- Painted Honeyeater
- Pied Cormorant

Figure 4

Previously documented significant fauna within 10km of the study areas

PSP 1074 and 1075 Jacksons Creek

N

0 1 2

Kilometres

ecology & heritage partners

Attachment A

Threatened Flora and Fauna Recorded Within 10 Kilometres of the Study Areas

Table A1 – Northern Link: Threatened Flora Recorded in the Project Locality

Scientific name	Common name	Total number of documented records	Last documented record	EPBC Act[1]	FFG Act[2]	DEPI[3]
NATIONAL SIGNIFICANCE						
# Amphibromus fluitans	River Swamp Wallaby-grass	-	-	VU	-	-
# Carex tasmanica	Curly Sedge	-	-	VU	L	v
# Dianella amoena	Matted Flax-lily	1	1998	EN	L	e
Diuris basaltica	Small Golden Moths	1	1904	EN	L	v
# Glycine latrobeana	Clover Glycine	-	-	VU	L	v
Lepidium hyssopifolium	Basalt Peppercress	1	1977	EN	L	e
# Pimelea spinescens subsp. spinescens	Spiny Rice-flower	2	2004	CR	L	e
# Prasophyllum frenchii	Maroon Leek-orchid	-	-	EN	L	e
# Rutidosis leptorhynchoides	Button Wrinklewort	-	-	EN	L	e
# Senecio macrocarpus	Large-headed Fireweed	5	2004	VU	L	e
# Xerochrysum palustre	Swamp Everlasting	-	-	VU	L	v
STATE SIGNIFICANCE						
Comesperma polygaloides	Small Milkwort	2	1984	-	L	v
Dianella sp. aff. longifolia (Benambra)	Arching Flax-lily	39	2005	-	-	v
Dianella tarda	Late-flower Flax-lily	1	2005	-	-	v
Eucalyptus leucoxylon subsp. connata	Melbourne Yellow-gum	15	2011	-	-	v
**Geranium sp. 3*	Pale-flower Crane's-bill	2	2012	-	-	r
Nicotiana suaveolens	Austral Tobacco	12	2011	-	-	r
**Podolepis sp. 1*	Basalt Podolepis	1	2004	-	-	e
Pterostylis truncata	Brittle Greenhood	1	1770	-	L	e
Rhagodia parabolica	Fragrant Saltbush	10	2011	-	-	r
Senecio cunninghamii var. cunninghamii	Branching Groundsel	2	1901	-	-	r

Scientific name	Common name	Total number of documented records	Last documented record	EPBC Act[1]	FFG Act[2]	DEPI[3]
Tripogon loliiformis	Rye Beetle-grass	1	1987	-	-	r
REGIONAL SIGNIFICANCE						
Alternanthera sp. 1 (Plains)	Plains Joyweed	1	2004	-	-	k
**Clematis decipiens*	Slender Clematis	1	1900	-	-	k
**Convolvulus angustissimus subsp. omnigracilis*	Slender Bindweed	3	2012	-	-	k
Desmodium varians	Slender Tick-trefoil	3	2006	-	-	k
Lepidium pseudohyssopifolium	Native Peppercress	1	1977	-	-	k
Sclerolaena muricata var. muricata	Black Roly-poly	3	1987	-	-	k

Notes: 1) Listed as Critically Endangered (CR), Endangered (E) or Vulnerable (V) under the EPBC Act

2) Listed (L) under the FFG Act

3) Listed as Endangered (e), Vulnerable (v), Rare (r) or Status Poorly Known (k) on the Victoria Advisory List (DSE 2005b)

- Records only identified from the EPBC Act Protected Matters Search Tool

Table A2 – Northern Link: Threatened Fauna Recorded in the Project Locality

Common name	Scientific name	Total number of documented records	Last documented record	EPBC Act[1]	FFG Act[2]	DEPI[3]
NATIONAL SIGNIFICANCE						
Birds						
Australasian Bittern	*Botaurus poiciloptilus*	1975	2	EN	L	en
Swift Parrot	*Lathamus discolor*	2007	6	EN	L	en
Regent Honeyeater	*Anthochaera phrygia*	1975	2	EN	L	cr
# Australian Painted Snipe	*Rostratula australis*	-	-	VU, M	L	cr
# Fairy Tern	*Sternula nereis*	-	-	VU	L	en
Mammals						
Spot-tailed Quoll	*Dasyurus maculatus maculatus*	1883	1	EN	L	en
# Grey-headed Flying-fox	*Pteropus poliocephalus*	-	-	VU	L	vu
# New Holland Mouse	*Pseudomys novaehollandiae*	-	-	VU	L	vu
Reptiles						
Grassland Earless Dragon	*Tympanocryptis pinguicolla*	1990	1	EN	L	cr
# Pink-tailed Worm-Lizard	*Aprasia parapulchella*	-	-	VU	L	en
# Striped Legless Lizard	*Delma impar*	-	-	VU	L	en
Amphibians						
Growling Grass Frog	*Litoria raniformis*	2009	20	VU	L	en
Fish						
Macquarie Perch	*Macquaria australasica*	1970	1	EN	L	en
# Australian Grayling	*Prototroctes maraena*	-	-	VU	L	vu
# Dwarf Galaxias	*Galaxiella pusilla*	-	-	VU	L	vu
Invertebrates						
Golden Sun Moth	*Synemon plana*	2008	5	CR	L	cr
STATE SIGNIFICANCE						
Birds						
Musk Duck	*Biziura lobata*	1976	3	-	-	vu
Australasian Shoveler	*Anas rhynchotis*	1977	2	-	-	vu
Hardhead	*Aythya australis*	1975	1	-	-	vu
Diamond Dove	*Geopelia cuneata*	1999	1	-	L	nt
White-throated Needletail	*Hirundapus caudacutus*	1990	6	M	-	vu
Eastern Great Egret	*Ardea modesta*	1980	10	M	L	vu
Intermediate Egret	*Ardea intermedia*	1975	1	-	L	en
Black Falcon	*Falco subniger*	1977	2	-	-	vu

Common name	Scientific name	Total number of documented records	Last documented record	EPBC Act[1]	FFG Act[2]	DEPI[3]
Baillon's Crake	*Porzana pusilla palustris*	1975	3	-	L	vu
Common Greenshank	*Tringa nebularia*	1977	1	M	-	vu
Red-chested Button-quail	*Turnix pyrrhothorax*	1956	1	-	L	vu
Powerful Owl	*Ninox strenua*	1975	1	-	L	vu
Barking Owl	*Ninox connivens connivens*	1975	1	-	L	en
Masked Owl	*Tyto novaehollandiae novaehollandiae*	1975	1	-	L	en
Brown Treecreeper (south-eastern ssp.)	*Climacteris picumnus victoriae*	1990	7	-	-	nt
Speckled Warbler	*Chthonicola sagittatus*	1990	4	-	L	vu
Diamond Firetail	*Stagonopleura guttata*	2005	5	-	L	nt
Mammals						
Brush-tailed Phascogale	*Phascogale tapoatafa*	1985	1	-	L	vu
Common Dunnart	*Sminthopsis murina murina*	1990	1	-	-	vu
Amphibians						
Brown Toadlet	*Pseudophryne bibronii*	1990	12	-	L	en
Southern Toadlet	*Pseudophryne semimarmorata*	1960	1	-	-	vu
Fish						
Southern Pygmy Perch	*Nannoperca australis*	2005	6	-	-	vu
REGIONAL SIGNIFICANCE						
Birds						
Nankeen Night Heron	*Nycticorax caledonicus hillii*	1976	2	-	-	nt
Whiskered Tern	*Chlidonias hybridus javanicus*	1975	1	-	-	nt
Azure Kingfisher	*Alcedo azurea*	1987	2	-	-	nt
Spotted Quail-thrush	*Cinclosoma punctatum*	1975	3	-	-	nt
Royal Spoonbill	*Platalea regia*	1975	1	-	-	nt
Latham's Snipe	*Gallinago hardwickii*	1979	3	M	-	nt
Mammals						
Fat-tailed Dunnart	*Sminthopsis crassicaudata*	1913	4	-	-	nt
Fish						
River Blackfish	*Gadopsis marmoratus*	1981	1	-	-	dd

Notes: 1) Listed as Critically Endangered (CR), Endangered (E), Vulnerable (V) or Migratory (M) under the EPBC Act

2) Listed (L) under the FFG Act

3) Listed as Critically Endangered (cr), Endangered (e), Vulnerable (v), Near Threatened (nt) or Data Deficient (dd) on the Victoria Advisory List (DSE 2009a, DSE 2013)

- Records only identified from the EPBC Act Protected Matters Search Tool

Table A3 – Southern Link: Threatened Flora Recorded in the Project Locality

Scientific name	Common name	Total number of documented records	Last documented record	EPBC Act[1]	FFG Act[2]	DEPI[3]
NATIONAL SIGNIFICANCE						
*# *Amphibromus fluitans*	River Swamp Wallaby-grass	1	1995	VU	-	-
# Caex tasmanica	Curly Sedge	-	-	VU	L	v
# Dianella amoena	Matted Flax-lily	-	-	VU	L	v
Diuris basaltica	Small Golden Moths	2	1906	EN	L	v
# Glycine latrobeana	Clover Glycine	1	1995	VU	L	v
Lepidium hyssopifolium	Basalt Peppercress	3	1982	EN	L	e
# Pimelea spinescens subsp. spinescens	Spiny Rice-flower	109	2010	CR	L	e
# Prasophyllum frenchii	Maroon Leek-orchid	-	-	EN	L	e
# Rutidosis leptorhynchoides	Button Wrinklewort	6	1982	EN	L	e
# Senecio macrocarpus	Large-headed Fireweed	12	2004	VU	L	e
STATE SIGNIFICANCE						
Allocasuarina luehmannii	Buloke	3	1996	-	L	-
Austrostipa breviglumis	Cane Spear-grass	1	1981	-	-	r
Austrostipa hemipogon	Half-bearded Spear-grass	1	1990	-	-	r
Botrychium australe	Austral Moonwort	1	1995	-	L	v
Calotis lappulacea	Yellow Burr-daisy	1	1983	-	-	r
Comesperma polygaloides	Small Milkwort	8	1986	-	L	v
Coronidium gunnianum	Pale Swamp Everlasting	1	1986	-	-	v
Cullen parvum	Small Scurf-pea	11	2006	-	L	e
Cullen tenax	Tough Scurf-pea	7	2002	-	L	e
Dianella sp. aff. longifolia (Benambra)	Arching Flax-lily	48	2006	-	-	v

Scientific name	Common name	Total number of documented records	Last documented record	EPBC Act[1]	FFG Act[2]	DEPI[3]
Dianella tarda	Late-flower Flax-lily	1	2005	-	-	v
Diuris palustris	Swamp Diuris	3	1979	-	L	v
Diuris punctata var. punctata	Purple Diuris	4	1982	-	L	v
Eleocharis plana	Flat Spike-sedge	1	1986	-	-	v
Eragrostis trachycarpa	Rough-grain Love-grass	1	1994	-	-	r
Eucalyptus leucoxylon subsp. connata	Melbourne Yellow-gum	17	2011	-	-	v
**Euphrasia scabra*	Rough Eyebright	1	1995	-	L	e
**Geranium sp. 3*	Pale-flower Crane's-bill	2	2012	-	-	r
Leiocarpa leptolepis	Pale Plover-daisy	1	1912	-	L	e
**Microseris scapgiera s.s.*	Plains Yam-daisy	1	1995	-	-	v
Nicotiana suaveolens	Austral Tobacco	17	2011	-	-	r
**Podolepis sp. 1*	Basalt Podolepis	1	2004	-	-	e
Pterostylis truncata	Brittle Greenhood	3	2002	-	L	e
Rhagodia parabolica	Fragrant Saltbush	17	2011	-	-	r
Rytidosperma setaceum var. brevisetum	Short-bristle Wallaby-grass	1	1994	-	-	r
Senecio cunninghamii var. cunninghamii	Branching Groundsel	5	1981	-	-	r
Tripogon loliiformis	Rye Beetle-grass	10	1995	-	-	r
REGIONAL SIGNIFICANCE						
Alternanthera sp. 1 (Plains)	Plains Joyweed	4	2006	-	-	k
Callitriche palustris var. palustris	Swamp Water-starwort	2	1978	-	-	k
**Convolvulus angustissimus subsp. omnigracilis*	Slender Bindweed	4	2012	-	-	k
Desmodium varians	Slender Tick-trefoil	7	2006	-	-	k
**Hypoxis vaginata var. brevistigmata*	Yellow Star	1	1995	-	-	k
Lepidium pseudohyssopifolium	Native Peppercress	3	1995	-	-	k

Scientific name	Common name	Total number of documented records	Last documented record	EPBC Act[1]	FFG Act[2]	DEPI[3]
Maireana aphylla	Leafless Bluebush	2	1982	-	-	k
Sclerolaena muricata var. muricata	Black Roly-poly	6	1987	-	-	k

Notes: 1) Listed as Critically Endangered (CR), Endangered (E) or Vulnerable (V) under the EPBC Act

2) Listed (L) under the FFG Act

3) Listed as Endangered (e), Vulnerable (v), Rare (r) or Status Poorly Known (k) on the Victoria Advisory List (DSE 2005b)

- Records only identified from the EPBC Act Protected Matters Search Tool

Table A4 – Southern Link: Threatened Fauna Recorded in the Project Locality

Common name	Scientific name	Total number of documented records	Last documented record	EPBC Act[1]	FFG Act[2]	DEPI[3]
NATIONAL SIGNIFICANCE						
Birds						
Australasian Bittern	*Botaurus poiciloptilus*	1950	3	EN	L	en
Plains-wanderer	*Pedionomus torquatus*	1949	5	VU	L	cr
Superb Parrot	*Polytelis swainsonii*	1846	1	VU	L	en
Red-tailed Black-Cockatoo	*Calyptorhynchus banksii graptogyne*	1846	1	EN	L	en
Swift Parrot	*Lathamus discolor*	2007	12	EN	L	en
Regent Honeyeater	*Anthochaera phrygia*	1933	2	EN	L	cr
# Australian Painted Snipe	*Rostratula australis*	-	-	VU, M	L	cr
# Fairy Tern	*Sternula nereis*	-	-	VU	L	en
Mammals						
Spot-tailed Quoll	*Dasyurus maculatus maculatus*	1883	1	EN	L	en
Eastern Barred Bandicoot	*Perameles gunnii*	2003	6	EN	L	rx
# Grey-headed Flying-fox	*Pteropus poliocephalus*	-	-	VU	L	vu
# New Holland Mouse	*Pseudomys novaehollandiae*	-	-	VU	L	vu
Reptiles						
Striped Legless Lizard	*Delma impar*	2001	2	VU	L	en
Grassland Earless Dragon	*Tympanocryptis pinguicolla*	1990	1	EN	L	cr
# Pink-tailed Worm-Lizard	*Aprasia parapulchella*	-	-	VU	L	en
Amphibians						
Growling Grass Frog	*Litoria raniformis*	2013	33	VU	L	en
Fish						
# Australian Grayling	*Prototroctes maraena*	-	-	VU	L	vu
# Dwarf Galaxias	*Galaxiella pusilla*	-	-	VU	L	vu
Invertebrates						
Golden Sun Moth	*Synemon plana*	2008	9	CR	L	cr
STATE SIGNIFICANCE						
Birds						
Musk Duck	*Biziura lobata*	1846	1	-	-	vu
Australasian Shoveler	*Anas rhynchotis*	1977	3	-	-	vu
Hardhead	*Aythya australis*	1987	3	-	-	vu
Diamond Dove	*Geopelia cuneata*	1999	1	-	L	nt
White-throated Needletail	*Hirundapus caudacutus*	1991	19	M	-	vu

Common name	Scientific name	Total number of documented records	Last documented record	EPBC Act[1]	FFG Act[2]	DEPI[3]
Eastern Great Egret	*Ardea modesta*	1991	15	M	L	vu
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	1846	1	-	L	vu
Grey Goshawk	*Accipiter novaehollandiae novaehollandiae*	1846	1	-	L	vu
Black Falcon	*Falco subniger*	1999	4	-	-	vu
Lewin's Rail	*Lewinia pectoralis pectoralis*	1991	1	-	L	vu
Australian Bustard	*Ardeotis australis*	1846	1	-	L	cr
Bush Stone-curlew	*Burhinus grallarius*	1846	1	-	L	en
Common Greenshank	*Tringa nebularia*	1977	1	M	-	vu
Barking Owl	*Ninox connivens connivens*	1933	1	-	L	en
Brown Treecreeper (south-eastern ssp.)	*Climacteris picumnus victoriae*	1991	19	-	-	nt
Speckled Warbler	*Chthonicola sagittatus*	1990	16	-	L	vu
Painted Honeyeater	*Grantiella picta*	1990	1	-	L	vu
Grey-crowned Babbler	*Pomatostomus temporalis temporalis*	1933	2	-	L	en
Hooded Robin	*Melanodryas cucullata cucullata*	1988	7	-	L	nt
Diamond Firetail	*Stagonopleura guttata*	2005	16	-	L	nt
Reptiles						
Bearded Dragon	*Pogona barbata*	1988	1	-	-	vu
Amphibians						
Brown Toadlet	*Pseudophryne bibronii*	1990	20	-	L	en
Fish						
Southern Pygmy Perch	*Nannoperca australis*	2005	4	-	-	vu
REGIONAL SIGNIFICANCE						
Birds						
Pied Cormorant	*Phalacrocorax varius*	1988	1	-	-	nt
Nankeen Night Heron	*Nycticorax caledonicus hillii*	1986	5	-	-	nt
Royal Spoonbill	*Platalea regia*	1989	5	-	-	nt
Spotted Harrier	*Circus assimilis*	1991	5	-	-	nt
Sooty Oystercatcher	*Haematopus fuliginosus*	1950	2	-	-	nt
Latham's Snipe	*Gallinago hardwickii*	1979	7	M	-	nt
Little Button-quail	*Turnix velox*	1846	1	-	-	nt
Whiskered Tern	*Chlidonias hybridus javanicus*	1846	1	-	-	nt
Black-eared Cuckoo	*Chrysococcyx osculans*	2000	3	-	-	nt
Azure Kingfisher	*Alcedo azurea*	1987	2	-	-	nt
Spotted Quail-thrush	*Cinclosoma punctatum*	1989	4	-	-	nt

Common name	Scientific name	Total number of documented records	Last documented record	EPBC Act[1]	FFG Act[2]	DEPI[3]
Reptiles						
Long neck tortoise	*Chelodina longicollis*	2011	1	-	-	dd
Fish						
River Blackfish	*Gadopsis marmoratus*	1981	1	-	-	dd

Notes: 1) Listed as Critically Endangered (CR), Endangered (E), Vulnerable (V) or Migratory (M) under the EPBC Act

2) Listed (L) under the FFG Act

3) Listed as Critically Endangered (cr), Endangered (e), Vulnerable (v), Near Threatened (nt) or Data Deficient (dd) on the Victoria Advisory List (DSE 2009a, DSE 2013)

- Records only identified from the EPBC Act Protected Matters Search Tool

Attachment B

Scattered Tree Data

Table B1. Northern Link - Scattered Trees (refer Figure 2a)

Parcel SPI	Tree #	Scientific name	Common name	DBH (cm)	Size Class	Conservation Significance	Bioregion	EVC	Latitude	Longitude
Q\PS435007	1	*Eucalyptus leucoxylon subsp. connata*	Melbourne Yellow Gum	160	VLOT	High*	VVP	EVC 61	-37.55516	144.73442
	2	*Eucalyptus camaldulensis*	River Red Gum	110	VLOT	High	VVP	EVC 851	-37.55378	144.74186
	6	*Eucalyptus leucoxylon subsp. connata*	Melbourne Yellow Gum	145	VLOT	High*	VVP	EVC 61	-37.55720	144.73765
	7	*Eucalyptus camaldulensis*	River Red Gum	96	LOT	High	VVP	EVC 851	-37.55509	144.74076
	8	*Eucalyptus camaldulensis*	River Red Gum	97	LOT	High	VVP	EVC 851	-37.55493	144.74044
	9	*Eucalyptus camaldulensis*	River Red Gum	72	LOT	High	VVP	EVC 851	-37.55403	144.74008
	10	*Eucalyptus camaldulensis*	River Red Gum	73	LOT	High	VVP	EVC 851	-37.55442	144.74391
	11	*Eucalyptus leucoxylon subsp. connata*	Melbourne Yellow Gum	71	LOT	High*	VVP	EVC 61	-37.55474	144.74413
	12	*Eucalyptus camaldulensis*	River Red Gum	65	MOT	High	VVP	EVC 851	-37.55606	144.74185
	13	*Eucalyptus camaldulensis*	River Red Gum	75	LOT	High	VVP	EVC 851	-37.55608	144.74219
	14	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	92	LOT	High	VVP	EVC 851	-37.55621	144.74206
	15	*Eucalyptus camaldulensis*	River Red Gum	83	LOT	High	VVP	EVC 851	-37.55633	144.74253
	16	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	128	VLOT	High	VVP	EVC 851	-37.55672	144.74270
	17	*Eucalyptus camaldulensis*	River Red Gum	95	LOT	High	VVP	EVC 851	-37.55691	144.74328
	18	*Eucalyptus camaldulensis*	River Red Gum	80	LOT	High	VVP	EVC 851	-37.55704	144.74353
	19	*Eucalyptus* spp.	Stag	115	VLOT	High	VVP	EVC 851	-37.55733	144.74342
	20	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	35	ST	High	VVP	EVC 851	-37.55796	144.74405
	21	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	110	VLOT	High	VVP	EVC 851	-37.55837	144.74412
	22	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	90	LOT	High	VVP	EVC 851	-37.55847	144.74414
	23	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	22	ST	High	VVP	EVC 851	-37.55852	144.74421
	24	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	22	ST	High	VVP	EVC 851	-37.55859	144.74424

Parcel SPI	Tree #	Scientific name	Common name	DBH (cm)	Size Class	Conservation Significance	Bioregion	EVC	Latitude	Longitude
	25	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	98	LOT	High	VVP	EVC 851	-37.55862	144.74425
	26	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	115	VLOT	High	VVP	EVC 851	-37.55999	144.74623
	27	*Eucalyptus camaldulensis*	River Red Gum	41	ST	High	VVP	EVC 851	-37.56250	144.74517
	28	*Eucalyptus camaldulensis*	River Red Gum	35	ST	High	VVP	EVC 851	-37.56286	144.74348
	29	*Eucalyptus camaldulensis*	River Red Gum	108	VLOT	Medium	VVP	EVC 61	-37.56149	144.73904
	30	*Eucalyptus melliodora*	Yellow Box	96	LOT	Medium	VVP	EVC 61	-37.56111	144.73955
	31	*Eucalyptus melliodora*	Yellow Box	86	LOT	Medium	VVP	EVC 61	-37.56134	144.73627
	32	*Eucalyptus* spp.	Stag	69	MOT	Medium	VVP	EVC 61	-37.56006	144.73640
	33	*Eucalyptus leucoxylon subsp. connata*	Melbourne Yellow Gum	91	LOT	High*	VVP	EVC 61	-37.55840	144.73663
	34	*Eucalyptus* spp.	Stag	180	VLOT	Medium	VVP	EVC 61	-37.56024	144.73584
	35	*Eucalyptus leucoxylon subsp. connata*	Melbourne Yellow Gum	110	VLOT	High*	VVP	EVC 61	-37.55845	144.73538
5~8\PP2174	36	*Eucalyptus microcarpa*	Grey Box	90	LOT	High	VVP	EVC 803	-37.54855	144.75021
	37	*Eucalyptus microcarpa*	Grey Box	100	LOT	High	VVP	EVC 803	-37.54841	144.75005
	38	*Eucalyptus melliodora*	Yellow Box	81	LOT	High	VVP	EVC 803	-37.54773	144.75079
	39	*Eucalyptus melliodora*	Yellow Box	95	LOT	High	VVP	EVC 803	-37.54726	144.75065
	40	*Eucalyptus melliodora*	Yellow Box	89	LOT	High	VVP	EVC 803	-37.54432	144.75004
	41	*Eucalyptus melliodora*	Yellow Box	55	MOT	High	VVP	EVC 803	-37.54429	144.74991
	42	*Eucalyptus melliodora*	Yellow Box	62	MOT	High	VVP	EVC 803	-37.54406	144.75005
	43	*Eucalyptus melliodora*	Yellow Box	65	MOT	High	VVP	EVC 803	-37.54390	144.75005
	44	*Eucalyptus melliodora*	Yellow Box	76	LOT	High	VVP	EVC 803	-37.54381	144.74981

Table B2. Southern Link - Scattered Trees (refer Figure 2b)

Parcel SPI	Tree #	Scientific name	Common name	DBH (cm)	Size Class	Conservation Significance	Bioregion	EVC	Latitude	Longitude
	87	*Eucalyptus microcarpa*	Grey Box	56	MOT	Medium	VVP	EVC 61	-37.60969	144.73600
	88	*Eucalyptus microcarpa*	Grey Box	38	ST	Low	VVP	EVC 61	-37.60935	144.73629
	89	*Eucalyptus camaldulensis*	River Red Gum	43	ST	Low	VVP	EVC 55_61	-37.61163	144.73000
	90	*Eucalyptus camaldulensis*	River Red Gum	45	ST	Low	VVP	EVC 55_61	-37.61169	144.73004
	91	*Eucalyptus camaldulensis*	River Red Gum	45	ST	Low	VVP	EVC 55_61	-37.61168	144.73002

Appendix D

Preliminary Cultural Heritage Assessment

ecology & heritage partners

Draft Report

Preliminary Cultural Heritage Study (Master Document) Jacksons Creek Road Crossings, Sunbury, Victoria

Prepared for

GTA

June 2014

Ecology and Heritage Partners Pty Ltd

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- Alex Blackett (GTA);
- Office of Aboriginal Affairs Victoria; and
- Heritage Victoria.

SUMMARY

Ecology and Heritage Partners has completed this Preliminary Cultural Heritage Study report as requested by GTA for two proposed road crossing sites over Jacksons Creek located at Sunbury, Victoria. The purpose of the study was to identify Aboriginal and historical cultural heritage values that may be present within the study area. Information gathered throughout the assessment was used to determine potential legislative implications (associated with cultural heritage values) and to identify the cultural heritage constraints and opportunities within the study areas and inform the siting and design of future alignment options.

The proposed crossing alignments intersect several places of Aboriginal and Historic Heritage. The density of Aboriginal places within proximity to the alignments, the presence of year-round water and the distinctive gorge and escarpment landforms, all suggest significant areas of archaeological potential are likely to occur with the study area. These areas of known and potential archaeological heritage represent several categories of Aboriginal Places including stone quarries and cultural places such as the Sunbury earth rings associated with the landforms along Jackson's Creek. The information provided in this Master Document informs the separate *opportunity and constraints* assessments for the Northern and Southern Link road alignments and Jackson Creek crossings. The Cultural Heritage Study report can also be employed during consultation with the Traditional Owners, the Wurundjeri Tribe Land and Cultural Heritage Compensation Council, and provides the archaeological data that can inform the alignment decisions where they will likely impact existing Aboriginal heritage places. Whilst providing the currently known archaeological context of the proposed Jackson's Creek crossings, it should be noted that large areas of the study area have not been subject to detailed studies and remain archaeologically unknown. Similarly no subsurface testing has occurred in the study areas and whilst extensive, the current archaeological record likely represents only a fraction of the archaeological heritage that exists in the creek corridor beneath the ground surface. In addition, this report does not account for the cultural significance that the Wurundjeri ascribe to heritage places and cultural landscapes within the study area.

CONTENTS

1 INTRODUCTION

Ecology and Heritage Partners Pty Ltd were commissioned by GTA to prepare this Preliminary Cultural Heritage Study for two proposed road crossing locations over Jacksons Creek located at Sunbury, Victoria (hereafter referred to as the 'study area- northern section and southern section').

The purpose of the assessment was to identify Aboriginal and historical cultural heritage values that may be present within the study area. Information gathered throughout the assessment was used to determine potential legislative implications (associated with cultural heritage values) for the proposed development works within the study area. This master document provides all the background information, data and references that inform the two separate *Opportunities and Constraints* documents for the two proposed Northern Link and Southern Link road and bridge alignments.

1.1 Ecology and Heritage Partners Pty Ltd Cultural Heritage Division

Ecology and Heritage Partners Pty Ltd is a professional cultural heritage and ecological consultancy providing high quality technical services in the field of Aboriginal and historical cultural heritage assessment, Cultural Heritage Management Plans (CHMPs), ecological assessment, research and management. The business provides effective and innovative cultural and natural heritage advice to a range of state and local government authorities/agencies, corporate and private clients.

The Cultural Heritage Division of Ecology and Heritage Partners is led by Oona Nicolson (Director and Principal Heritage Advisor) who has completed over 700 cultural heritage consulting projects as well as numerous other Aboriginal and historical assessments. The current report was authored by Pamela Ricardi and Dr Dan Cummins, senior archaeologists and Cultural Heritage Advisors at Ecology and Heritage Partners.

1.2 Heritage Legislation

Legislation relevant to the preparation of this Preliminary Cultural Heritage Study includes the *Aboriginal Heritage Act 2006*, the *Victorian Planning and Environment Act 1987* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

2 PROJECT METHODS

The following tasks were undertaken in preparation of the Preliminary Cultural Heritage Study and Constraints and Opportunities reports:

1. A review of available literature was undertaken using resources such as the Office of Aboriginal Affairs Victoria (OAAV) and Heritage Victoria, and the Ecology and Heritage Partners library of reports and knowledge of the area. A desktop study, with all relevant cultural heritage databases and mapping programs, was examined including:

- the Victorian Aboriginal Heritage Register (VAHR);
- the Victorian Heritage Register (VHR);
- the Victorian Heritage Inventory (VHI);
- the Heritage Overlay to the City of Hume Planning Scheme;
- the National Trust (Victoria) Register;
- National, Commonwealth and International Heritage Lists;
- Relevant federal and state legislation and policies.

2. Provide a brief review of land use for the study area;

3. Conduct a site inspection of the subject site by a qualified cultural heritage advisor to identify any Aboriginal and/or historical cultural heritage within the study area;

4. Provide information in relation to any implications of Commonwealth and State environmental legislation and Government policy associated with the proposed development;

5. Discuss any opportunities and constraints associated with the study area; and

6. Presentation of the results in this master document (Preliminary Cultural Heritage Study) and the , Constraints and Opportunities reports for the Northern and Southern Link Jacksons Creek Road Crossings.

2.1 Limitations

The cultural heritage information used to inform this Preliminary Cultural Heritage Study is limited to that obtained through desktop assessment and a brief site visit. Data and information held within the cultural heritage databases and mapping programs are likely to not wholly represent the presence or absence of cultural heritage places as many areas have not been thoroughly assessed for cultural heritage sites. More specifically, subsurface excavations have not been undertaken anywhere in the study areas and the extent of known Aboriginal Places is derived entirely from surface survey. As such, buried Aboriginal Places including those of high significance such as burials may occur within the study area.

In addition, this report is an opportunity to provide a historical context for understanding the study area and to identify potential areas that may contain Aboriginal or historical sites. Therefore, the results presented are

only preliminary and further detailed assessments may be required to determine the presence or otherwise of any cultural heritage values and associated legislative implications.

3 RESULTS

3.1 Aboriginal Cultural Heritage

The section reviews the Aboriginal context of the activity area and includes an examination of historical and ethnohistorical sources, previously recorded Aboriginal archaeological site types and locations in the geographic region of the activity area, and previous archaeological studies undertaken in the area. Together, these sources of information can be used to formulate a predictive statement concerning what types of sites are most likely to occur in the activity area, and where these are most likely to occur.

Archaeological evidence suggests that Aboriginal peoples had occupied all of Australia's environmental zones by 40,000 years BP. Sites such as Keilor and Bend Road in Melbourne and Box Gully on the northern shore of Lake Tyrell have dates extending back to 30–35,000 BP (Flood 1995: 286, Hewitt and Allen 2010, Richards et al. 2007).

3.1.1 Geomorphology and Geoarchaeological Context

The activity area comprises undulating plains which developed on the older Newer Volcanic lavas that formed in the Late Pliocene and during the Pleistocene, from about two million years ago and up to one million years ago (DEPI 2014). In these landscapes, flow boundaries are obvious, and corestones ('floaters') are often noticeable at the surface. The Volcanic Plains are described as "plains mainly on basalt lavas with many volcanic landforms and lakes; partly on weak sedimentary rock" (Duncan 1982: 3). They are made up of subdued topography which have been filled and covered by a relatively thin (<50m thick) 'blanket' of lava flow (Birch 2003: 367). The study area (northern and southern sections) consists of sheetflow basalt, undifferentiated Ordovician sedimentary rocks and unnamed alluvium.

The lava of the Victorian Volcanic Plains region represents the youngest phase of volcanic activity in Victoria, which was active from 4.6 million years ago to within (geologically) recent times (Late Pleistocene – Early Holocene). Although the flows have been grouped into 'Older' and 'Newer' Volcanics groups, there was not two separate volcanic events. Rather, "volcanism has continued intermittently over 190 million years and the Newer and Older Volcanics represent volumetric peaks at around 42-57 million years ago and 0-5 million years ago" (Birch 2003: 361; Price et al. 1988: 439-451).

The Volcanic Plains are part of the Newer Volcanics, comprising of extrusive tholeiitic through to alkaline basalts, with minor scoria and ash, and valley-filling basalts (Duncan 1982: 13). The basalts of the Newer Volcanics can be up to 120m thick where lava has filled valleys, though most are less than 70m thick (typically from 2m to 10m thick on the plains such as the activity area) and cover 15,000km^2. The Newer Volcanics includes around 200 scoria cones, over 50 lava tubes, 40 maars and 200 lava volcanoes.

The soils of the basaltic areas are predominantly shallow red and yellow duplex with deeper red and grey loam along water courses/drainage lines and depressions (Ross et al. 2003: 2). Specifically, the Volcanic Plains areas typically have red clay soils which can be several metres deep, and are characterised by buckshot (pisolitic ironstone concretions). Expansion and contraction of these clay soils is known to form irregular surface depressions and rises within the plains known as 'gilgai' (Birch 2003: 553).

3.1.2 History and Ethnohistory

The land to the north of Port Phillip Bay was the traditional location of the *Woi wurrung* people. At the time of European contact, the Sunbury area and the surrounding region lay within the traditional lands of people from the *Woi wurrung* language group. This language group is believed to have occupied the Yarra and Maribyrnong watersheds, bounded on the north by the Dividing Range from Mount Baw Baw eastward to Mount William and Mount Macedon and on the west by the Werribee River (Clark 1990: 379).

The *Woi wurrung* shared a cultural and linguistic affinity with the *Bun wurrung, Ngurai-illam wurrung*, *Djadja wurrung*, *Wada wurrung* and *Duang wurrung* language groups. Collectively these groups were known as the Kulin Nation occupying the south central Victorian region (Howitt 1904). This cultural grouping shared similarities in speech, burial practices, initiation, kinship marriage ties and religious beliefs. The language groups within the Kulin Nation adhered to a patrilineal descent system and the *Bunjil/Waa* moiety system. Each clan within the Kulin Nation language groups belonged to either one of two moieties; *Bunjil* (eaglehawk) and *Waa* (crow). Marriage partners were taken from the opposite moiety and membership in the moiety had religious, economic and social implications and obligations that transcended local allegiances and clans (Barwick 1984). The *Woi wurrung* were divided into four clans and each clan was responsible for a specific section of *Woi wurrung* territory. The clan responsible for the Sunbury area was the *Marin balug. Marin balug* in traditional East Kulin language means 'people from the big water, the Saltwater River' (Clark 1990:384).

In 1839 the Aboriginal protectorate scheme was introduced in Victoria. Aboriginal reserves and stations were established across Victoria and Aboriginal peoples were encouraged to move to them. *Woi wurrung* clans moved to the reserves and stations set up at Narre Narre Warren, Mordialloc, Warrandyte, and on the Acheron River. The Protectorate was largely unsuccessful and was disbanded in 1849. By the turn of the century only a small population of Aboriginal people lived on the missions and government stations, with most living and working in the same general area. The last missions and stations were phased out in the 1920s (Presland 1997:100).

Today the descendants of the *Wurundjeri willam* clan of the *Woi Wurrung* language group are represented by the Wurundjeri Tribe Land and Compensation Cultural Heritage Council Inc. (Wurundjeri). The Wurundjeri are the Registered Aboriginal Party (RAP) for the study area.

4 LEGISLATIVE AND POLICY IMPLICATIONS

Environment Protection and Biodiversity Conservation Act 1999

There are no known cultural heritage sites of National Significance. It is considered unlikely that any cultural heritage sites of National Significance will be located in the study area. Therefore no referral or further works would be required under the EPBC Act 1999.

Planning and Environment Act 1987

There are several sites listed on the Heritage Overlay under Hume City Council Planning Scheme that intersect with the some of the proposed crossing alignments.

Implications for the project

A planning permit from Hume City Council will be required to remove, impact or destroy any Heritage Overlay sites located within the study area. Additional studies may be required to inform this permit application.

Heritage Act 1995

This Act protects all non-Aboriginal heritage sites older than 50 years. If a site is of State Significance it is listed on the Victorian Heritage Register and a Permit from Heritage Victoria (HV) is required to disturb it. If an archaeological site is not of State significance it is usually listed on the Victorian Heritage Inventory (VHI) and Consent from Heritage Victoria would be required to disturb it.

Implications for the project

There are several historical place listed on the Victorian Heritage Register within 1 km of the study area, and intersect with several of the proposed alignments. If the selected crossing and road alignments/routes intersect with these historical places further historical heritage investigations will likely be required.

Aboriginal Heritage Act 2006

The *Aboriginal Heritage Act 2006* protects Aboriginal heritage in Victoria. If certain high impact activities are undertaken as stated in the *Aboriginal Heritage Regulations 2007* (revised 2009) then preparation of an Aboriginal Cultural Heritage Management Plan (CHMP) may be required to be approved by the OAAV or the Registered Aboriginal Party (RAP) prior to lodging a planning permit.

Triggers for mandatory preparation of a CHMP include whether certain criteria are met under the Regulations, required by the Minister, or if the activity requires an Environmental Effects Statement (EES) under Sections 46 to 49 of the *Environmental Effects Act 1978*.

The Regulations require a mandatory CHMP if:

1. All or part of the proposed activity is a high impact activity; and
2. All or part of the activity area (study area) is an area of cultural heritage sensitivity (subject to whether the entire area of cultural heritage sensitivity has been subject to *significant ground disturbance*).

'Significant ground disturbance' is defined in r.4 of the Regulations as meaning disturbance of – (a) the topsoil or surface rock layer of the ground; or (b) a waterway – by machinery in the course of grading, excavating, digging, dredging or deep ripping, but does not include ploughing other than deep ripping (O AAV 2010: 2). Few areas of significant ground disturbance occur within the study area, thus the requirement to prepare a CHMP stands.

Implications for the project

The proposed road and bridges crossing Jacksons Creek will require a mandatory CHMP as it is both a high impact activity (r. 44[e]) and occurs in areas of Cultural Heritage Sensitivity associated with a 200m corridor around Jacksons Creek (r. 23) and within 50m of several Aboriginal Places (r. 22[2]). Nonetheless, the results of the current report can inform the preparation of a CHMP. In particular the desktop component of the CHMP can be met by the current study to identify the cultural heritage requirements of the project as determined by the *Aboriginal Heritage Act 2006.* Furthermore, early stakeholder (Wurundjeri) engagement during the forthcoming stage of the project will form a framework for understanding and adapting the (final) project to meet (and exceed) the requirements of the *Aboriginal Heritage Act 2006.*

4.1 Conclusions and Recommendations

The proposed crossing alignments intersect several places of Aboriginal and Historic Heritage. The density of Aboriginal places within proximity to the alignments, the presence of year-round water and the distinctive gorge and escarpment landforms, all suggest significant Aboriginal heritage and areas of archaeological potential occur with the study area. Known areas of archaeological heritage point toward extensive areas of high archaeological sensitivity adjacent to the proposed creek crossings. These areas of known and potential archaeological heritage will need to be further assessed and mapped during forthcoming stages of the project and during the preparation of CHMPs for the road corridors. In addition, consultation with the Wurundjeri should be initiated to identify any cultural values associated with archaeological places and cultural landscapes within the study areas. The information in this report can be employed to assist consultation with the Wurundjeri during field inspection and preparation of additional heritage studies that can further refine alignment decisions based on identification of areas of (lower) Aboriginal heritage significance.

Given the incomplete archaeological understanding of the study area and the likelihood that additional surface and especially subsurface Aboriginal heritage occurs in the study area, it is recommended that the proponents retain several crossing options during preparation of Cultural Heritage Management Plans for the crossing locations. Should significant subsurface heritage such as burials, earth rings or significant campsites be identified during assessment for the crossings; retention of alternative alignments would enable the proponent to avoid such highly significant places without re-engineering the entire road infrastructure or conducting extensive salvage excavations (and in keeping with Section 61 of the *Aboriginal Heritage Act 2006*). Thus preparation of a CHMP is recommended at the earliest possible stage of the project following commissioning of the road.

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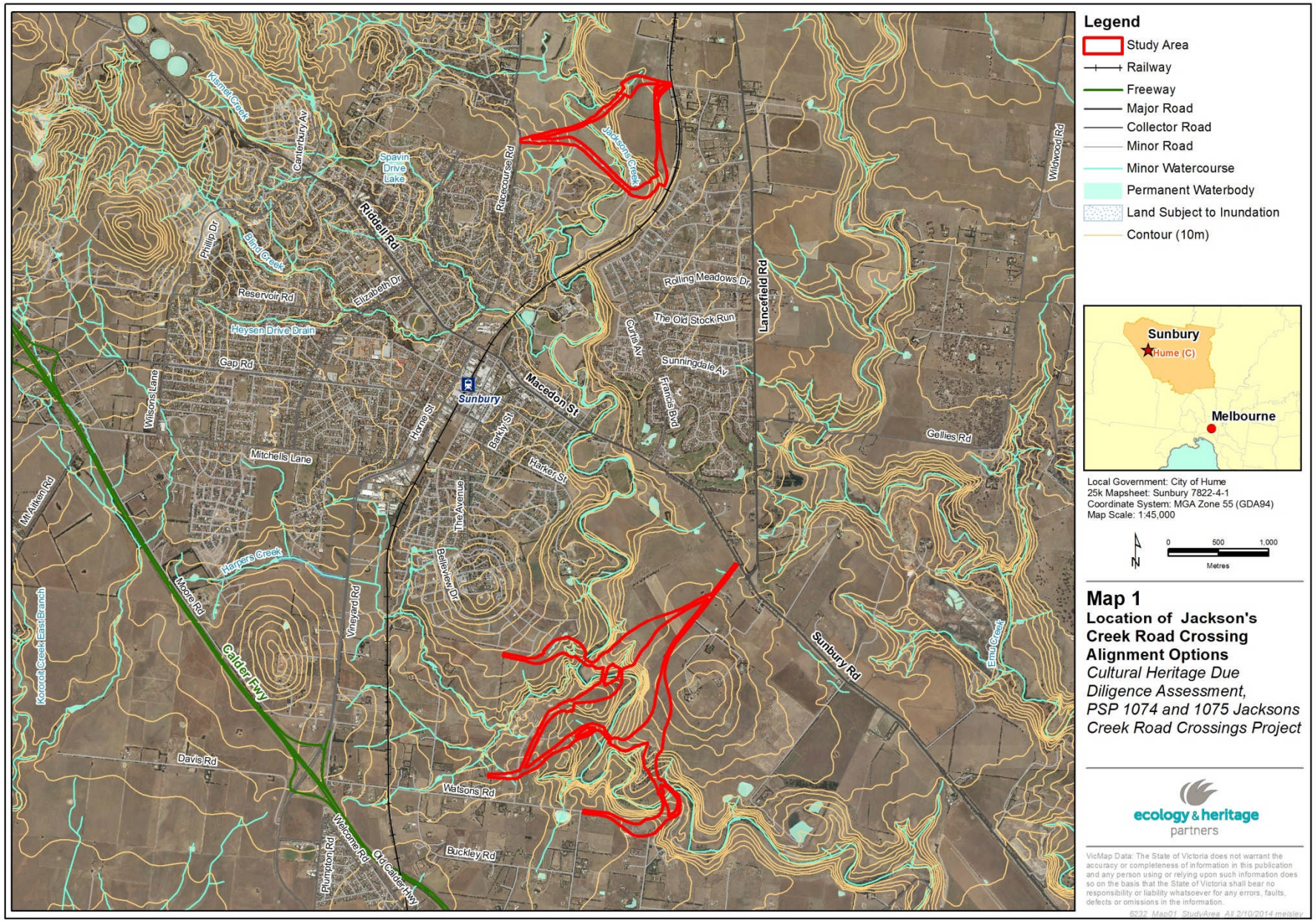
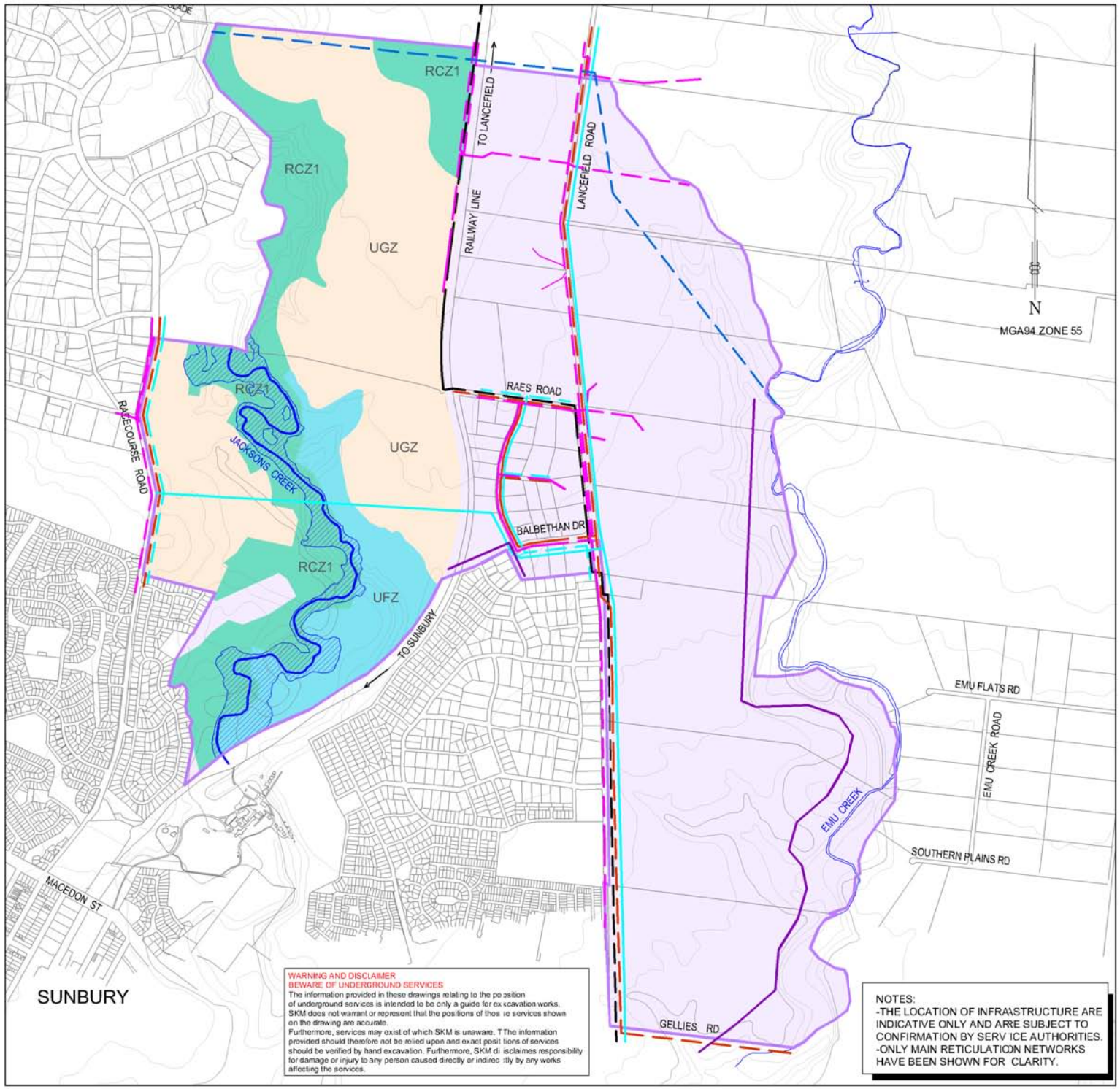
MAP


Legend
Study Area
Railway
Freeway
Major Road
Collector Road
Minor Road
Minor Watercourse
Permanent Waterbody
Land Subject to Inundation
Contour (10m)
Sunbury
Hume (C)
Melbourne
Local Government: City of Hume
25k Mapsheet: Sunbury 7822-4-1
Coordinate System: MGA Zone 55 (GDA94)
Map Scale: 1:45,000
0
500
1,000
Metres
Map 1
Location of Jackson's Creek Road Crossing Alignment Options
Cultural Heritage Due Diligence Assessment, PSP 1074 and 1075 Jacksons Creek Road Crossings Project
ecology & heritage partners
VicMap Data: The State of Victoria does not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that the State of Victoria shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.
6232_Map01_StudyArea_A3 2/10/2014 melsley
Kismet Creek
Canterbury Av
Spavin Drive Lake
Riddell Rd
Racecourse Rd
Jacksons Creek
Wickwood Rd
Phillip Dr
Blind Creek
Reservoir Rd
Elizabeth Dr
Heysen Drive Drain
Cap Rd
Wilsons Lane
Sunbury
Macedon St
Horne St
Barkly St
Curtis Av
Rolling Meadows Dr
The Old Stock Run
Sunningdale Av
Francis Blvd
Lancefield Rd
Gellies Rd
Mitchells Lane
Harker St
The Avenue
Bellaview Dr
Vineyard Rd
Mt Aitken Rd
Kororoit Creek East Branch
Harpers Creek
Moore Rd
Calder Fwy
Davis Rd
Watsons Rd
Welcome Rd
Old Calder Hwy
Plumpton Rd
Buckley Rd
Sunbury Rd
Emu Creek

Appendix E

Lancefield Road and Sunbury South PSP High Level Servicing Assessments – Existing and Proposed Services (SKM, 2013)



LEGEND

- PSP BOUNDARY
- URBAN FLOOD WAY ZONE (UFZ)
- RURAL CONSERVATION ZONE(RCZ)
- URBAN GROWTH ZONE (UGZ)

PROPOSED
- WATER
- SEWER

EXISTING
- NEXTGEN - Cable
- TELECOMMUNICATIONS
- WATER
- ELECTRICITY
- MWC WATER MAIN

REV	DATE	DRAWN	REV'D	APP'D	REVISION
01	6/11/2013	JW			ISSUED AS REPORT ATTACHMENT

DRAWING STATUS

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CLIENT: GROWTH AREA AUTHORITY

PROJECT: INFRASTRUCTURE AND SERVICING REPORT

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
JW	JS/MO	DATE	DATE
DESIGNED	DESIGN REVIEW		
JS	DK		

TITLE

PSP No. 1075 LANCEFIELD ROAD SERVICING LAYOUT PLAN

SCALE	DRAWING No	REV
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A3

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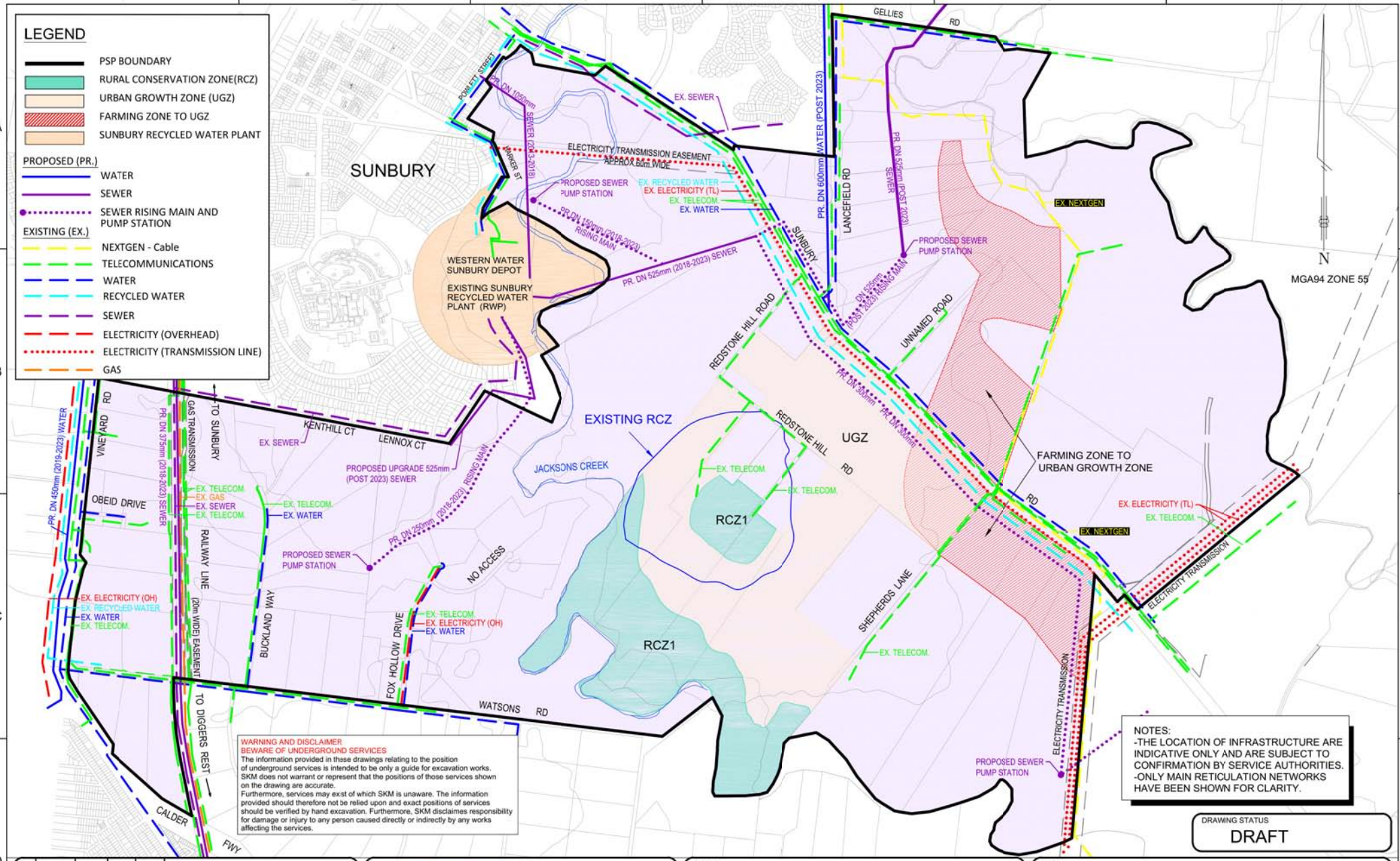

REV	DATE	DRAWN	REV'D	APP'D	REVISION
01	11/11/2013	JW	MC/JS	JS	ISSUED AS REPORT ATTACHMENT

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PROJECT: INFRASTRUCTURE AND SERVICING REPORT

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
JW	JS/MO		
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE: PSP No. 1074 SUNBURY SOUTH SERVICING LAYOUT PLAN

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Appendix F

Meeting Minutes – Workshop 1

Meeting Minutes

Job No:	14M1881000	**GTA Rep:**	TC, AB	**Date:**	17 June 2014
Job Name:	Jacksons Creek Road Crossings – Workshop 1			**Time:**	3:00pm
Client:	Metropolitan Planning Authority (MPA)			**Location:**	Hume Council Offices
Purpose:	Project Workshop 1				

Attendees:	• Mat Garner, John Petrakos (MPA) • Mark Burton (PTV) • Frank Deserio (VicRoads) • Andrew Johnson, Sarah Kernohan, Amanda Dobb (Hume CC) • Adam Davidson, Phil McCutcheon, Mary-Anne Carmody, Leah Wittingslow (land owners / other) • Tom Courtice (Chair), Alex Blackett (GTA Consultants)
Apologies:	None
Distribution:	All Attendees

Item	Discussion Topic	Action By
1	**<u>Workshop Context & Purpose</u>**	

i	• ***Broad context / purpose of project:***
	  • To prepare a robust assessment of options for road crossings of Jacksons Creek to guide the preparation of the Sunbury South and Lancefield Road Precinct Structure Plans, as well as wider road network planning.
	  • Assessment will take into account cost, engineering feasibility, transport network design, land use, cultural heritage, biodiversity values, hydrological and landscape impact.
	  • Culminating in concept designs and cost estimates for two preferred options.
		Note

ii	• ***Workshop objectives:***
	  • Provide an overview of wider study area
	  • To present initial findings on the study areas (characteristics and significant features)
	  • To discuss likely importance / significance of various features
	  • To discuss initial feasibility constraints based on example alignments
	  • To discuss the suggested road standards (allowance for two road types)
	  • Present initial assessment criteria and that a comparative assessment will be used to identify the preferred alignment
	  • Highlight additional relevant information to be provided to study team
	  • Identify 'refined' study areas based on key constraints
	  • Agree next steps to progress to Workshop 2 (Assessment Framework)
		Note

2	**<u>Wider Study Area</u>**	

i	• ***Sunbury Town Centre***:
	  • Already congested with limited number of alternatives for through traffic – how is this expected to be managed?
	  • Need to better understand the existing and future traffic conditions
	  • Need to consider the impact of providing and not providing the additional Jacksons Creek road crossings
	  • Is there potential for any additional local road crossings over Jacksons Creek in the area, whether connecting the Growth Areas or not
		Council /MPA [1]

ii	• ***Sunbury South Growth Area:***
	  • Preliminary concept plan has been prepared but is subject to the alignment and type of Jacksons Creek road crossing
	  • Any arterial road should go near but not through the activity centre
		Note

iii	• ***Lancefield Road Growth Area:***
	  • Preliminary concept plan has been prepared but is subject to the alignment and type of Jacksons Creek road crossing, as well as the number and type of crossings of the rail line.
	  • Any arterial road should go near but not through the activity centre
		Note

3	**<u>Transport Network</u>**	

i	• ***Rail:***
	  • Railway station locations to be confirmed
	  • Status of existing rail crossings within the Lancefield Road Growth Area
	  • Interim and ultimate rail crossing numbers and types within the Lancefield Road Growth Area
		PTV

Ii	• ***Bus:***
	  • Bus routes through growth areas is yet to be defined
	  • Bus services are expected to be accommodated on the road crossings of Jacksons Creek
	  • What grades would be considered acceptable given the site constraints that exist
		Note

iii	• ***Pedestrians & Cyclists:***
	  • Pedestrian and bicycle routes through growth areas will be consistent with road design requirements
	  • Pedestrian and bicycle routes are expected to be accommodated along the road crossings of Jacksons Creek
		Note

4	**<u>Cultural Heritage & Biodiversity Values</u>**	
i	• Further detail to help distinguish what areas are more significant	MPA

	than others	
5	**<u>Two Road Types (Arterial & Collector)</u>**	

i	• ***Arterial:***
	  • Outline grade, speed, carriageway, parking and path characteristics to be achieved
	  • Consideration should be given to the nature of the study areas and site constraints (i.e. Alpine Road design standards)
		VicRoads

ii	• ***Collector:***
	  • Outline grade, speed, carriageway, parking and path characteristics to be achieved
	  • Consideration should be given to the nature of the study areas and site constraints (i.e. >50km/h corners)
		Council

iii	• ***Road Funding:***
	  • Consider whether the proposed Jackson Creek road crossings are of State significance
	  • Obtain legal advice on the ability to use GAIC funding for a non-arterial road crossing
		MPA [1]

6	**<u>Consultation</u>**	

i	• ***'Wider Community Groups':***
	  • Consists of specific community groups that have indicated a vested interest in Jacksons Creek
	  • The wider community groups are not being consulted on the 'need' for additional road crossings of Jacksons Creek
		Note

ii	• ***Workshop 2:***
	  • Proposed to occur on 16 July 2014
	  • Specific invitee list to be developed
	  • Confirmation, invitation and venue booking required
		MPA / Council

7	**<u>Refined Study Area</u>**	
i	• ***Sunbury South Growth Area:*** • Four general alignment areas have been identified for further investigation	GTA
ii	• ***Lancefield Road Growth Area:*** • Two general alignment areas have been identified for further investigation	GTA
6	**<u>Other Assessment Inputs</u>**	

i	• ***Initial Modelling of Road Alignments:***
	  • Investigate ways to balance cut and fill quantities
	  • Consider angling the bridge (i.e. not necessarily flat)
		GTA

Ii	• ***Board Level (Order of Magnitude) Costs:*** • Provide board level (order of magnitude) costs for road versus	GTA

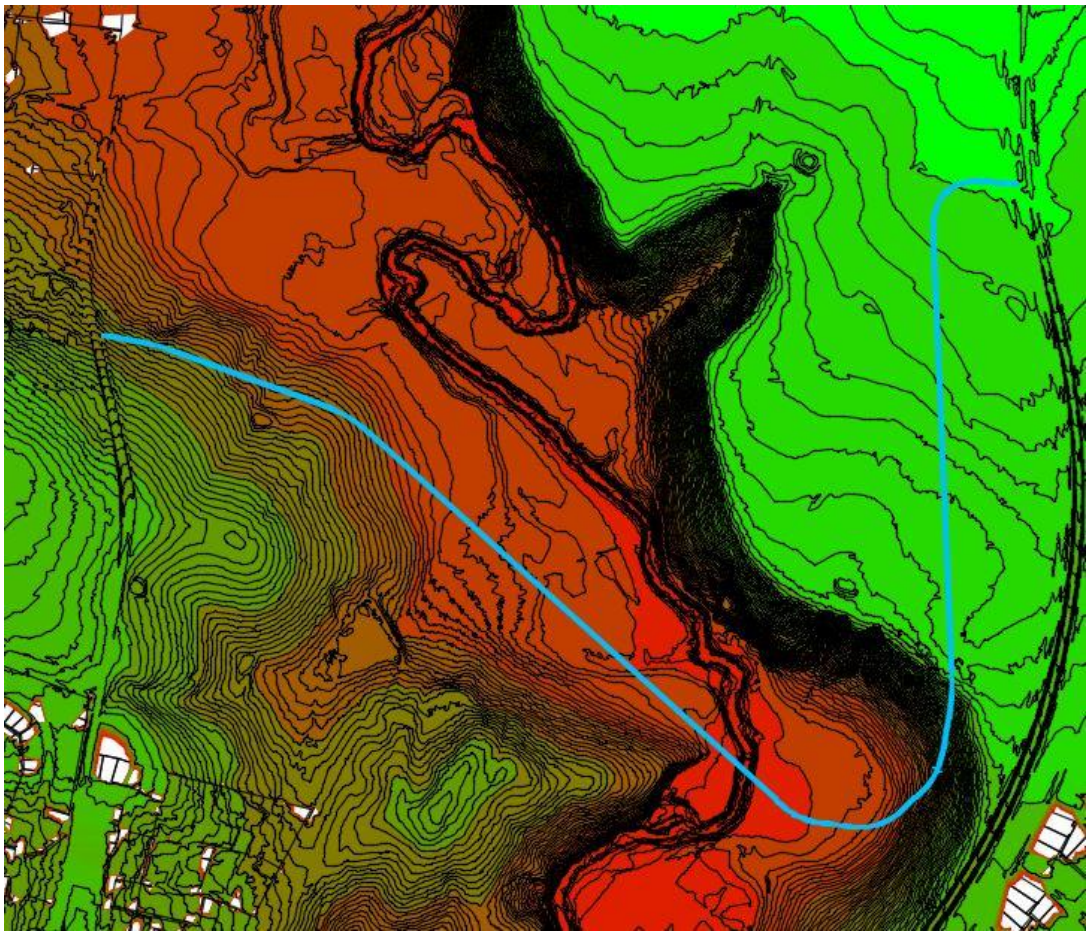
	bridge construction	
lii	• ***Soil Erosion:*** • Provide advice on the useability of fill extracted from the area (i.e. concerns were raised about soil in the area eroding if wet)	Council
iv	• ***Flood Levels:*** • To be provided by Melbourne Water	MPA

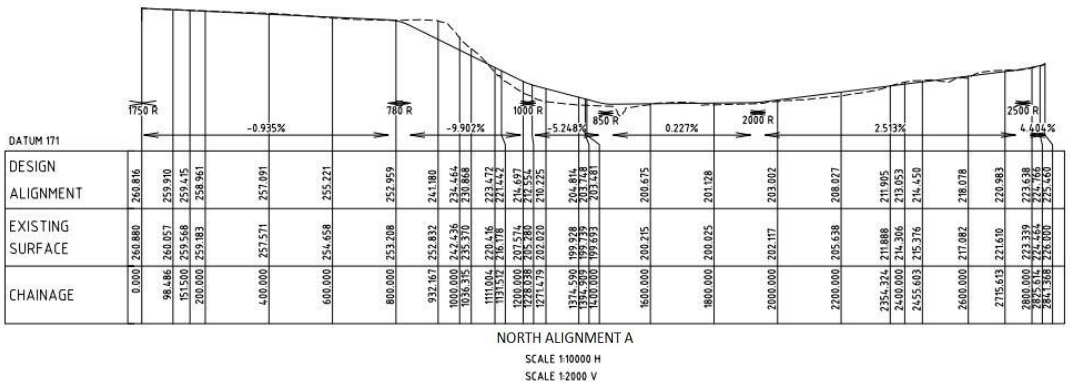
[1] The associated tasks are outside or not required to be considered as part of this study.

Appendix G

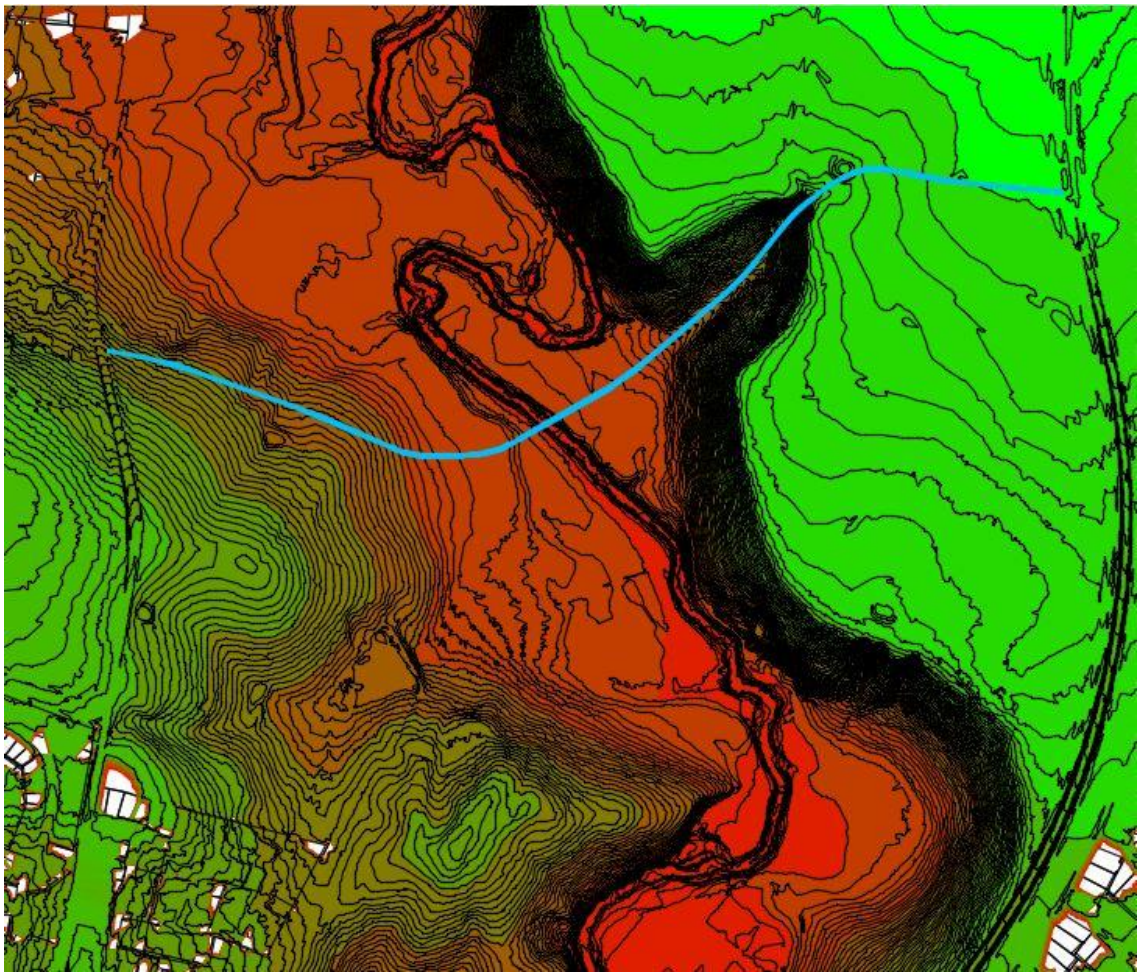
Feasible Alignments – North and South

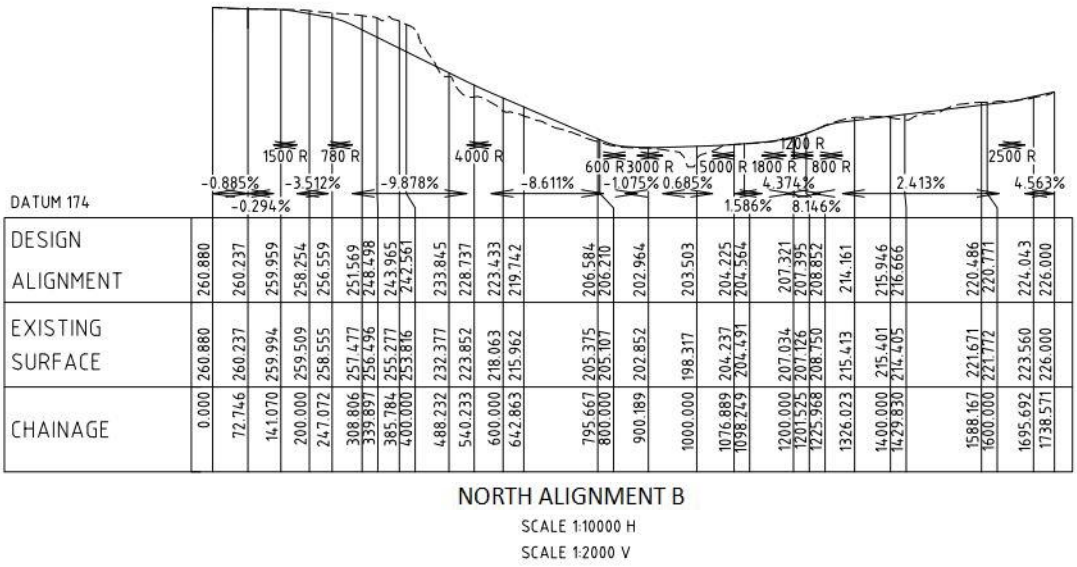
Northern Section – Alignment A



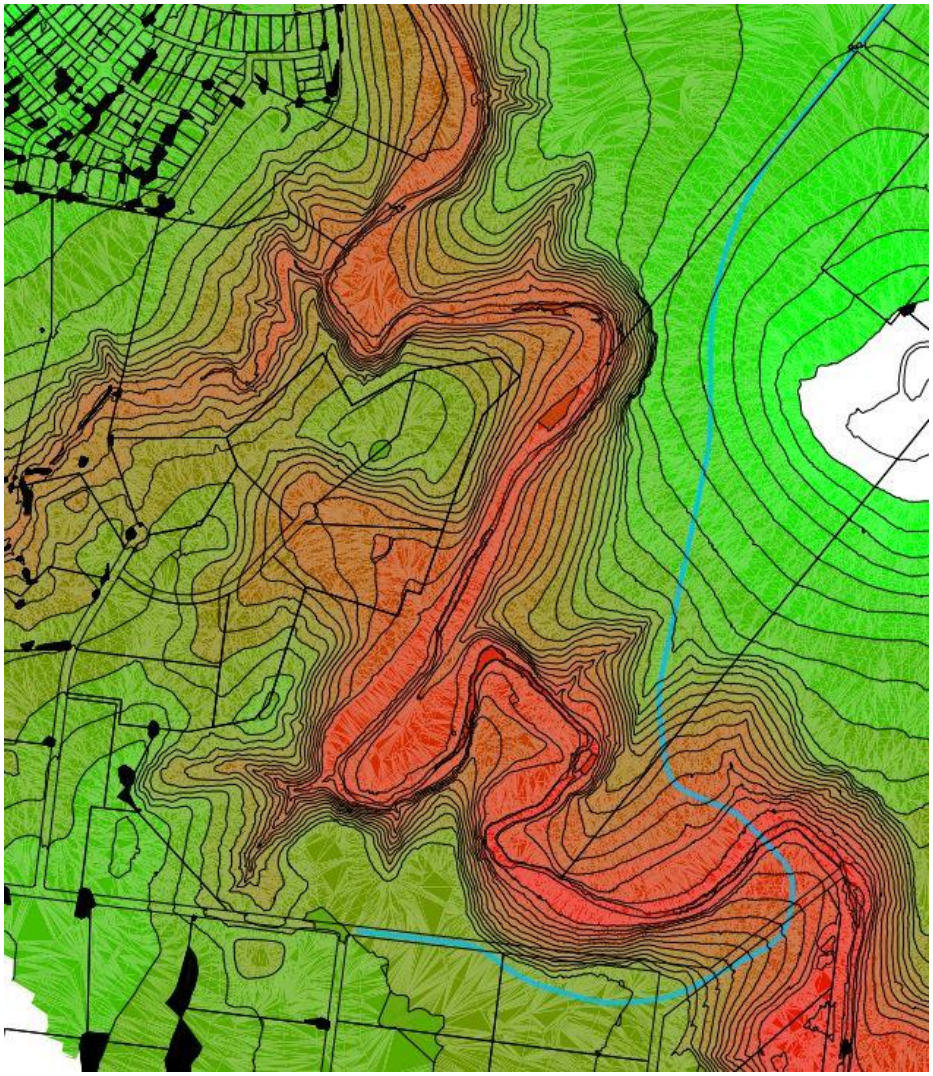


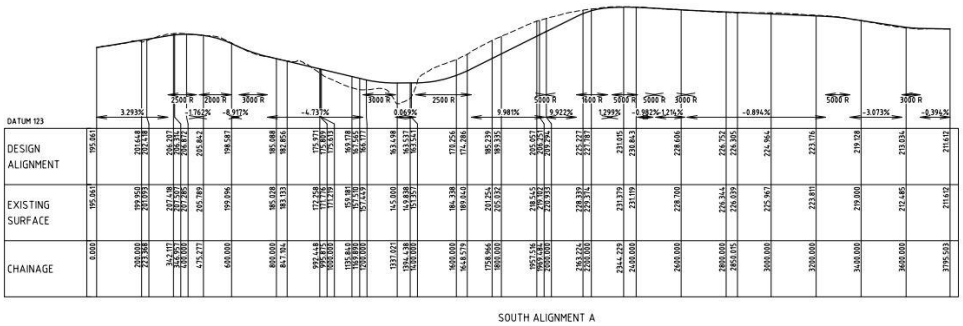
Northern Section – Alignment B





Southern Section – Alignment A





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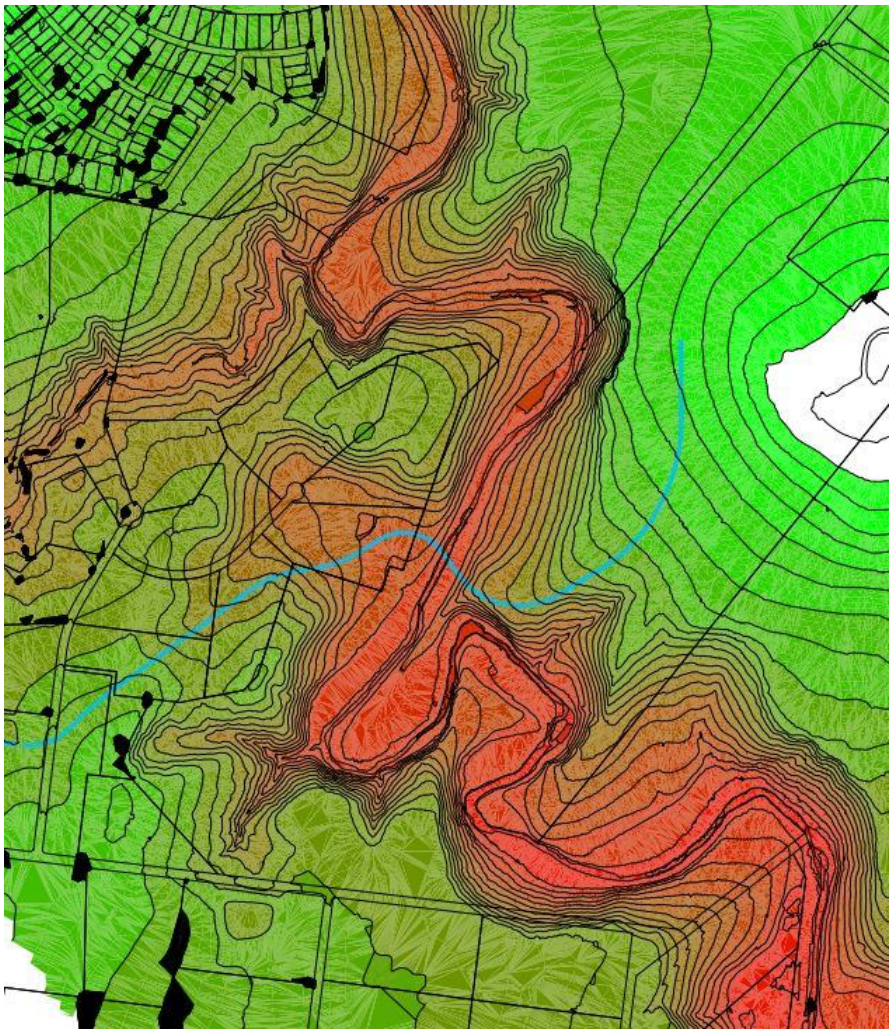

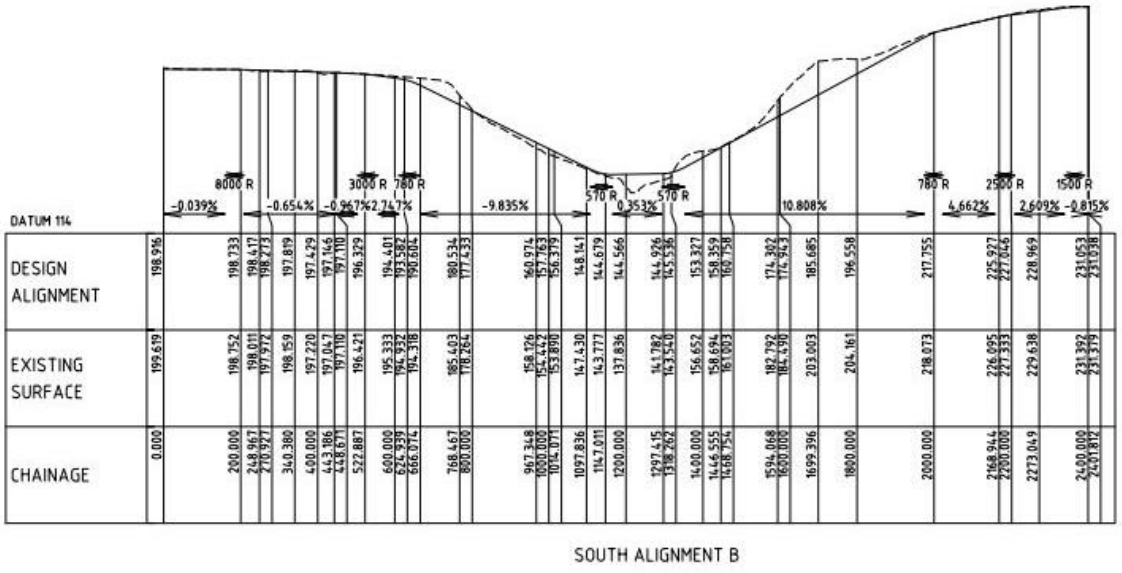

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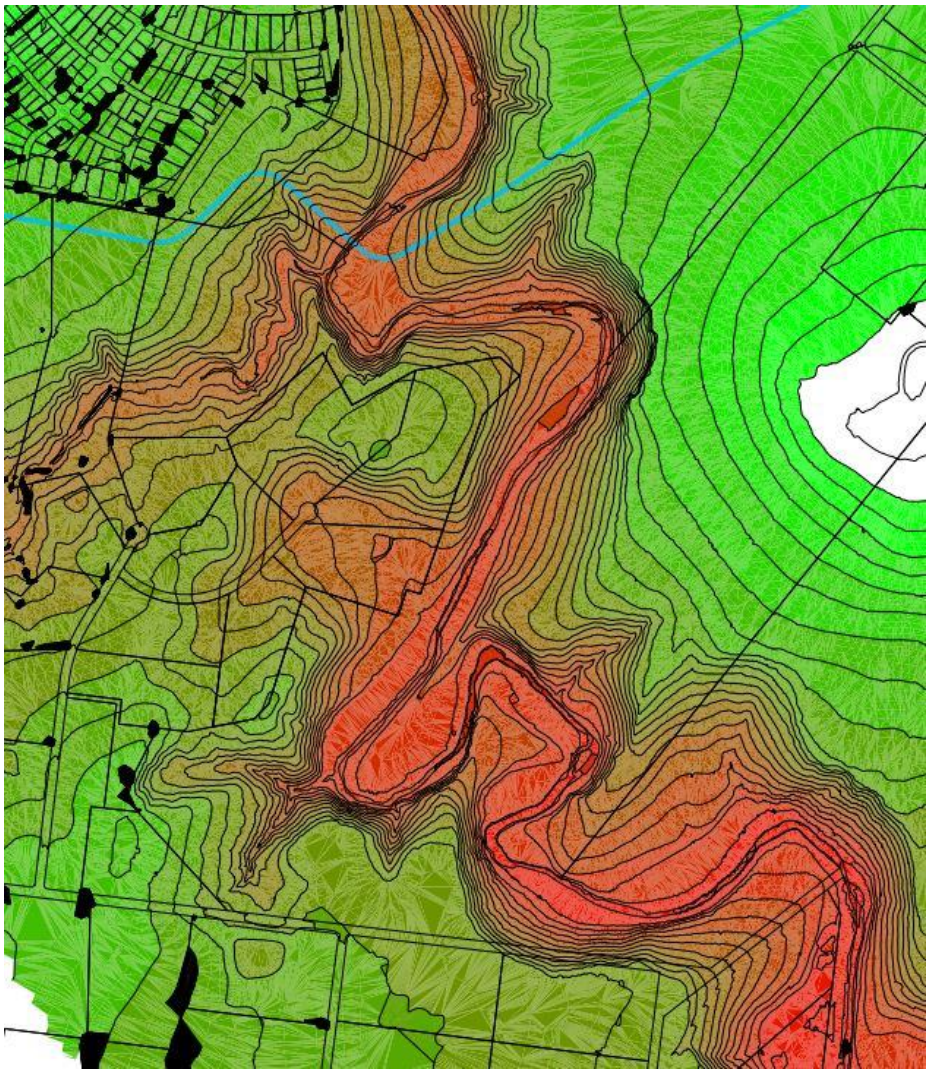

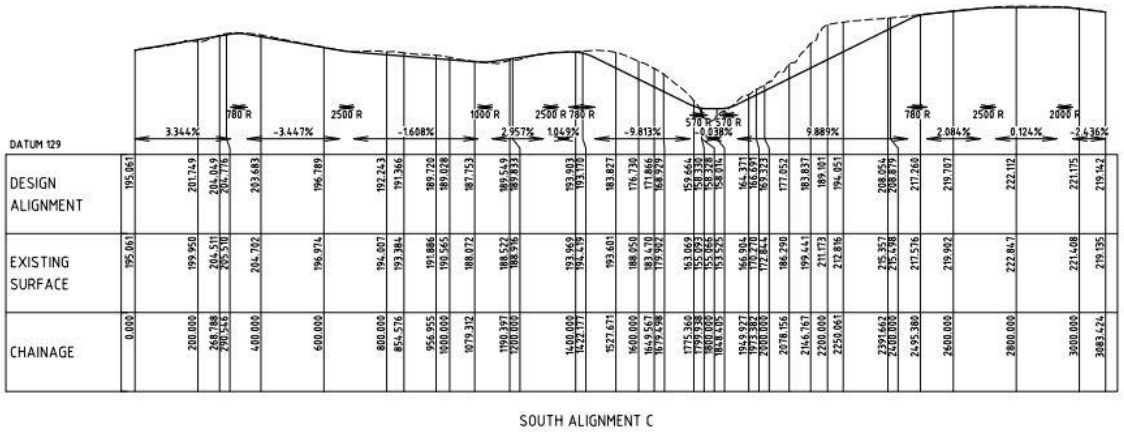

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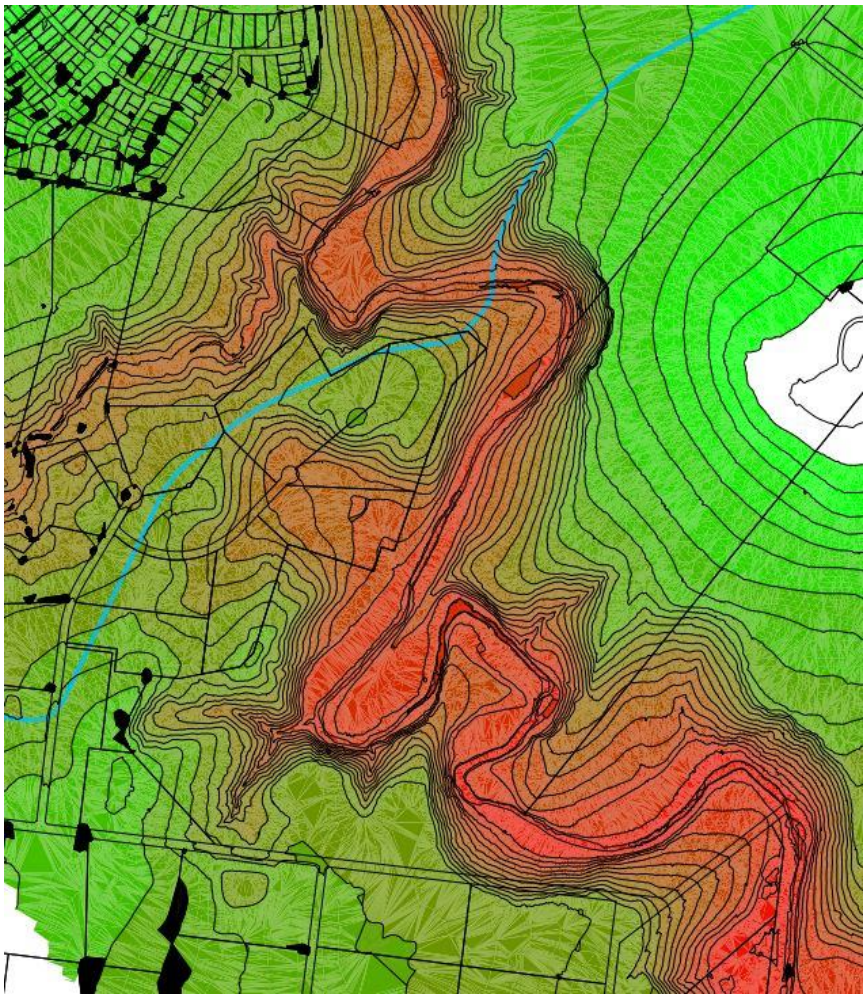
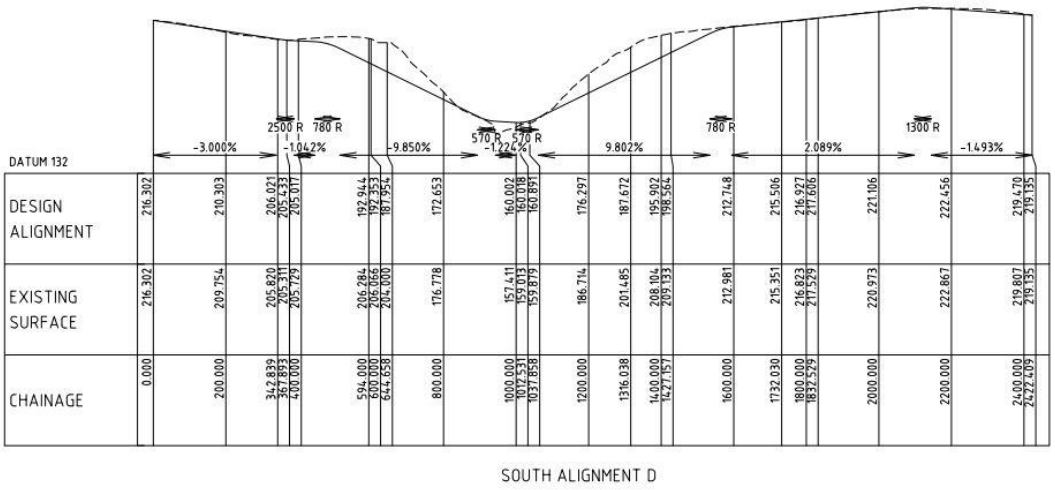
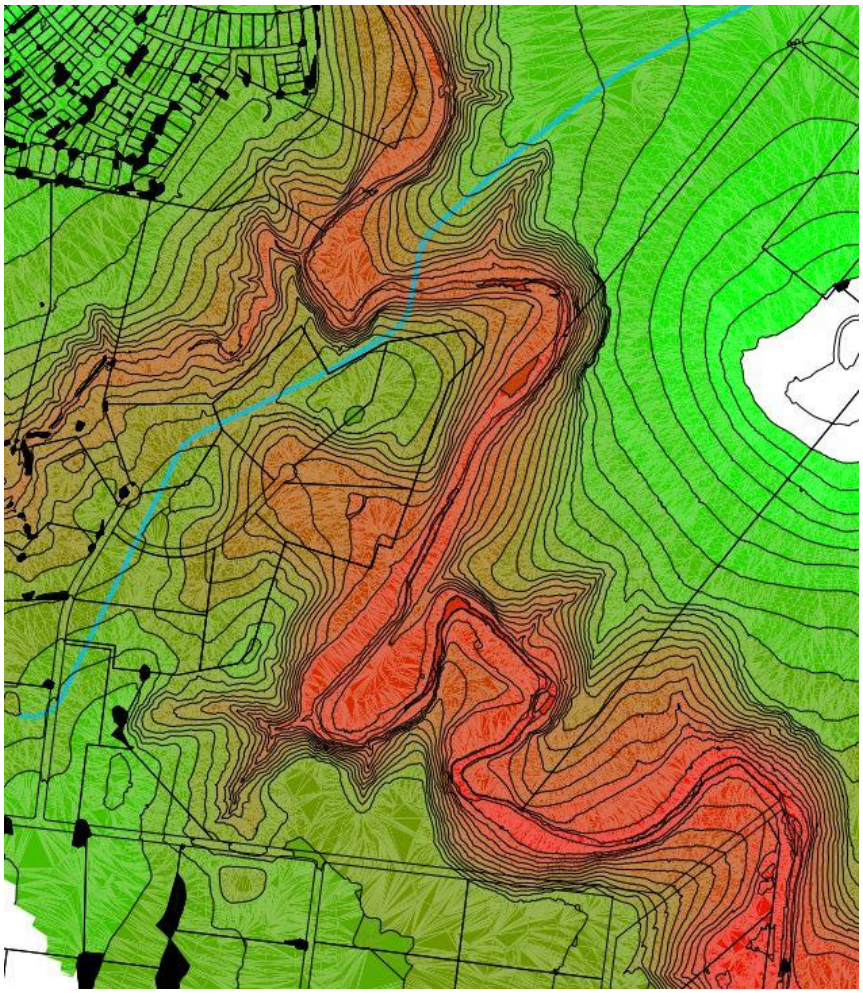
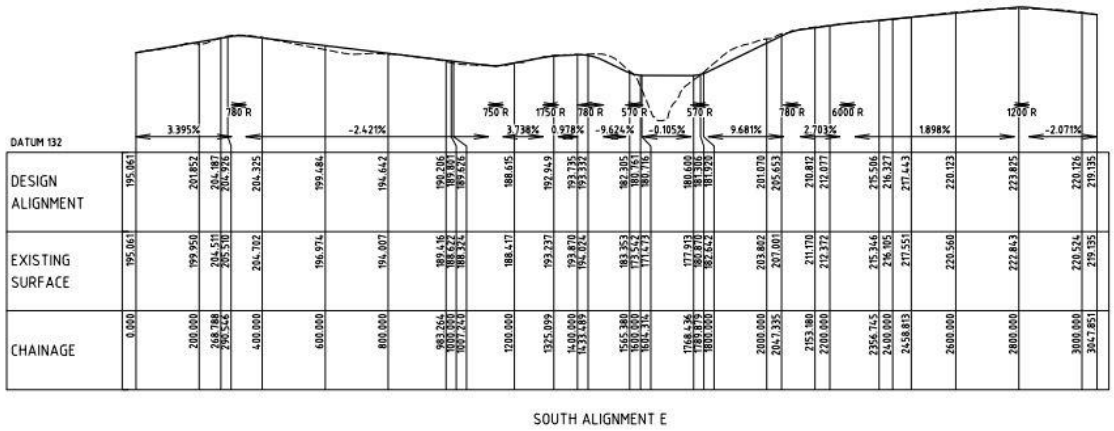


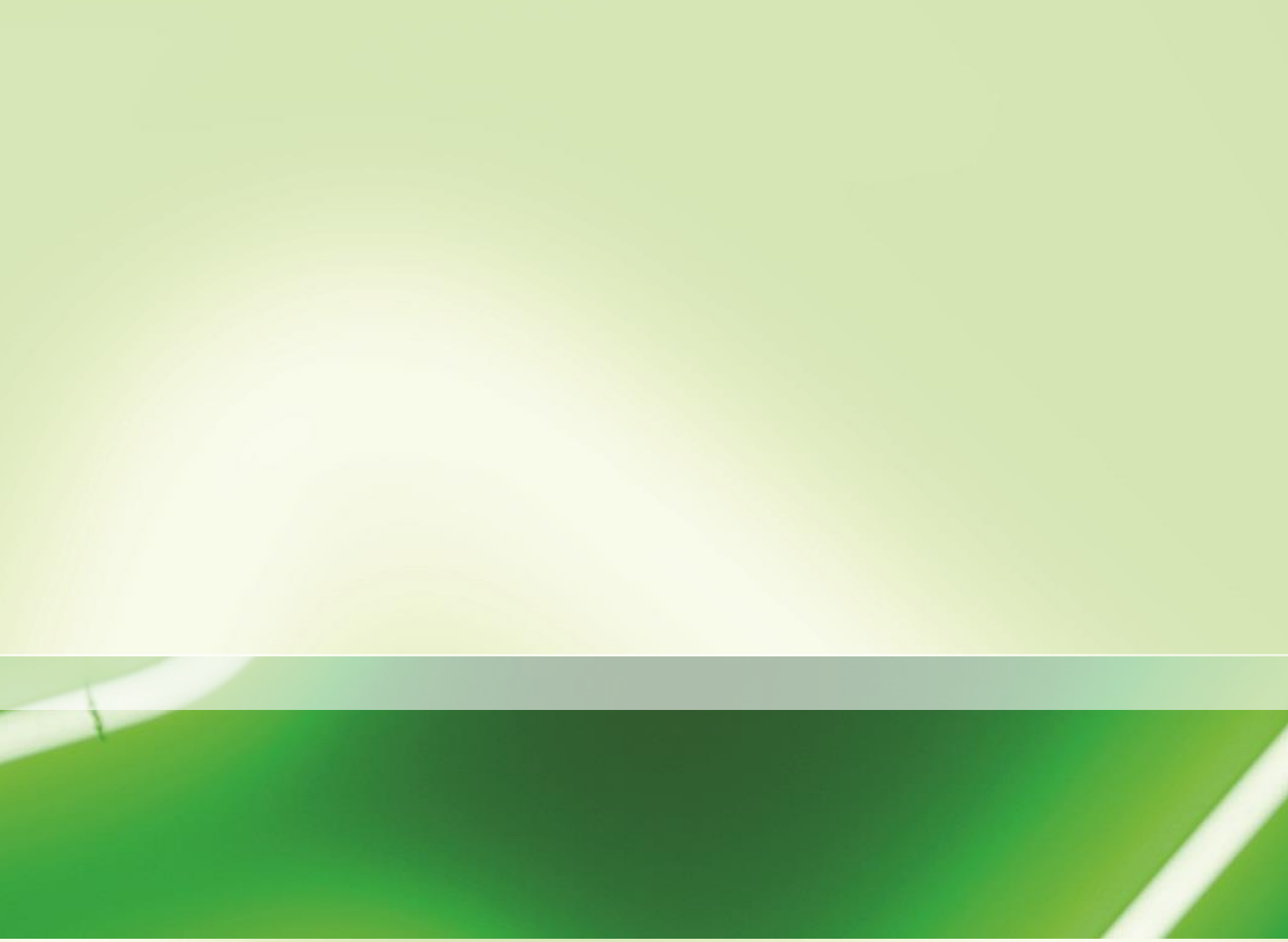


Southern Section – Alignment E





SOUTH ALIGNMENT E



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Appendix B

Workshop Minutes

Meeting Minutes

Job No:	14M1881000	**GTA Rep:**	TC, AB	**Date:**	17 June 2014
Job Name:	Jacksons Creek Road Crossings – Workshop 1			**Time:**	3:00pm
Client:	Metropolitan Planning Authority (MPA)			**Location:**	Hume Council Offices
Purpose:	Project Workshop 1				

Attendees:	• Mat Garner, John Petrakos (MPA) • Mark Burton (PTV) • Frank Deserio (VicRoads) • Andrew Johnson, Sarah Kernohan, Amanda Dobb (Hume CC) • Adam Davidson, Phil McCutcheon, Mary-Anne Carmody, Leah Wittingslow (land owners / other) • Tom Courtice (Chair), Alex Blackett (GTA Consultants)
Apologies:	None
Distribution:	All Attendees

Item	Discussion Topic	Action By
1	**<u>Workshop Context & Purpose</u>**	

i	• ***Broad context / purpose of project:***
	  • To prepare a robust assessment of options for road crossings of Jacksons Creek to guide the preparation of the Sunbury South and Lancefield Road Precinct Structure Plans, as well as wider road network planning.
	  • Assessment will take into account cost, engineering feasibility, transport network design, land use, cultural heritage, biodiversity values, hydrological and landscape impact.
	  • Culminating in concept designs and cost estimates for two preferred options.
		Note

ii	• ***Workshop objectives:***
	  • Provide an overview of wider study area
	  • To present initial findings on the study areas (characteristics and significant features)
	  • To discuss likely importance / significance of various features
	  • To discuss initial feasibility constraints based on example alignments
	  • To discuss the suggested road standards (allowance for two road types)
	  • Present initial assessment criteria and that a comparative assessment will be used to identify the preferred alignment
	  • Highlight additional relevant information to be provided to study team
	  • Identify 'refined' study areas based on key constraints
	  • Agree next steps to progress to Workshop 2 (Assessment Framework)
		Note

2	**<u>Wider Study Area</u>**	

i	• ***Sunbury Town Centre***:
	  • Already congested with limited number of alternatives for through traffic – how is this expected to be managed?
	  • Need to better understand the existing and future traffic conditions
	  • Need to consider the impact of providing and not providing the additional Jacksons Creek road crossings
	  • Is there potential for any additional local road crossings over Jacksons Creek in the area, whether connecting the Growth Areas or not
		Council /MPA [1]

ii	• ***Sunbury South Growth Area:***
	  • Preliminary concept plan has been prepared but is subject to the alignment and type of Jacksons Creek road crossing
	  • Any arterial road should go near but not through the activity centre
		Note

iii	• ***Lancefield Road Growth Area:***
	  • Preliminary concept plan has been prepared but is subject to the alignment and type of Jacksons Creek road crossing, as well as the number and type of crossings of the rail line.
	  • Any arterial road should go near but not through the activity centre
		Note

3	**<u>Transport Network</u>**	

i	• ***Rail:***
	  • Railway station locations to be confirmed
	  • Status of existing rail crossings within the Lancefield Road Growth Area
	  • Interim and ultimate rail crossing numbers and types within the Lancefield Road Growth Area
		PTV

Ii	• ***Bus:***
	  • Bus routes through growth areas is yet to be defined
	  • Bus services are expected to be accommodated on the road crossings of Jacksons Creek
	  • What grades would be considered acceptable given the site constraints that exist
		Note

iii	• ***Pedestrians & Cyclists:***
	  • Pedestrian and bicycle routes through growth areas will be consistent with road design requirements
	  • Pedestrian and bicycle routes are expected to be accommodated along the road crossings of Jacksons Creek
		Note

4	**<u>Cultural Heritage & Biodiversity Values</u>**	
i	• Further detail to help distinguish what areas are more significant	MPA

	than others	
5	**<u>Two Road Types (Arterial & Collector)</u>**	

i	• ***Arterial:***
	  • Outline grade, speed, carriageway, parking and path characteristics to be achieved
	  • Consideration should be given to the nature of the study areas and site constraints (i.e. Alpine Road design standards)
		VicRoads

ii	• ***Collector:***
	  • Outline grade, speed, carriageway, parking and path characteristics to be achieved
	  • Consideration should be given to the nature of the study areas and site constraints (i.e. >50km/h corners)
		Council

iii	• ***Road Funding:***
	  • Consider whether the proposed Jackson Creek road crossings are of State significance
	  • Obtain legal advice on the ability to use GAIC funding for a non-arterial road crossing
		MPA [1]

6	**<u>Consultation</u>**	

i	• ***'Wider Community Groups':***
	  • Consists of specific community groups that have indicated a vested interest in Jacksons Creek
	  • The wider community groups are not being consulted on the 'need' for additional road crossings of Jacksons Creek
		Note

ii	• ***Workshop 2:***
	  • Proposed to occur on 16 July 2014
	  • Specific invitee list to be developed
	  • Confirmation, invitation and venue booking required
		MPA / Council

7	**<u>Refined Study Area</u>**	
i	• ***Sunbury South Growth Area:*** • Four general alignment areas have been identified for further investigation	GTA
ii	• ***Lancefield Road Growth Area:*** • Two general alignment areas have been identified for further investigation	GTA
6	**<u>Other Assessment Inputs</u>**	

i	• ***Initial Modelling of Road Alignments:***
	  • Investigate ways to balance cut and fill quantities
	  • Consider angling the bridge (i.e. not necessarily flat)
		GTA

Ii	• ***Board Level (Order of Magnitude) Costs:*** • Provide board level (order of magnitude) costs for road versus	GTA

	bridge construction	
lii	• ***Soil Erosion:*** • Provide advice on the useability of fill extracted from the area (i.e. concerns were raised about soil in the area eroding if wet)	Council
iv	• ***Flood Levels:*** • To be provided by Melbourne Water	MPA

[1] The associated tasks are outside or not required to be considered as part of this study.

Meeting Minutes

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Job No:	14M1881000	**GTA Rep:**	TC, AB	**Date:**	17 July 2014
Job Name:	Jacksons Creek Road Crossings – Workshop 1			**Time:**	1:00pm
Client:	Metropolitan Planning Authority (MPA)			**Location:**	Hume Council Offices
Purpose:	Project Workshop 2				

Attendees:	• Mat Garner, John Petrakos (MPA) • Mark Burton (PTV), Frank Deserio (VicRoads) • Michael Ward (DEPI), Raffaela Arico (Melbourne Water), Alex Macleod (Parks Victoria) • Andrew Johnson, Sarah Kernohan, Gareth Edgley (Hume CC) • Adam Davidson, Anthony Stafford, Phil McCutcheon, Mary-Anne Carmody, Julie Lancashire (land owners / other) • Chad Browning (Ecology and Heritage) • Tom Courtice (Chair), Alex Blackett (GTA Consultants)
Apologies:	None
Distribution:	All Attendees

Item	Discussion Topic	Action / By
1	**Workshop Objective**	**TC**
ii	• Confirmation of project methodology; project objectives; and key identified issues, opportunities and risks • Identification and agreement on evaluation criteria • Prioritisation and weight of evaluation criteria • Assessment Framework Application	• Nil
2	**Overall Project Objective**	**TC**
i	• Identify the most appropriate road crossing alignment for the Lancefield Road and Sunbury South Precinct Structure Plans (PSPs 1075 and 1074), taking account of engineering feasibility, cost, cultural heritage, ecology, visual amenity, transport network and development considerations.	• Nil
3	**Evaluation Criteria**	**All**
i	• <u>Transport Network:</u> The ability of the options to perform their intended role (local or arterial road) within the context of the existing and proposed arterial road network is the key consideration for transport network. In addition, the likely amount and desirability of through traffic on the roads was discussed. Depending on the road type, a level of through traffic is to be expected, however detailed analysis of the wider transport network are beyond the scope of this study and should be investigated through a broader strategic modelling exercise. It was also noted that the road alignments should all be capable of	It is noted that this assessment is high level only and will likely require revisiting as part of a future strategic modelling exercise. However, it is not expected

	accommodating buses, pedestrians and cyclists, so this will not be a discriminating factor. On this basis, the factors for assessing this criterion include: • The comparative travel time / length of each crossing option (from agreed 'start' and 'end' points – refer below) • Being a viable alternative to travelling through the Sunbury Township along Sunbury Road (i.e. whether the roads could be expected to perform a limited through traffic function, or more significant through traffic function in the case of the four-lane road) As noted above, this assessment will be high level only as no strategic modelling is included in the project. • Provide connectivity with the existing and proposed arterial road network • Ability for the alignment to be upgraded to a four-lane road (or higher order two-lane road) in the future (two-*lane road option only*)	that any of the proposed alignments would be fundamentally unsuitable from a broader transport network perspective.
ii	• <u>Development Considerations:</u> The road crossing alignment options will be an input to the PSP process, rather than the other way around. However, it is noted that some initial work has been done to identify likely future town centres and developable areas, and this may allow for some assessment of future road options. It was noted however that this criterion is relatively less important, since this study is intended to be a key input to the future PSPs and will drive land use and access decisions in the PSP areas. It was noted that the currently identified alignment options do not appear to preclude any likely land use or structure for the PSPs. On this basis, the resulting factors for assessing this criterion relate to: • The resulting road network and intersection spacing • Provision of an appropriate level of access to / around the proposed activity centres (ideally close to but not through) • Overall ability to support the social, economic and land use objectives of the Growth Plans and other strategic planning documents	It is noted that this criterion is likely to be relatively less important and unlikely to drive the outcome of the assessment.
iii	• <u>Engineering Feasibility</u> Discussion on this criterion covered aspects relating to the following: • Suitability of using the cut material from the area for fill purposes (*Council to provide their knowledge on the useability of cut material*) • What are the start and end points of the alignment options (*MPA is to provide the developable extend of the PSPs along Jacksons Creek*) • Has the recently received flood level data impacted any of the identified feasible alignments (*GTA to consider and advise*)	**Council:** Provide any feedback on the likely usability of fill material **MPA:** Provide advice on the developable extent of PSPs along Jacksons Creek **GTA:** Advise on any impact of flood data on

	• What are the design parameters for the two road types and whether there is any flexibility in the road design standards being adopted (*GTA to prepare and consult on initial long-sections based on provided road design standards to understand the need and extent for flexibility*) • That the feasibility of the alignments are directly related to their cost On this basis, the resulting factors for assessing this criterion relate to: • Constructability of road and bridge within Jacksons Creek • Impact on existing and proposed services where known • Ability for the alignments to go over and under the train line • Volume of earthworks (cut / fill) and length of bridge	proposed alignments **GTA:** once road long sections prepared, circulate to Council and VicRoads for comment
iv	• <u>Cultural Heritage</u> It was clear from the discussion on this criterion that the extent of cultural heritage constraints are not fully understood within the study area, especially below ground given the historical significance and occupation of the area to the Wurundjeri people over a very long time period. The Sunbury Earth Rings are well known and must be avoided, with a general scattering of other artefacts, objects, trees, places and formations of some cultural heritage value. While some level of impact can't be avoided with the alignment options, those proposed are currently considered to avoid the known significant cultural heritage items. However, the Wurundjeri will be consulted separately once the preferred alignments are determined and within the wider development of the PSPs. It is also noted that no below ground proofing for cultural heritage items will be undertaken at this time, so only above ground inspections are able to be used in comparing the identified feasible alignments (above ground inspections yet to be completed). On this basis, the resulting factors for assessing this criterion relate to: • Level of impact on the known cultural heritage items • Time and cost in gaining required approvals • What flexibility exists for the alignment to avoid future identified cultural heritage items • Minimising excavation of the existing land form as there is currently a requirement to filter excavated soil by hand in the area (*MPA to investigate the extent and necessity of this requirement*)	**MPA** to investigate the extent and necessity of hand filtering / visual inspection of fill material.
v	• <u>Ecology</u> There are a number of relatively uniform areas of high ecological value that extend along Jacksons Creek that will not be able to be avoided. There are also some isolated areas of value already identified, with additional ones, such as existing and proposed frog ponds (*Parks to provide*) to be indicated. Moreover, above ground inspections will be undertaken to help compare the impact of the identified feasible alignments on ecological areas of value (yet to be completed). Once	**Parks Victoria** to provide information on proposed frog ponds **Parks Victoria** to provide any information on

	these are documented, the impacts on the ecologically valuable areas will be compared based on the extent of works required for each road alignment. What was also identified is that there should be consideration of how the alignments fragment the key ecological areas and impact on the movement of animals (both protected and unprotected species). On this basis, the resulting factors for assessing this criterion relate to: • Level of impact on the identified ecological areas of value • Time and cost in gaining required approvals • Resulting fragmentation of key ecological areas and impacts on the movement of animals (both protected and unprotected species)	whether Holden Flora Reserve has any differences in relative importance of areas
vi	• <u>Amenity</u> This criterion is expected to be considered on a relatively qualitative basis, as it relates to how it impacts the amenity of existing and potential community members in the area. It is expected that this criterion will consider the following factors: • Visual (impact on significant existing views, amount of cut / fill) • Access between communities and to recreation opportunities (positive)	Note: changed from visual amenity to a broader criterion of overall amenity
vii	• <u>Cost</u> In terms of the cost criterion, this will cover the following factors: • Broad level construction cost estimates • Land acquisition • Cultural heritage and ecological ameliorative measures It was discussed that given the unknown nature of using cut material from the study area and likely transporting costs to move material each side of Jacksons Creek that for sensitivity purposes, the cost of earth works would be determined based on a balance amount and on an absolute volume basis each alignment, in order to determine the importance of this as a differentiating factor between alignment options.	**MPA / Council** to provide any recent land acquisition costing for the area
4	**Prioritisation and Weighting**	**TC**
i	• <u>Prioritisation of Criteria</u> The following recommendations are made based on the discussion held at the workshop: • The cost criterion should be considered separately from the others. This is on the basis that the feasible alignments be considered against the other criteria, then a 'value for money' evaluation be done, to see what cost difference there is between the options and what improved performance you get for the additional cost. • Cultural heritage will also be considered separately, based on further engagement with the Wurundjeri (to be undertaken by MPA in parallel)	Nil

	• Engineering feasibility, ecology, transport network, amenity and development considerations are all able to be assessed in a methodological and systematic way, with the following prioritisation between criteria:
	  • Engineering feasibility is an overarching consideration and of highest importance, given the nature of the likely engineering constraints for most / all alignments
	  • Ecology is an important factor with potential "show stoppers" in certain areas (particularly southern alignment), although it is noted that many ecological constraints are relatively uniform along the corridor and can be mitigated
	  • Amenity is of lesser importance but may be a differentiating factor (potentially in a positive sense)
	  • Transport network and development considerations are also of lower importance and not considered likely to have a fundamental impact on the alignments, but may be useful to differentiate between to alignments that perform similarly on all other criteria.	

ii	• <u>Weighting</u> It was indicated that specific weighting will not be applied for this project, as there is no universally accepted method to determine this (given the subjective / qualitative nature of some criteria). Furthermore, weightings are not considered to improve the transparency of the assessment given the level of consistency of the constraints along the length of Jacksons Creek. Rather, the weighting of the criteria will be considered through the above prioritisation, with conflicts / close outcomes to be considered *if necessary* via a second stage assessment.	Nil
5	**Evaluation of Criteria**	
I	It was proposed that the alignment options will be ranked in order of how well they perform against the factors associated with each criterion. In this regard, it is proposed that the middle ranked option(s) will be allocated to the middle of the five categories presented in Table 1, and the other options distributed over the five categories based on their relative level of performance compared with the middle ranked option(s). **Table 1: Five Categories of Performance** **Level of Performance** Significant Higher Performance Higher Performance Neutral / Same Performance Lower Performance Significant Lower Performance Given the five categories presented in Table 1 and the proposed comparative assessment progress above, there can be expected to be a level of professional judgement used to rank the relative performance of	Nil

	the feasible alignments against the varies factors of each criteria and by how much. An overall performance for each feasible alignment will be determined and ultimately used to rank them. This will be supported by analysis and explanatory notes to ensure that the allocation of performance is transparent and able to be further interrogated, if required.	
6	**Feedback**	**All**
I	The above provides a summary of what was discussed at the workshop and an outline of what the decision framework is currently proposed for assessing the relative performances of the identified feasible alignments. It is requested at this time that any further comments and/or feedback of the proposed decision framework be provided to MPA by Friday 1 August 2014.	**All**: provide feedback on minutes by 1 August 2014

JACKSONS CREEK CROSSING – COMMUNITY STAKEHOLDER MEETING

17 July 2014 – 18:00-20:00 – Sunbury Leisure and Aquatic Centre

Attendees/Apologies

Record of invitation: D/14/6734

NAME	ORGANISATION	ATTENDED
Arnie Azaris	Sunbury Conservation Society Inc.	Yes
Trevor Dance	NA	Yes
Bernie O'Farrel	Sunbury Residents Association	No
Christina Cheers	Friends of Emu Bottom Wetlands Reserve	No
Christina Cheers	Friends of Jacksons Creek Eco Network	No
Roger McGlashan	Friends of Holden Flora & Fauna Reserve	Attended technical workshop on 17 July and also on behalf of Christina Cheers

Summary of discussion and subsequent feedback

Slides that were presented: D/14/6735

The presentation ran through the creek crossing assessment project overview and the elements that are proposed to feed into the evaluation matrix that will be used to assess different creek crossing options.

Arnie and Trevor expressed concerns about erosion in Sunbury and the potential implications this will have for the creek crossing. Images demonstrating erosion in Sunbury have been sent.

Arnie and Trevor were asked to reflect on the presentation and send through comments about the evaluation matrix.

A total of 10 emails were received by the MPA and they have been saved into TRIM.[1] A summary of the feedback from Arnie and Trevour is provided below. It should be noted that both Arnie and Trevor invited the MPA to visit Sunbury with them to better understand the basis of their feedback.

Arnie advised that the following matrix criteria should be weighted accordingly (based on importance to the community):

Transport Network - **4**

Development Considerations - **7**

Engineering Feasibility - **5**

Cultural Heritage - **2**

Ecology - **3**

Visual Amenity - **1**

[1] Ref: COR/14/8549; COR/14/8550; COR/14/8551; COR/14/8552; COR/14/8553; COR/14/8554; COR/14/8555; COR/14/8556; COR/14/8557

Cost - **6**

Transport Network

- Sunbury South option will need to include through car traffic - a new route in this area will be used to bypass Sunbury. Road will need to be big enough to accommodate this.
- Connectivity with local road network (e.g. Jacksons Hill - Knightsbridge St connecting to this Rd, but also to Watsons Rd to access Diggers Rest and Calder Freeway south of Diggers Rest).
- Alternative/additional options - Shield St/Mitchells Lane Railway overpass; Gap Rd/Station St under or overpass; Link from new road to Diggers Rest and Calder Freeway south of Diggers Rest.

Development Considerations

- No additional comments.

Engineering Feasibility

- Do not underestimate the severity of the erosion propensity . This is a very real concern due to the type of soils and sub-soils. Severe tunnel (and other) erosion in areas being considered.
- Amount/type of fill required
- Extent of stabilisation required and impact on area
- Do not underestimate the severity of flooding and water levels in and around Jacksons Creek and its tributaries (much greater than Melbourne Water estimates).

Cultural Heritage

- Aboriginal and European Heritage Vistas are very important.
- Shire of Bulla Heritage Study - City of Hume heritage study: former Shire of Bulla District, 1998/Moloney, David. 6 v. 1998. InfraLib 720.99452 HUM (Contents: vol.1 Part one: Introduction; Part two: Heritage conservation program -- vol. 2 Part three: Environmental history/David Moloney -- vol.3 Part four: Cultural landscapes and heritage areas Johnson -- vol.4 Part five: site reports and maps Parish of Bollinda, Parish of Bulla Bulla, Parish of Buttlejorrk -- vol.5 Part five: site reports and maps Parish of Holden, Parish of Kalkallo, Parish of Mickleham, Township of Bulla -- vol.6 Part five: site reports and maps Township of Sunbury, Parish of Tullamarine, Parish of Will Will Rook, Parish of Yuroke.
- Previous Aboriginal Cultural Management Plans and reports in Sunbury that we are aware of have not fully addressed the Aboriginal Cultural Heritage Issues and/or have been conducted for only limited areas that did not end up being in the same location as the final plans for works.

Ecology

- Existing DSE EVC mapping.
- Seek advice from HCC Environment department and experts like Roger Cook whom manages the remnant vegetation on public land within Hume.

Visual Amenity

- Emu Bottoms Wetlands and Northern Sunbury Options are particularly sensitive. Federal and State Funding has been provided for this site over the last couple of decades. The wetlands are promoted by Hume Council as a special place for all in Sunbury and beyond. Many politicians have visited the Wetland had their photos taken there too.
- Aboriginal and European Heritage Vistas.
- Shire of Bulla Heritage Study - City of Hume heritage study: former Shire of Bulla District, 1998/Moloney, David. 6 v. 1998. InfraLib 720.99452 HUM (Contents: vol.1 Part one:

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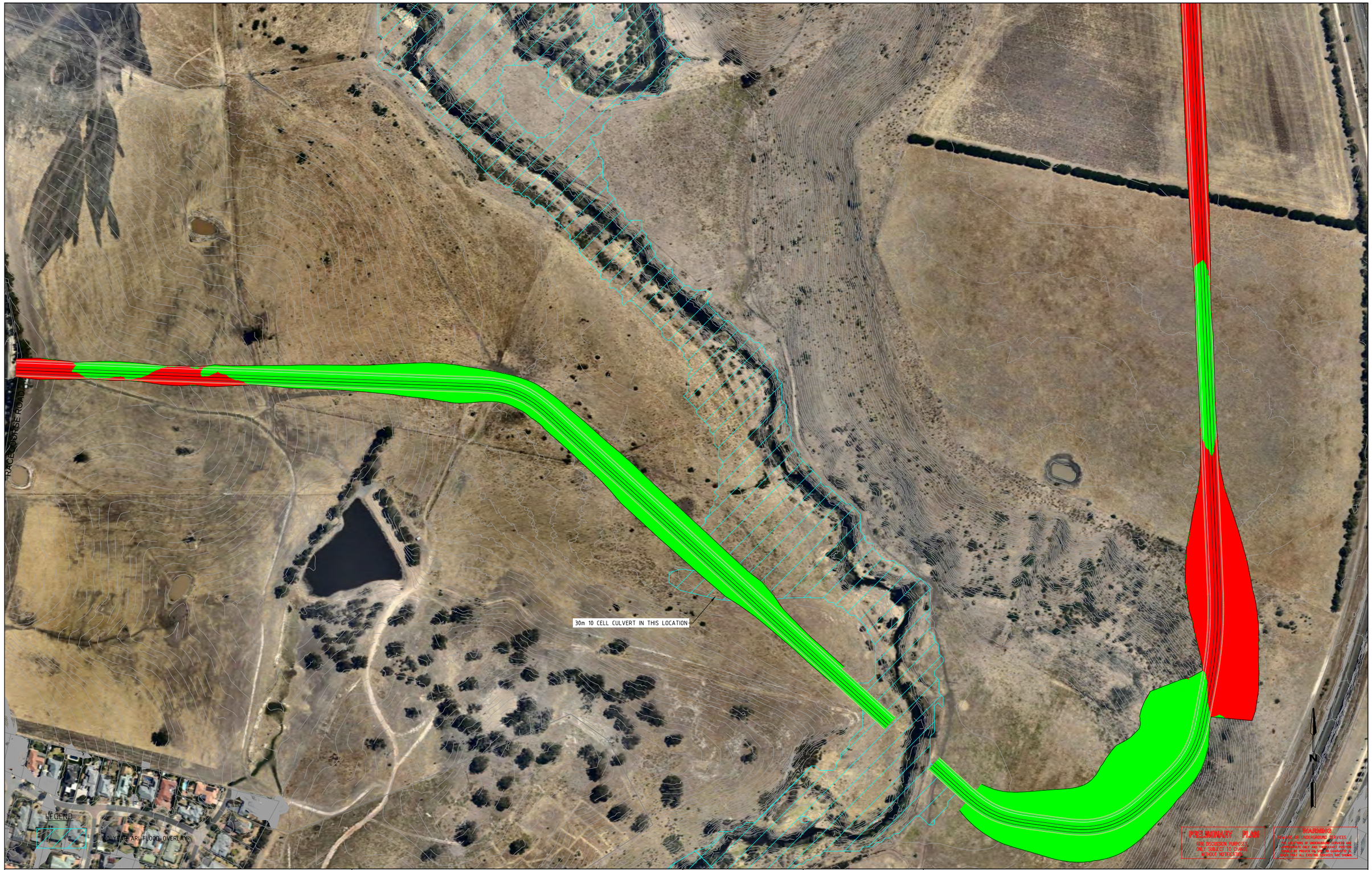
Cost

- Alternative/additional options - Shield St/Mitchells Lane Railway overpass; Gap Rd/Station St under or overpass; Link from new road to Diggers Rest and Calder Freeway south of Diggers Rest.

Appendix C

Concept Plans & Long Sections



AMENDMENTS

ISSUE	DATE	DESCRIPTION	BY	CHK.	APP.
P2	13.10.2014	REVISED TO ACCOMMODATE BRIDGE LOCATIONS	T.O	S.W	
P1	10.09.2014	PRELIMINARY ISSUE	T.O	S.W	

GENERAL NOTES

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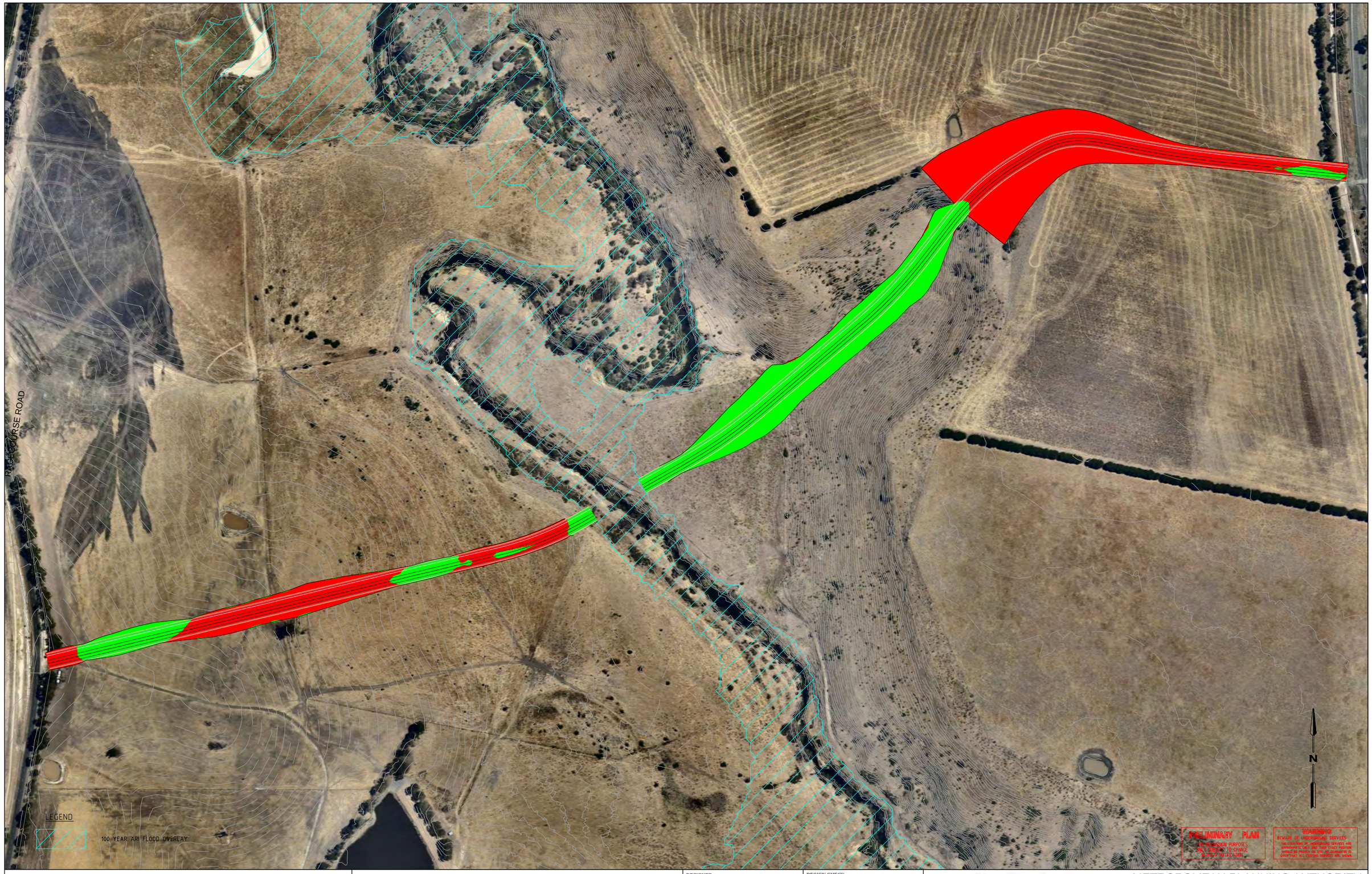
JACKSONS CREEK CROSSING OPTIONS

NORTH CONNECTOR OPTION A

MAP REF.	DRAWING NO.	SHEET	ISSUE
	14M1881006-300	1 OF 16	P2



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JACKSONS CREEK CROSSING OPTIONS

NORTH CONNECTOR OPTION B

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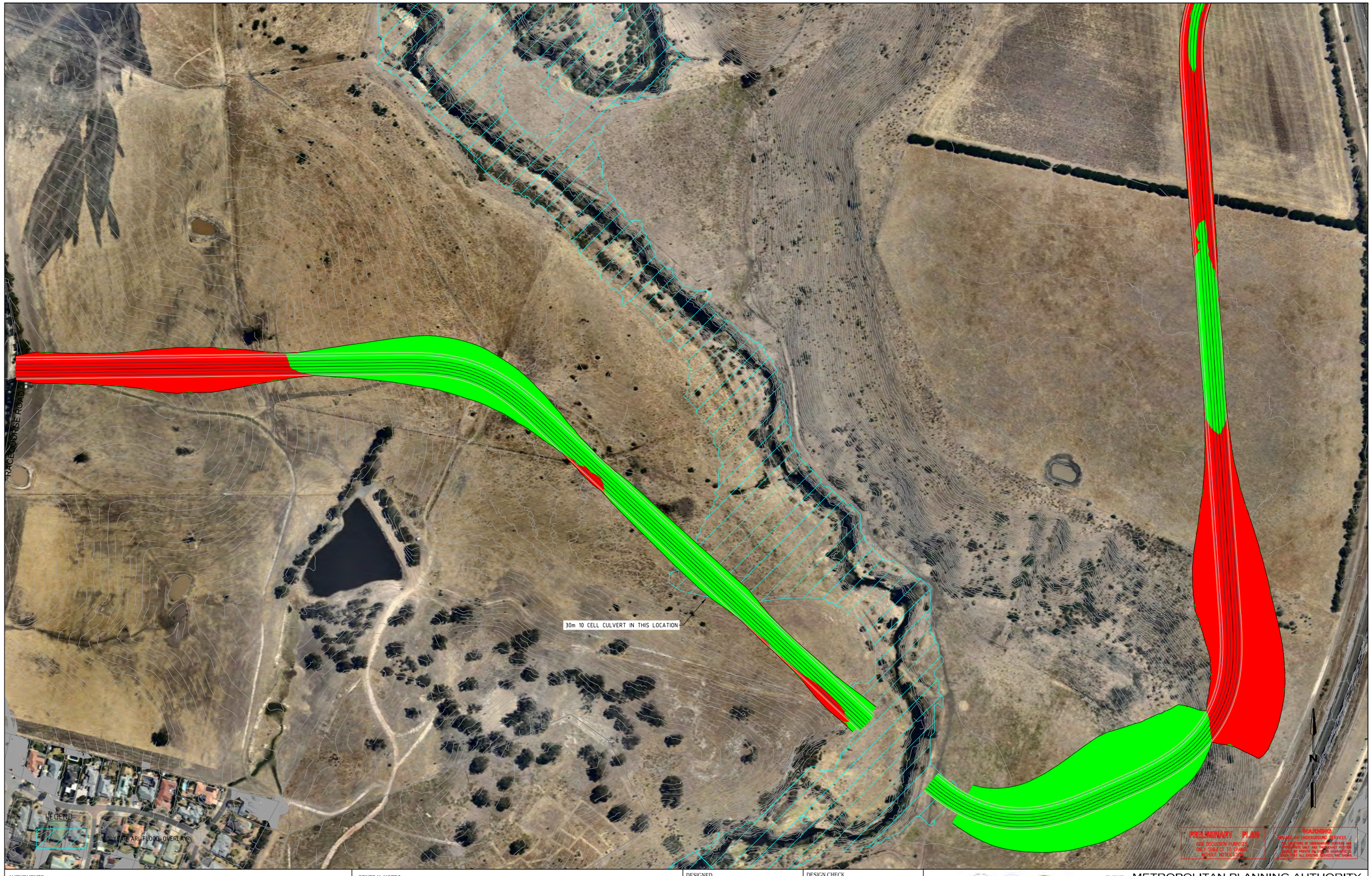

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GENERAL NOTES

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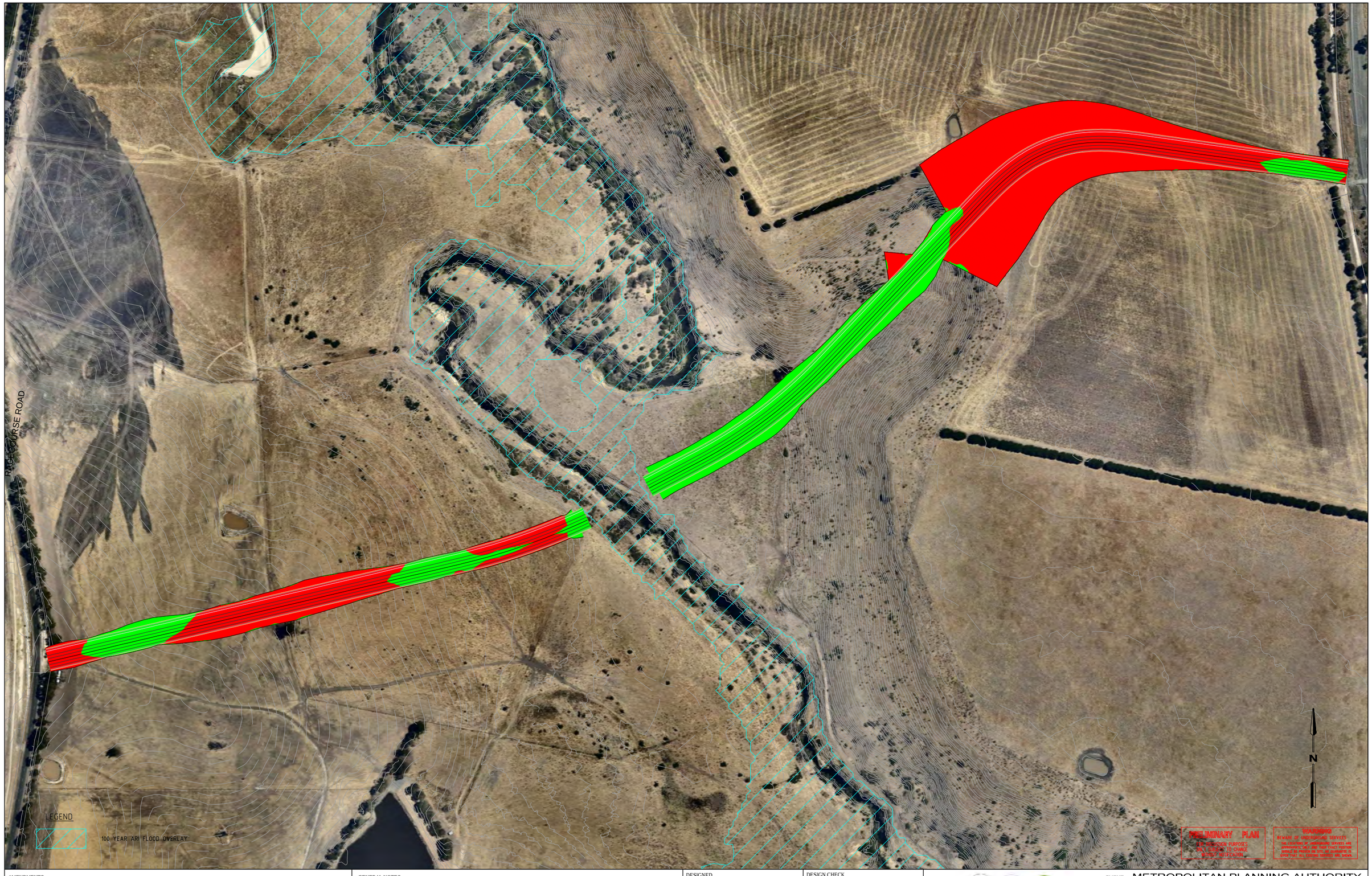
CLIENT: METROPOLITAN PLANNING AUTHORITY

JACKSONS CREEK CROSSING OPTIONS

NORTH ARTERIAL OPTION A

MAP REF.	DRAWING NO.	SHEET	ISSUE
	14M1881006-350	3 OF 16	P2



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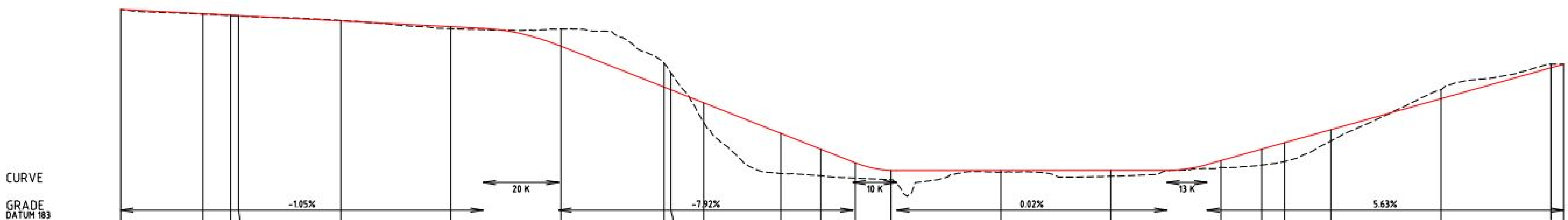
CLIENT METROPOLITAN PLANNING AUTHORITY

JACKSONS CREEK CROSSING OPTIONS

NORTH ARTERIAL OPTION B

MAP REF.	DRAWING NO.	SHEET	ISSUE
	14M1881006-351	4 OF 16	P2



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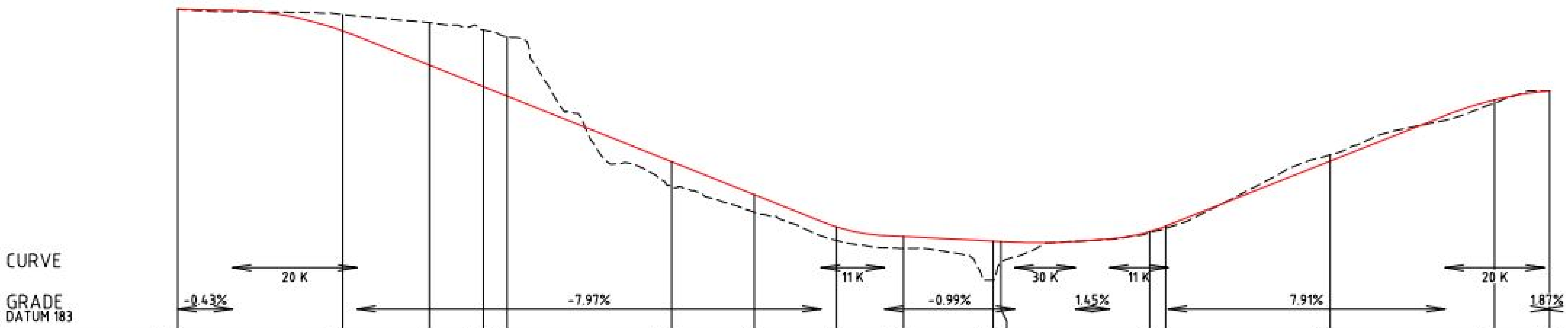

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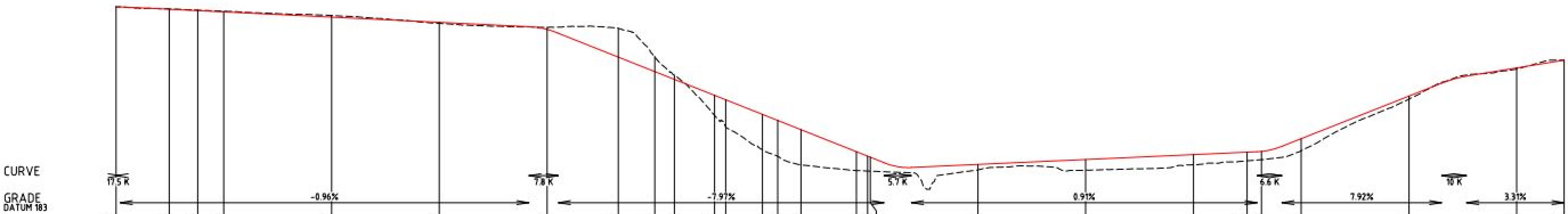

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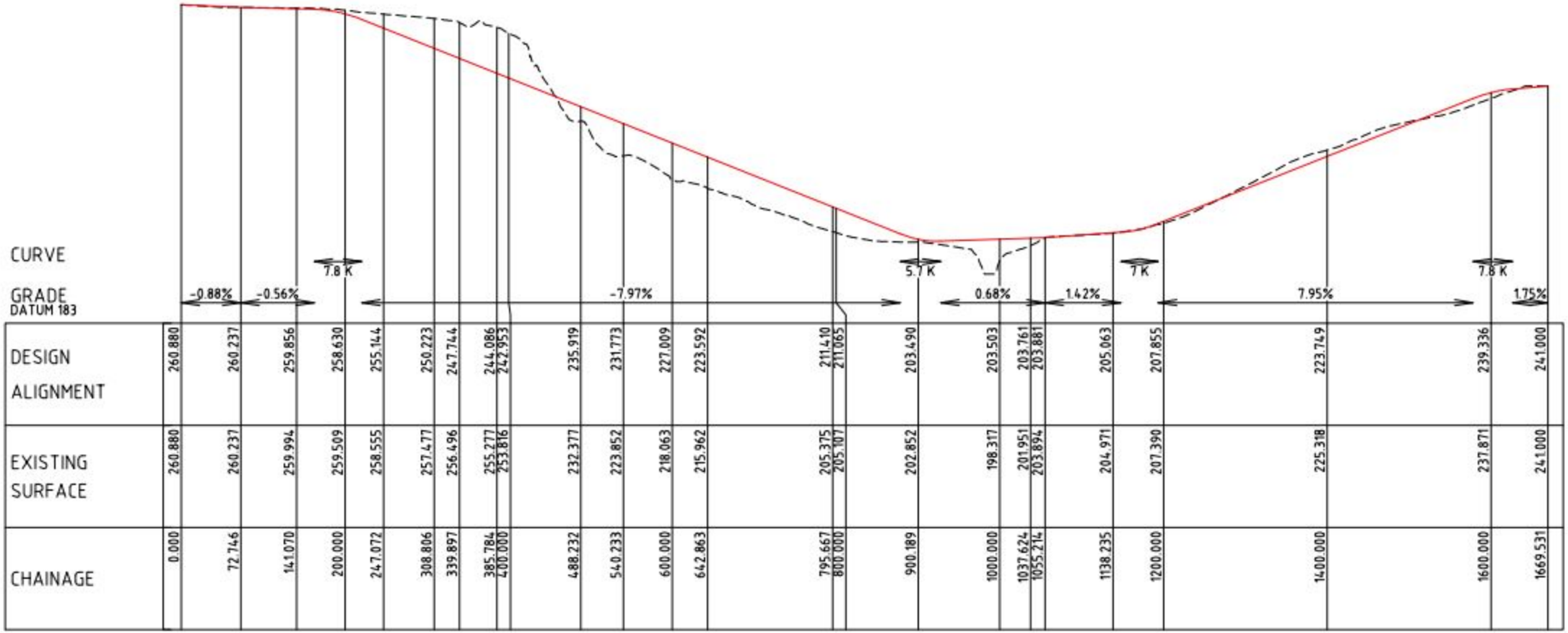
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Appendix D

Bridge Structures Report

Jackson's Creek Crossings
Bridge Options Study Report

transport | community | industrial & mining | carbon & energy

Prepared for: GTA Consultants

Client representative: Alex Blackett

Date: 26 September 2014
RevA

sustainable*thinking*®

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Prepared by: ……. Date: 26 September 2014
Chris Morton

Reviewed by: ……. Date:
Name

Authorised by: ……. Date:
Name

Report Revision History					
Rev No.	**Description**	**Prepared by**	**Reviewed by**	**Authorised by**	**Date**
A	Draft	C. Morton			26/09/2014

1. Introduction

1.1 Background

The Metropolitan Planning Authority has engaged GTA Consultants to undertake a high level feasibility exercise to identify preferred road alignments to the north and south of Sunbury. Both the north and south alignments cross over Jacksons Creek. GTA has appointed **pitt&sherry** to provide specialist bridge engineering advice on the project.

1.2 Scope of Work

The scope of work to be undertaken by **pitt&sherry** as part of this assignment includes:

- Attend project meetings
- Attend walkthrough site visit
- Develop bridge concepts for the various alignment options
- Provide advice regarding broad level cost for bridges
- Comment on potential aesthetic treatments

This report briefly summarises the findings of our initial assessment of the bridge options for the potential bridge sites.

2. Site Inspection

pitt&sherry bridge engineer Chris Morton attended a walkthrough inspection of the various alignment options on 15 September 2014, along with GTA project manager Alex Blackett and other stakeholders. Photographs taken during the inspection of the potential crossing locations are provided below.

During the inspection a copy of the 1:63,360 series geological map of Sunbury was used as a guide to the surface geology in the area. Several rock outcrops were observed, including Tertiary Period igneous rock and Ordovician Period sedimentary rock.

2.1 North Study Area

Figure 1: North Study Area Option A

Figure 2: North Study Area Option B

2.2 South Study Area

Figure 3: South Study Area Option A

Figure 4: South Study Area Option B

Figure 5: South Study Area Option C

Figure 6: South Study Area Option D

Figure 7: South Study Area Option E

3. Bridge Form

For this investigation short to medium span bridge configurations have been considered. In Victoria the predominant form of construction for road bridges in this span range comprise of precast concrete Super-T beams. These bridge elements offer numerous advantages over other forms of construction, including efficiency in manufacture and erection and long term strength and durability. The bridge concepts presented here are all based on using Super-T beams, which come in a range of standard sizes and lengths.

The bridges would conform to AS5100 Bridge Design (2004) requirements, including design loading for SM1600 and 100 year design life. At this stage we have assumed medium performance level traffic barriers for all bridge concepts.

3.1 Superstructure

The bridge superstructures for the various bridge concepts presented in this report all comprise of the following:

- Precast prestressed concrete Super-T beams (simply supported)
- 180mm thick cast insitu reinforced concrete deck with asphalt surfacing
- Medium performance level traffic barriers (to AS5100 standard)

For the connector roads a bridge width of 11m has been adopted while for the arterial roads the bridge width has been taken as 20m. These widths would likely require between 5 to 6 and 9 to 11 Super-T beams per span for the connector and arterial roads respectively.

Figure 8: Precast concrete Super-T beams

3.2 Substructure

A site geotechnical investigation has not yet been undertaken at any of the potential bridge sites and therefore the type and extent of footings required for each bridge concept is very uncertain. However the form of the above ground substructure elements presented in this report include:

- Cast insitu abutments (including sill beams, fender walls and wingwalls)
- Spill through batters with rock beaching
- Cast insitu pier columns and crossheads (for all bridge concepts except for alignment option South E)
- Precast matchcast segment concrete blocks for piers on alignment option South E

The alternative form of pier construction for option South E is anticipated as these piers would typically be very tall. This form of pier construction was used on the Western Highway twin bridges over the Djerriwarrh Creek (Anthony's Cutting) in 2011, where the piers reached a height of 32m.

Figure 9: Cast insitu pier construction

4. Bridge Concepts

4.1 Span Configurations

Concept bridge span configurations for the various crossing locations have been prepared by **pitt&sherry** and these are illustrated by the stick figure elevations presented in Appendix A. In developing the arrangements due consideration was given to the road geometry and 100 year flood height supplied by GTA as well as the spanning capability of the various Super-T beam depths. A 600mm minimum clearance (freeboard) between the 100 year ARI flood height and the superstructure soffit level was adopted, consistent with Melbourne Water requirements.

Generally, the span lengths and beam depths were taken to be equal. Where varying span length and/or beam depth was necessary (in order to avoid positioning a pier in the middle of the creek or so as not to compromise the freeboard requirement) such adjustments were made. The height difference between existing surface level and proposed road surface level was particularly low on alignment option North A and we have incorporated box culvert units in lieu of an additional bridge span as a variation to illustrate what might be possible here.

Table 1: Summary of bridge concepts

Study Area	Option	Road	Length (m)	Width (m)	No. Spans
North [1.]	A	Connector	70+30	11	3+10
North	B	Connector	65	11	3
South	A	Connector	90	11	3
South	B	Connector	90	11	3
South	C	Connector	75	11	3
South	D	Connector	75	11	3

Study Area	Option	Road	Length (m)	Width (m)	No. Spans
South	E (Short)	Connector	135	11	4
South	E (Long)	Connector	350	11	10
North	A	Arterial	100	20	4
North	B	Arterial	80	20	3
South	A	Arterial	130	20	5
South	B	Arterial	110	20	3
South	C	Arterial	70	20	3
South	D	Arterial	65	20	2
South	E (Short)	Arterial	140	20	4
South	E (Long)	Arterial	330	20	10

Notes:

1. 70m bridge length (3 spans) plus 30m culvert length (10 cells)

4.2 Indicative Costs

High-level budget estimates for bridge construction are illustrated in the following charts. **pitt&sherry** has significant experience in the field of bridge engineering and we have drawn on our knowledge of typical bridge construction rates taken from many projects. For this purpose of this exercise we have assumed rates of between $3,500 and $5,000 per square metre of bridge deck area for bridge construction. Generally, the lower end of the price range may be expected for structures where the piers are simple to construct and beams can be easily transported and lifted in place, and where culverts may be incorporated. The higher end could be expected for the South E options where the pier height will be significant and there will be higher costs associated with placement of the beams. More refined cost estimates are to be provided once the preferred crossing locations have been selected.

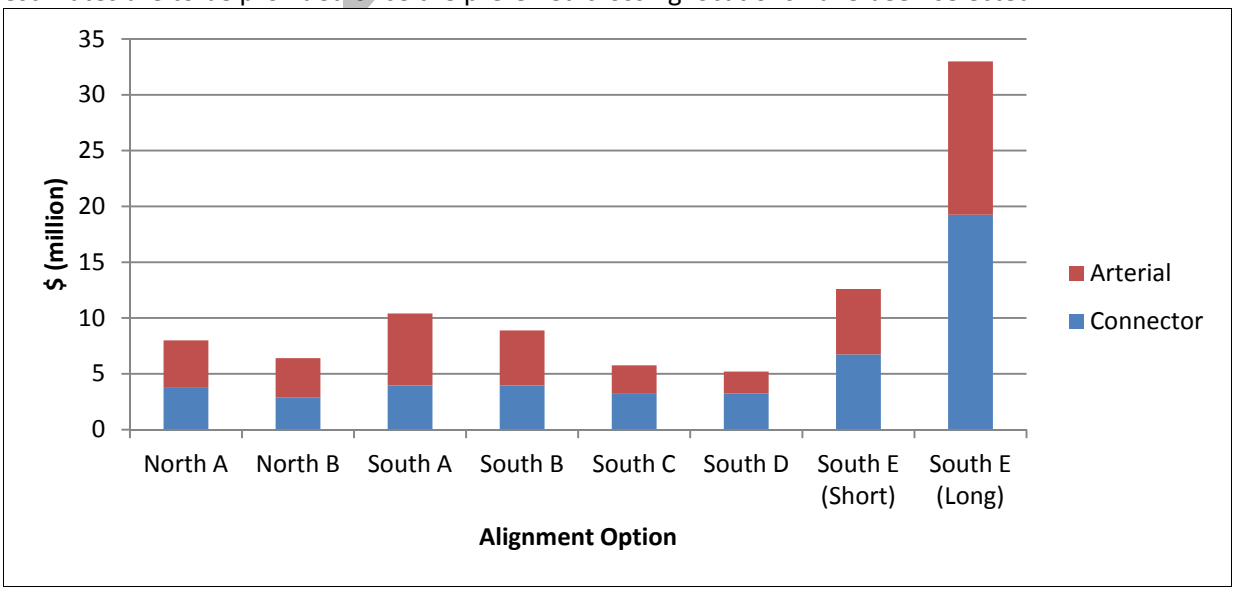


Figure 10: Preliminary cost estimates for bridge concepts

The construction cost rates assumed here are inclusive of all material, labour and equipment to construct the bridges, including earthworks in the immediate vicinity of the structure. It is also inclusive of typical preliminary costs such as site establishment, project plans and contractor's project management costs and profit. The rates do not include costs associated with design, administering the contract or supervision of the works by the principal's representative, or costs associated with bridge architectural treatments.

4.3 Aesthetic Treatments

The form and extent of aesthetic treatments on a bridge structure can vary a great deal. The below images show examples of features used on three road bridges in Victoria, however there are many more examples.

For the Jacksons Creek bridges aesthetic treatments may provide an opportunity to acknowledge the Aboriginal cultural heritage value of the area.

The cost of any aesthetic treatment will ultimately depend on how much emphasis is placed on this aspect of the design. It could range from a few tens of thousands to a few hundred thousand dollars.

Figure 11: Protection screens over rail, Tarneit Road, Werribee

Figure 12: Architectural feature on Westgate Freeway

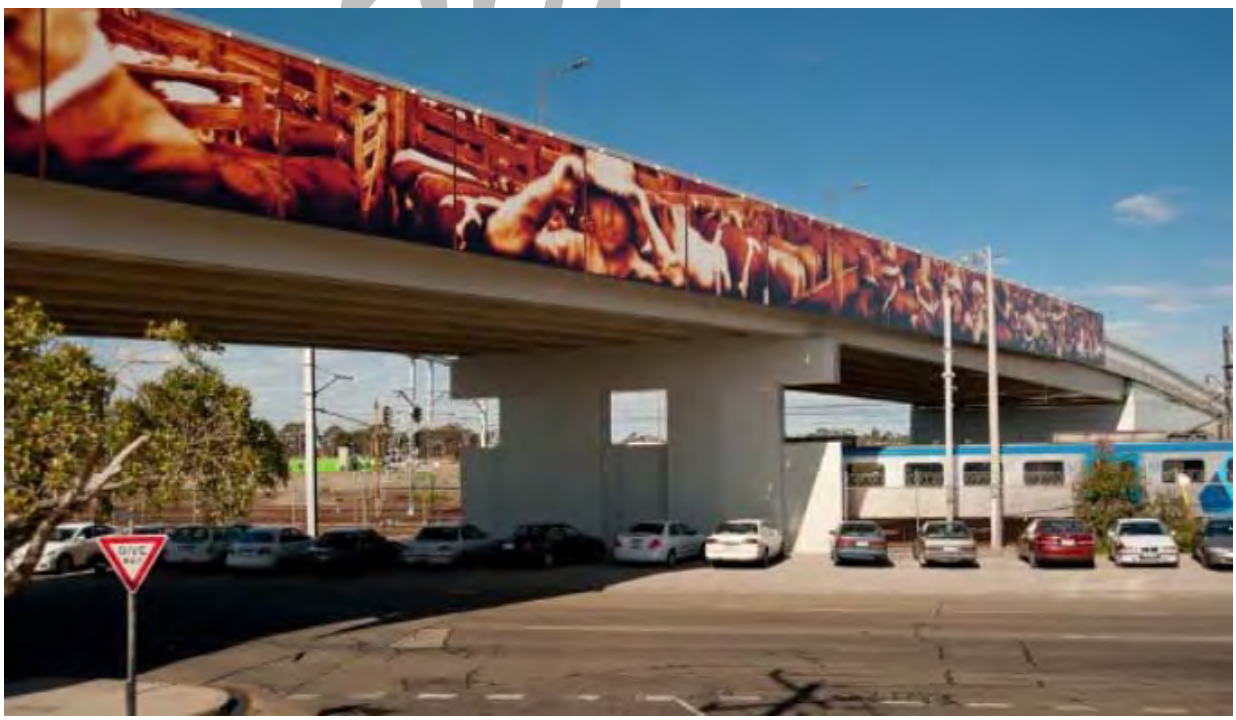


Figure 13: Artwork mounted on Stockmans Bridge, Dandenong

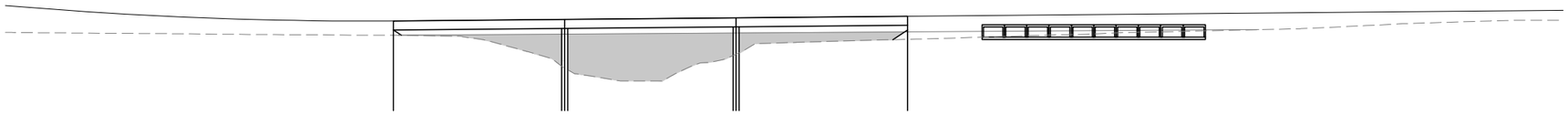
5. Summary

Short to medium span bridges comprising of precast concrete Super-T beams are expected to be the most cost effective form of construction for the proposed crossings for Jacksons Creek. Perhaps the only exception may be the longer structures required for the South E alignments where other forms of construction may be more economical, however this is outside the scope of the current assignment. Having said this, standard Super-T beams were used on the 165m long twin bridges over the Djerriwarrh Creek (Anthony's Cutting) in 2011, where the piers reached a height of 32m.

Anticipated costs for bridge construction are in the order of $2.9m to $3.8m and $6.4m to $8.0m for the north study area connector and arterial roads respectively. For the south study area the range is approximately $3.2m to $19.3m for the connector roads and $5.2m to $33.0m for arterial roads.

Appendix A

Bridge Concepts
(Stick Figure Diagrams)



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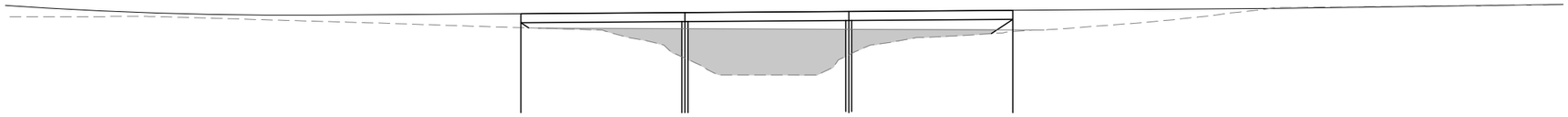

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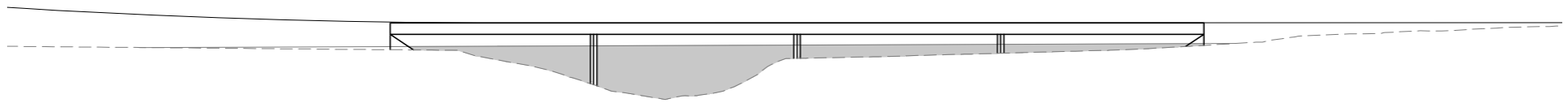

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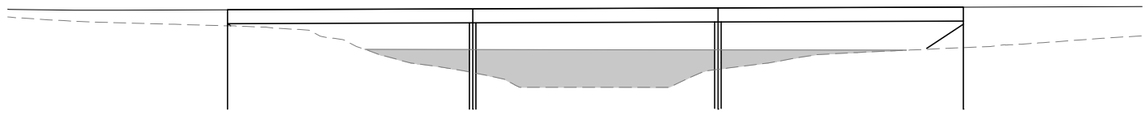

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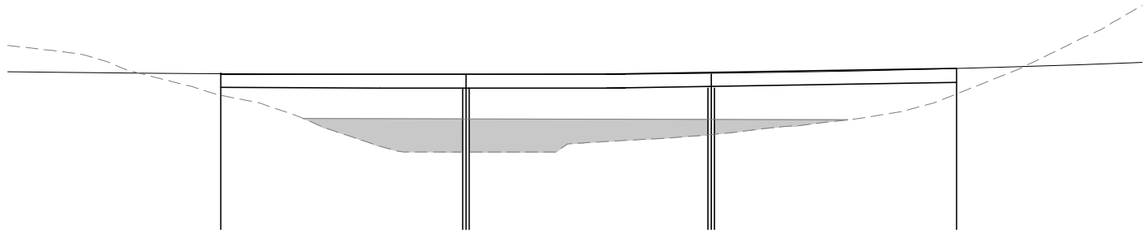

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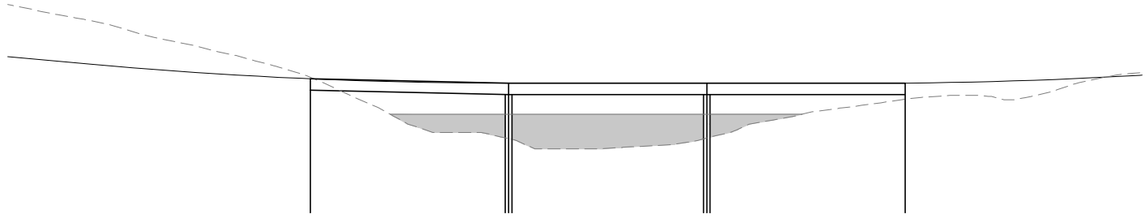

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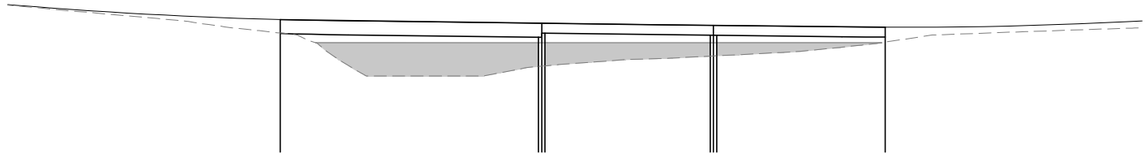

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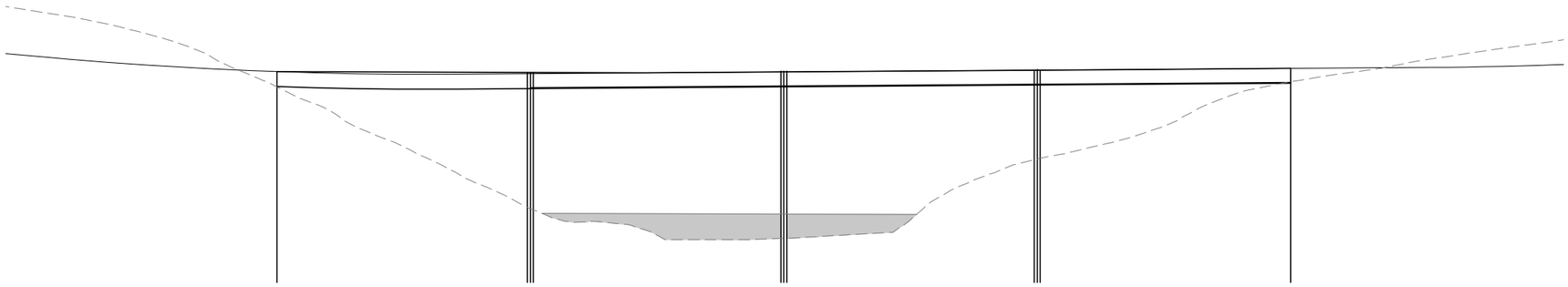

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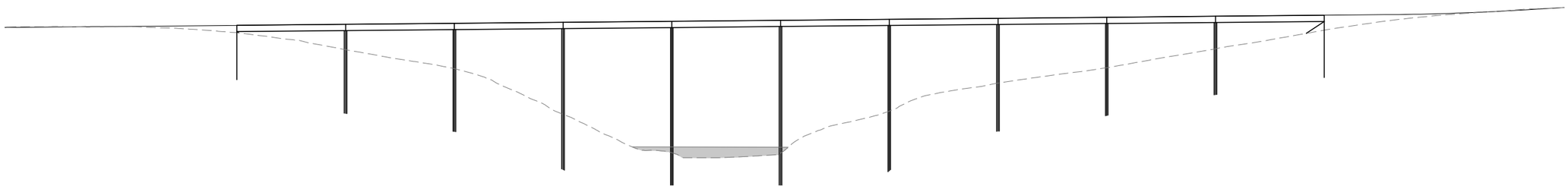

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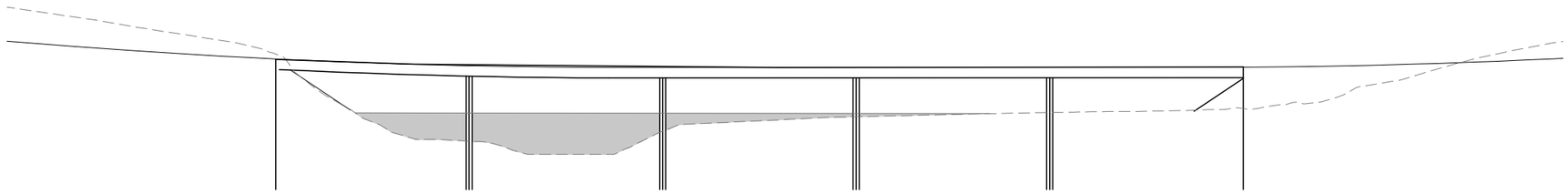

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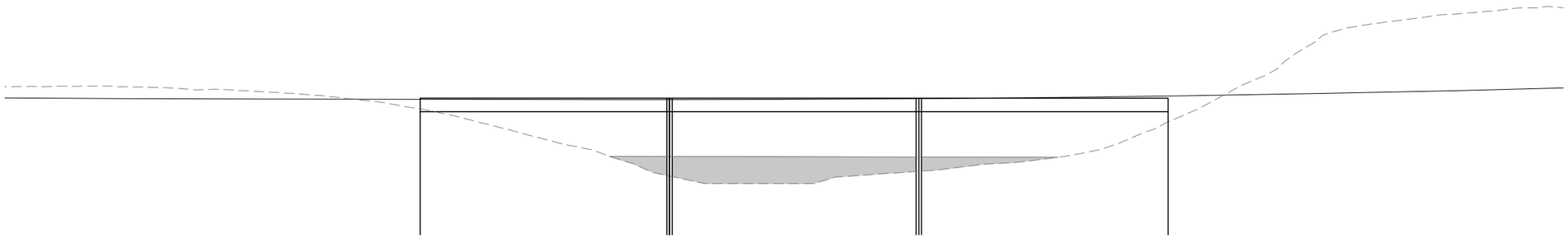

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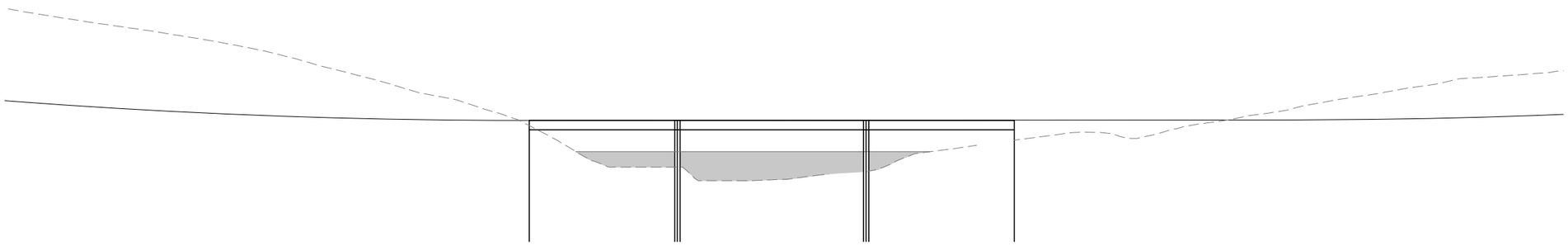

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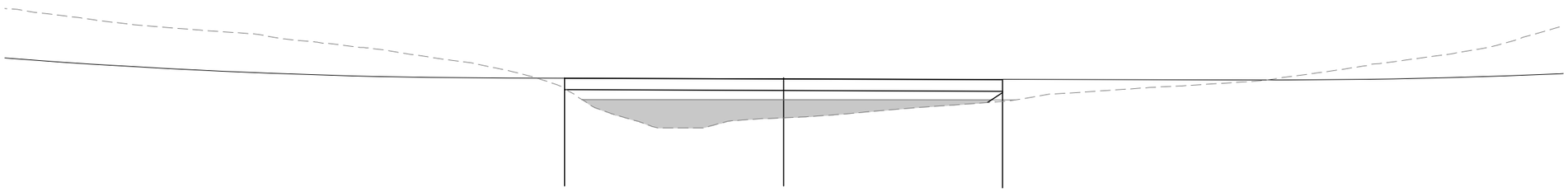

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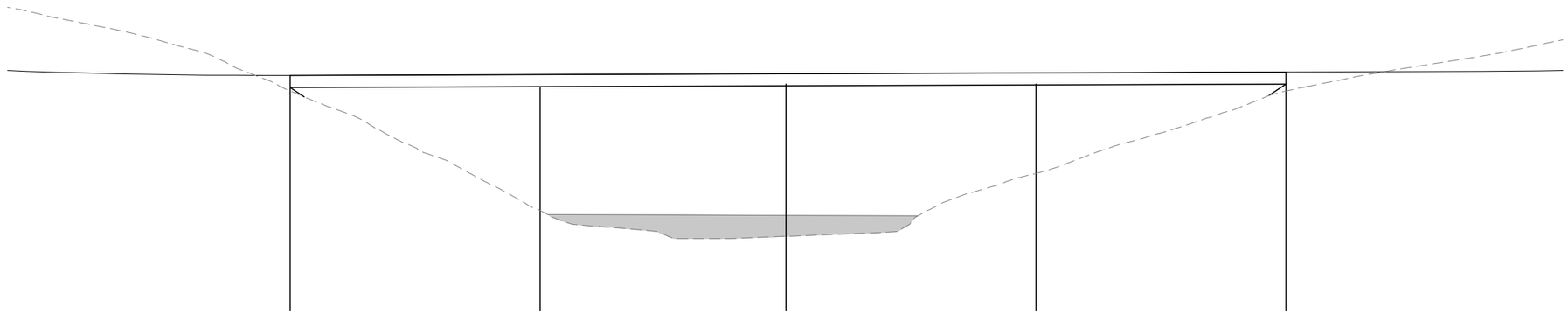

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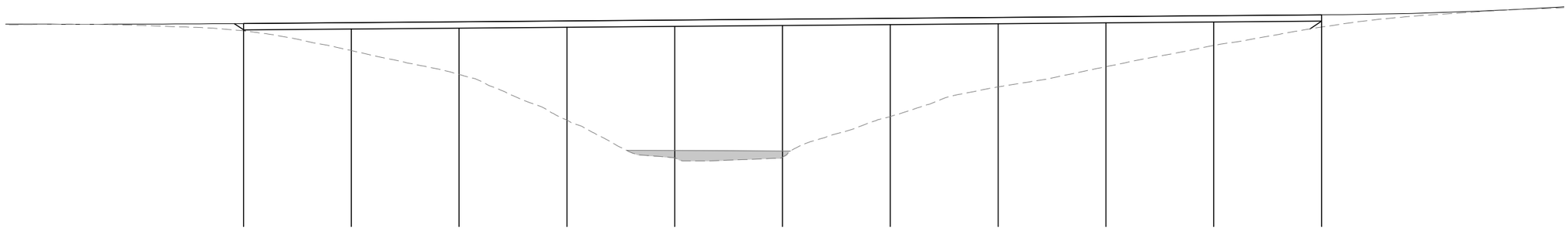

ELEVATION - OPTION E (LONG)
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REFERENCE FILES ATTACHED:

P&S FORM DRG-A3 REV -5

DRAWING REVISION HISTORY					
No.	DESCRIPTION	DRAWN	DESIGNED	REVIEWED	DATE
A	CONCEPT	RL	CM	CM	26/09/14

APPROVED
ORIGINAL COPY ON FILE
"e" SIGNED BY
K
SIGNED
DATE

SCALE (PLOTTED FULL SIZE) AS SHOWN (A3)
SHEET SIZE A3

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CLIENT: GTA CONSULTANTS
PROJECT: JACKSONS CREEK CROSSINGS
STATUS: **CONCEPT**

DRAWING TITLE: BRIDGE CONCEPTS
SOUTH STUDY AREA ARTERIAL ROAD - SHEET 2
DATUMS: AHD / MGA PLANE
CLIENT No. -
DRAWING No. ML14079-S105
REVISION A
Sep. 26, 14 - 14:12:05 Name: ML14079-S105.dwg Updated By: Ryan Loe

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Appendix E

Cultural Heritage Assessment Report

ecology & heritage partners

Final Report

Opportunities and Constraints Analysis (Cultural Heritage), Jacksons Creek Road Crossings for the Northern Link

Prepared for

GTA

October 2014

Ecology and Heritage Partners Pty Ltd

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CONTENTS

1 INTRODUCTION

This report presents the results of the opportunities and constraints analysis specific to the Northern Link Jacksons Creek crossings. The Master Document provides an overview of the heritage context that informs the current analysis and includes all references referred to in the current document.

It should be noted that this opportunities and constraints analysis is derived from a purely archaeological perspective. It is not informed by ethnographic information or traditional ecological knowledge (TEK); information that can only be obtained during consultation with the Traditional Owners, the Wurundjeri Tribe Land and Cultural Heritage Compensation Council. As a result, this report does not account for the cultural significance that the Wurundjeri ascribe to heritage places and cultural landscapes within the study area.

The use of archaeological data thus provides a limited contribution to informing the alignment decisions where they will likely impact *previously identified* Aboriginal heritage places. Moreover, it should be noted that large areas of the study area have not been subject to detailed studies and remain archaeologically unknown; as such the current contribution is based primarily on *existing* heritage information. Similarly no subsurface testing has occurred in the study areas and whilst extensive, the current archaeological record likely represents only a fraction of the archaeological heritage that exists in the creek corridor beneath the ground surface.

2 RESULTS

2.1 Register Searches Northern Link (Map 2)

A search of the Victorian Aboriginal Heritage Register (VAHR) was conducted on 27 May 2014 for sites within a 1 km radius of the study area (both northern and southern sections). Searching an area with this radius ensured that a relevant and representative sample of information was obtained.

The search identified 30 registered Aboriginal Places within a 1 km radius of the study area (northern link). Two of these sites (VAHR 7822-0697 and 7822-0700) are within the Option B alignment within the study area (see Map 4). Both are artefact scatters however; VAHR 7822-0700 is an isolated artefact comprising one silcrete flake, while VAHR 7822-0697 is a high density surface artefact scatter spread across a large area of the floodplain (see Figure 1). This latter site comprises different artefact types such as blades, blade cores and an axe head and different raw material types such as silcrete, quartz, basalt and greenstone. Option B alignment intersects directly with one known Aboriginal Place (VAHR 7822-1898) an exposure of artefacts on the western side of the river but passes within close proximity of several other Aboriginal Places. Both alignment Options ascend to the escarpment on the western side of the creek which is considered 'archaeologically unknown' (Map 4).

In addition, within 1 km of the study area, are three of the five Sunbury Earth Rings. These sites are highly significant because they provide a rare glimpse into past Aboriginal society particularly in reference to spiritual and celebratory aspects of Aboriginal culture (OAAV Mini Posters, 2008). Only eight Earth Rings occur within the state of Victoria.

Table 1: Summary of Previously Identified Aboriginal Site Component Types within 1km of the Study Area (Northern Link). (Map 2)

Site Type	Quantity	Percentage (%)
Artefact Scatter	19	58
Isolated Artefact	1	3
Scarred Tree	7	21
Object Collection	1	3
Earth Feature	3	9
Aboriginal Cultural Place	2	6
Total	**33**	**100**

Local Council

The study area is located within the City of Hume and is governed by the City of Hume Planning Scheme. Planning schemes set out policies and provisions for the use, development and protection of land.

The Heritage Overlay of the City of Hume Planning Scheme was examined. No Aboriginal heritage places listed on the Heritage Overlay are present within the study area.

2.1.1 Previous Aboriginal Archaeological Investigations Relevant to the Northern Link Study Area

Regional and localised archaeological investigations have established the general character of Aboriginal sites located within close proximity to the study area. This information, together with environmental context, histories of land use and historical and ethnohistorical information can be used to form the basis for a site prediction statement. Below are summarised the most relevant localised archaeological investigations carried out in the region.

In 1982 Frankel prepared a report (#061) on the earth rings at Sunbury (located within 1 km south of the current study area) based on his investigation of the site in 1979. Comprising three shallow circular dish-like hollows, the rings are located on the upper slopes of the sandstone and shale hills which rise 50 m above the river flats east of Jacksons Creek. Frankel's aim was to identify whether the rings were of Aboriginal construction and to determine their nature and method of manufacture. The remains of two small stone cairns and a total of 164 silcrete artefacts were recovered from the excavations. Based on the ethnography of the area and the site contents, Frankel concluded that there was no reason not to associate the rings with Aboriginal socio-religious activities. Since Frankel's research two additional earth rings have been recorded in the Sunbury area.

In 2011 Barker completed a Cultural Heritage Management Plan (#11279) for a proposed residential subdivision at 275 Racecourse Road, Sunbury, located directly to the west of the current study area. The desktop assessment indicated that the activity area contained three previously recorded surface artefact scatters, however only one of these was relocated during the standard assessment. Inspection of this site resulted in an additional 60 artefacts being located. Visibility throughout the survey was poor and limited to firebreak tracks. It was concluded that as two of the previously recorded sites could not be relocated, the artefacts associated with these sites had likely been moved around the surrounding tracks due to general disturbance of the soil. It was noted that the soil on the firebreak tracks was distinctly different from the soils across the rest of the activity area, suggesting that it had been introduced to the site. Complex testing involved the excavation of 20 1 x 1 m test pits and a total of 121 shovel probes. This investigation focused on establishing soil stratigraphy and identifying the existence of a subsurface component to the surface artefacts. No artefacts were recovered during the complex assessment. Sub surface testing indicated that the three previously recorded sites were not *in situ* and had most likely been brought into the activity area during soil dumping from surrounding subdivisions and road construction.

Also in 2011, Walther, Berelov and Thiele undertook a Cultural Heritage Management Plan (#11394) for the Sunbury Electrification Project Bendigo Rail Line from Macedon Street Bridge, located approximately 300 m south of the current study area. The desktop assessment indicated that two scarred trees had previously been recorded within 50 m of the activity area. One new site comprising one silcrete flake was located within the rail corridor during the standard survey. The artefact is not considered to be *in situ*, having been affected by cut and fill activities undertaken as a result of railway construction and general disturbance within the rail reserve. It was concluded unlikely that any additional sites would be located within the activity area due to the level of disturbance.

2.1.2 Aboriginal Cultural Heritage: Constraints

Several archaeological studies have identified a high density of Aboriginal Places associated with the Jackson's creek corridor. These studies have predominantly focused on the western side of the creek and as such the creeks eastern bank and hinterland remain relatively archaeologically unknown (as can be seen on Map 3, where only one Aboriginal Place has been recorded east of the creek). Nonetheless, these previous studies make it possible to broadly categorise the nature and distribution of the Aboriginal heritage along the creek. In both study areas, several high density artefact scatters occur along Jackson's Creek. On examination of the sites cards for these places, several had very large surface areas that intersect with area of the proposed crossing locations (VAHR 7822-0697, 7822-1998, 7822-1900 in the north). The surficial area of these places has been mapped on Map 4. These larger Aboriginal sites are linked by a near-continuous distribution of smaller sites along the creek banks. The majority of these places occur within 100m of the creek itself. As many of these sites have been recorded along tracks and exposures where surface visibility is high; these smaller sites may represent larger or richer subsurface sites. Similarly, as the red clay soils of the creek corridor can be several metres deep, it is also likely that unknown and deeply buried Aboriginal places (including burials) may occur in this corridor. This creek corridor (see Map 4) should be considered of highly sensitivity and detailed archaeological assessment will be required to ensure such cultural resources are not inadvertently impacted during any construction work.

In the northern study area, the Sunbury earth rings (VAHR 7822-0098 and 7822-0099) are just over 200m south of the southernmost proposed alignment (Option A). This proximity represents a likely visual impact to these places, considered to be amongst the most highly significant heritage places to the Wurundjeri. Several artefact scatters and a Scarred Tree (VAHR 7822-1062) are also associated with the earth rings and also contribute to the cultural and scientific significance of this location; a mid-level terrace close to the creek (Figure 2). Given the high cultural and scientific significance associated with these places, Map 4 shows a 200 m buffer around these places (representing likely visual range of a large roadway). Additional information about the earth rings will be obtained during the site visit and cultural values recording. Avoidance of this area is considered the most appropriate management strategy.

2.2 Historical Cultural Heritage in the Northern Link Area

For an overview of Historical Cultural Heritage consult the master document.

2.2.1 Register Searches

Victorian Heritage Register

The Victorian Heritage Register (VHR), established by the Victorian Heritage Act 1995, provides the highest level of statutory protection for historical sites in Victoria. Only the State's most significant historical sites are listed on the VHR. A search of the VHR for information relating to the study area was undertaken. The study area (northern and southern sections) and the surrounding 1 km of land were investigated.

Two heritage places were listed in the VHR within a 1 km radius of the study area. Details of these sites can be found in Table 5. None of these heritage places are located within the study area.

Victorian Heritage Inventory

The Victorian Heritage Inventory (VHI), established by the Victorian Heritage Act 1995, provides the statutory protection for all historical archaeological sites, areas or relics, and private collections of relics, in Victoria. Sites listed on the VHI are not of State significance but are usually of regional or local significance. A search of the VHI for information relating to the study area was undertaken. The study area (northern and southern sections) and the surrounding 1 km of land were investigated.

One historical place was listed on the VHI within a 1 km radius of the study area. Details of this site can be found in Table 3. This heritage place is located within the study area.

Local Council Heritage Overlay

The study area is located within the City of Hume and is governed by the City of Hume Planning Scheme (PS). Planning schemes set out policies and provisions for the use, development and protection of land. The Heritage Overlay of the City of Hume was examined.

Three heritage places were identified in the PS within a 1 km radius of the study area. Details of these three sites can be found in Table 3. One of these heritage places is located within the study area.

National Trust of Australia (Victoria) Register

The National Trust of Australia (Victoria) is an independent, not-for-profit organisation that classifies a number of heritage places. Listing by the National Trust does not impose any statutory protection, however often National Trust Register listings are supported by the local council Planning Scheme.

Two heritage places were listed in the National Trust Register within a 1 km radius of the study area. Details of this site can be found in Table 3. None of these heritage places are located within the study area.

Victorian War Heritage Inventory

The Victorian War Heritage Inventory (VWHI) was established in 2011 as a means to catalogue Victoria's war history such as war memorials, avenues of honour, memorial buildings, former defence sites and places of commemoration. Places listed on the VWHI do not currently have discrete statutory protection, however many are concurrently listed on the VHR, VHI, or local planning schemes.

No heritage places were listed in the AHD within the study area (northern and southern sections) or within 1 km of the study area.

National, Commonwealth and International Heritage Lists

The Australian Government Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) maintains the National Heritage List (NHL), a register of exceptional natural, Aboriginal and historical heritage places which contribute to Australia's national identity. The SEWPaC also maintains the Commonwealth Heritage List (CHL), a Register of natural, Aboriginal or historical heritage places located on Commonwealth land which have Commonwealth heritage values.

A place can be listed on one or both lists, and placement on either list gives the place statutory protection under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999).

The World Heritage List (WHL) lists cultural and natural heritage places which are considered by the World Heritage Council to have outstanding universal value. In addition, the SEWPaC also maintains the Register of the National Estate (RNE) which is a list of natural, Indigenous and historic heritage places throughout Australia. Following amendments to the Australian Heritage Council Act 2003, the RNE was frozen on 19 February 2007 and no new places were added or removed. In February 2012 the RNE ceased statutory operation and sites listed on the RNE no longer have statutory protection, however items listed on the RNE may continue to be considered during approvals processes.

Listings on the NHL, CHL, WHL and RNE are accessed via the Australian Heritage Database (AHD), managed by SEWPaC.

Three heritage places were listed in the AHD within a 1 km radius of the study area. Details of these sites can be found in Table 3. One of these heritage places is located within the study area.

Table 2: Historic Heritage Places within 1 km of the Study Area (northern section) (Map 3).

Register & Site Number	Site Name	Site Type	Within Study Area?
VHR H0275 HO 45 RNE 5555 and 55560 NT B1817 and B1038	Rupertswood (including lodge and gates)	Structural	No
VHR H1692 HO 61 RNE 16044 NT B3039	Jacksons Creek Rail Bridge	Civic	No
VHI H7822-2291	Sunbury Volunteer Military Exercise Site	Military	Yes
HO 366	Cannon Gully- Eastern Escarpment of Jacksons Creek	Natural	Yes
RNE 15668	The Mount Alexander-Murray Valley Railway Line	Civic	Yes

2.2.2 Previous Historical Archaeological Investigations - Northern Link

In 2003, Tulloch undertook an archaeological survey at Lancefield Road, Sunbury East (#1618). A total of five historical sites were recorded during the survey, comprising a series of dry stone walls, a farm complex, bluestone blocks and a ford (D7822-0379, D7822-0371, D7822-0380, D7822-0381 and D7822-0382). Based on the survey it was determined that the activity area contains the remains of an early farming complex that relates to the use of animals. The presence of a horse works circle, a ford and walled enclosures suggest that either a variety of stock was kept, or that farming practices changed over the years.

In 2005, Hyett and Tucker completed a cultural heritage assessment of The Sanctuary, Sunbury (#2412). Remnants of two dry stone walls and a galvanised shed were identified during the survey; however none of these features were identified as having sufficient historic attributes to warrant registering with Heritage Victoria.

In 2007, Murphy and Dugay-Grist completed a cultural heritage assessment of Macedon and Racecourse Roads in Sunbury (#2485). One new site comprising a scatter of historic artefacts was recorded during the survey (H7822-0855). The scatter includes early ginger beer bottle fragments and bottle glass. It was determined to be highly disturbed due to repeated ploughing and stock trampling. The area surrounding this scatter for approximately 100 metres is considered potentially sensitive for the location of additional historic artefacts and possible structural remains associated with this site. No subsurface testing was conducted.

2.3 Field Visit

A brief site visit was undertaken by Dan Cummins on 15 September 2014. It should be noted that this site visit did not involve survey of the alignments or involve investigation of Aboriginal or post-contact heritage. It did however provide an opportunity to identify and photograph those landforms and known Aboriginal Places which the proposed the Northern Link alignments are likely to impact.

Figure 1: Location of proposed crossing of Jacksons Creek at Option B, looking east across VAHR 7822-0697 which occurs across the floodplain in the middle distance.

Figure 2: View of terrace landform west of Jackson Creek on which Sunbury Rings (VAHR 7822-0099 and 7822-0098) are located from Jacksons Creek at Option A.

Figure 3: West facing panorama of basin through which Option A ascends the escarpment on the eastern side of Jacksons Creek. The location of the Sunbury Rings is the creek terrace in the centre of the frame on the far side of Jacksons Creek.

3 OPTIONS ASSESSMENT – CULTURAL HERITAGE

3.1 Introduction

The following section provides a comparative summary of the likely impacts to Aboriginal Heritage resources caused by the proposed Northern Link road and bridge crossing alignments across Jacksons Creek. This assessment should be considered preliminary as the exact nature and extent of Aboriginal heritage within the creek corridor is not comprehensively understood. In particular no subsurface testing or archaeological excavation has occurred in the study area; hence the extent of below-ground heritage is unknown. This caveat cannot be understated as amongst the most ancient and scientifically significant archaeological sites in Victoria, the 30,000 year old Keilor burials, have been identified in similar terrace landforms to the south.

With regard to the arterial versus collector roads it should be noted that the impacts of the proposed arterial roads are greater but do not affect the relative performance of each bridge location. That is, there is a *quantitative* difference in the impact from the arterial roads but the *relative* impact between categories is unchanged. Thus the performance of the collector roads should be considered higher as a whole but not relative to the other alignment options. Only if either a north or south creek crossing is considered (rather than both) would the impact of a single arterial road be considered a better option than two collector roads with regard to total impacts to Aboriginal heritage resources.

The Sunbury Rings are the only earth features in the area and represent the most sensitive Aboriginal Places; consequently they have the highest criteria for impact avoidance. In the Jacksons Creek corridor the waterway has incised a spectacular series of escarpments, cliffs and basin landforms that represent significant cultural landscapes. Along with the likely physical impacts associated with the extent of earthworks required within the 200m creek corridor, visual impacts to the cultural landscape have been factored into the ranking for the 'River Corridor' in Table 3. Impacts to 'Aboriginal cultural places' relate to the likely impacts to known archaeological heritage in the creek corridor. 'Heritage Overlay' impacts relate to the limited impacts likely to non-Aboriginal heritage within the alignments. Scarred trees will not be impacted but this category is retained to demonstrate this fact. Impacts to 'artefacts/objects' includes an assessment of the likely impacts to higher densities of Aboriginal artefacts associated with the 'Aboriginal Places' category but also includes the likelihood of impacts to 'predicted' or currently unknown Aboriginal heritage.

3.1.1 Northern Alignments – Discussion of Impacts

As Option A passes closer to the highest ranked criterion (Sunbury Rings), and on this basis alone, Option B presents as a higher performing alignment. Furthermore, Option A passes through a number of recorded Aboriginal Places on both sides of Jacksons Creek (VAHR 7822-1898 and probably7822-1901). The existing pattern of sites across the extensive floodplains, point bars, and alluvial basins (overflow channels) suggests it is probable that VAHR 7822-1901 extends eastward into the deep basin through which Option A passes (Figure 3). Furthermore, Option A passes through an archaeologically unknown area along the top of the escarpment on the eastern side of the creek (Map 4), thus presenting significant risk in the likely occurrence of currently unknown heritage resources in this area. This risk could be significantly minimised by

reconfiguring this part of the road closer to the existing rail and track corridor, which has already been significantly impacted. An obvious benefit of this would be that it would not result in the creation of an isolated pocket of (undevelopable) land between the road and the rail line.

Option B is more direct and passes at a great distance from the Sunbury Rings and hence scores higher in this variable. Option B does pass through a large Aboriginal Place (VAHR 7822-0697) that extends across a large part of the creek floodplain on the eastern bank of Jacksons Creek (Map 4). Although this site is large, it is a diffuse scatter and is not necessarily of greater significance than the sites further south in the vicinity of the Option A crossing.

Whilst the gully through which Option B ascends can be considered a part of the cultural landscape that will be impacted/destroyed; this gully is steep sided and is unlikely to harbour Aboriginal archaeological sites of any size or complexity (as it is unsuited terrain for a campsite).

Table 3: Cultural Heritage – Northern Link Summary

A	B
Sunbury Earth Rings	
Some Impact	Low Impact
River Corridor	
Neutral / Minimal Impact	Neutral / Minimal Impact
Aboriginal cultural places	
Some Impact	Some Impact
Heritage Overlay / Register Items / Inventory	
Low Impact	Some Impact
Scarred Trees	
Neutral / Minimal Impact	Neutral / Minimal Impact
Artefacts / Objects	
Neutral	Neutral

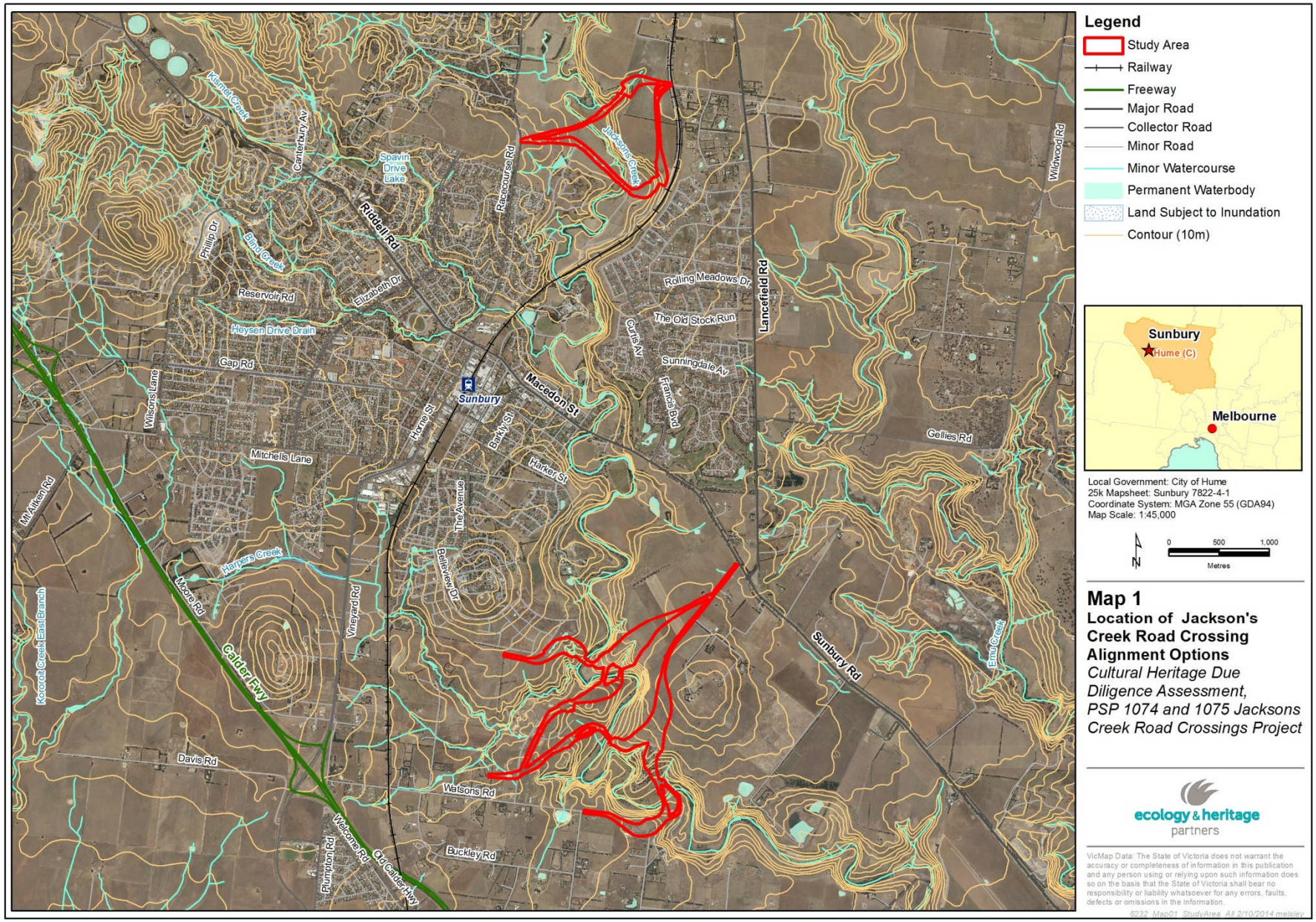
3.1.2 Northern Alignment Options – Costs and Considerations

Archaeological heritage management of the Option B alignment based on the current archaeological understanding of the creek corridor is likely to be more extensive and expensive. However, should those sites in the Option A corridor be determined to be more extensive as a result of subsurface investigations (such as finding that 7822-1901 is larger than currently recorded, as speculated above) the two options are likely to be equivalent in scale and expense. Impacts to Aboriginal Places such as VAHR 7822-0697 (Option B) will need to be managed. Management where harm cannot be avoided under Section 61 of the *Aboriginal Heritage Act 2006* usually involves archaeological salvage and/or non-archaeological salvage of the area of the Aboriginal Place to be impacted. Archaeological salvage usually involves controlled excavation of trenches of varying sizes (up to 10x10m) by hand to obtained detailed information about the site and site formation processes, including soil analysis and radiocarbon dating to determine when and how long the site was occupied. Additional data from artefact usewear analysis and other studies can also inform how the site was used by past Aboriginal populations.

In comparison non-archaeological salvage usually involves larger areas of mechanical excavation and sieving of sediments to sterile deposits (A and B horizons of varying depths depending on landform) within the entire footprint of the impact area to extract the heritage objects/artefacts with limited (if any) stratigraphic control or additional data being collected. As the *context* of the artefacts is not controlled the amount of interpretation about past Aboriginal lifeways and practices is extremely limited.

Management recommendations can include a combination of these strategies for mitigation of cultural heritage resources during the consultation with the RAP (Wurundjeri) as a part of the CHMP process. Other recommendations including heritage signage and trails can also be discussed and negotiated. There are no set requirements for the management of Aboriginal heritage under the *Aboriginal Heritage Act 2006.*

MAPS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Study Area
Railway
Freeway
Major Road
Collector Road
Minor Road
Minor Watercourse
Permanent Waterbody
Land Subject to Inundation
Contour (10m)
Sunbury
Hume (C)
Melbourne
Local Government: City of Hume
25k Mapsheet: Sunbury 7822-4-1
Coordinate System: MGA Zone 55 (GDA94)
Map Scale: 1:45,000
0
500
1,000
Metres
N
Map 1
Location of Jackson's Creek Road Crossing Alignment Options
Cultural Heritage Due Diligence Assessment, PSP 1074 and 1075 Jacksons Creek Road Crossings Project
ecology & heritage partners
VicMap Data: The State of Victoria does not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that the State of Victoria shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.
6232_Map01_StudyArea_A3 2/10/2014 melsley
Kismet Creek
Canterbury Av
Spavin Drive Lake
Riddell Rd
Racecourse Rd
Jacksons Creek
Wickwood Rd
Phillip Dr
Blind Creek
Reservoir Rd
Elizabeth Dr
Heysen Drive Drain
Cap Rd
Wilsons Lane
Rolling Meadows Dr
The Old Stock Run
Curtis Av
Sunningdale Av
Francis Blvd
Lancefield Rd
Gellies Rd
Sunbury
Macedon St
Horne St
Barkly St
Harker St
Mitchells Lane
The Avenue
Bellaview Dr
Vineyard Rd
M Aitken Rd
Kororoit Creek East Branch
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Moore Rd
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Emu Creek
Davis Rd
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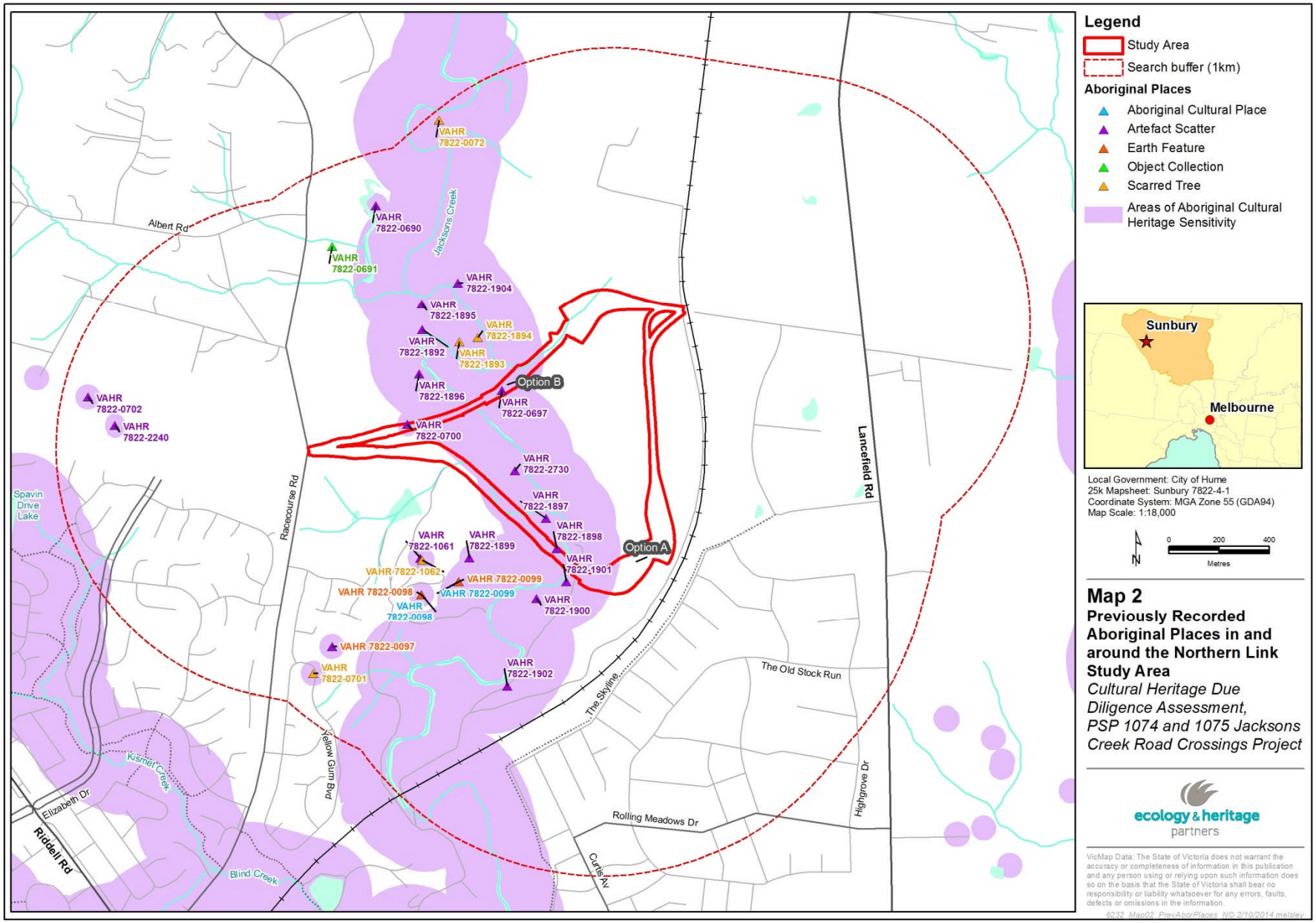
Old Calder Hwy
Plumpton Rd
Buckley Rd


Legend
Study Area
Search buffer (1km)
Aboriginal Places
Aboriginal Cultural Place
Artefact Scatter
Earth Feature
Object Collection
Scarred Tree
Areas of Aboriginal Cultural Heritage Sensitivity
Sunbury
Melbourne
Local Government: City of Hume
25k Mapsheet: Sunbury 7822-4-1
Coordinate System: MGA Zone 55 (GDA94)
Map Scale: 1:18,000
0 200 400
Metres
N
Map 2
Previously Recorded Aboriginal Places in and around the Northern Link Study Area
Cultural Heritage Due Diligence Assessment, PSP 1074 and 1075 Jacksons Creek Road Crossings Project
ecology & heritage partners
VicMap Data: The State of Victoria does not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that the State of Victoria shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.
6232_Map02_PrevAborPlaces_NO 2/10/2014 melsley
Albert Rd
Jacksons Creek
Racecourse Rd
Lancefield Rd
Spavin Drive Lake
Option A
Option B
The Old Stock Run
The Skyline
Rolling Meadows Dr
Highgrove Dr
Curtis Av
Yellow Gum Blvd
Kismet Creek
Elizabeth Dr
Riddell Rd
Blind Creek
VAHR 7822-0072
VAHR 7822-0690
VAHR 7822-0691
VAHR 7822-1904
VAHR 7822-1895
VAHR 7822-1894
VAHR 7822-1892
VAHR 7822-1893
VAHR 7822-1896
VAHR 7822-0697
VAHR 7822-0702
VAHR 7822-2240
VAHR 7822-0700
VAHR 7822-2730
VAHR 7822-1897
VAHR 7822-1898
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VAHR 7822-0098
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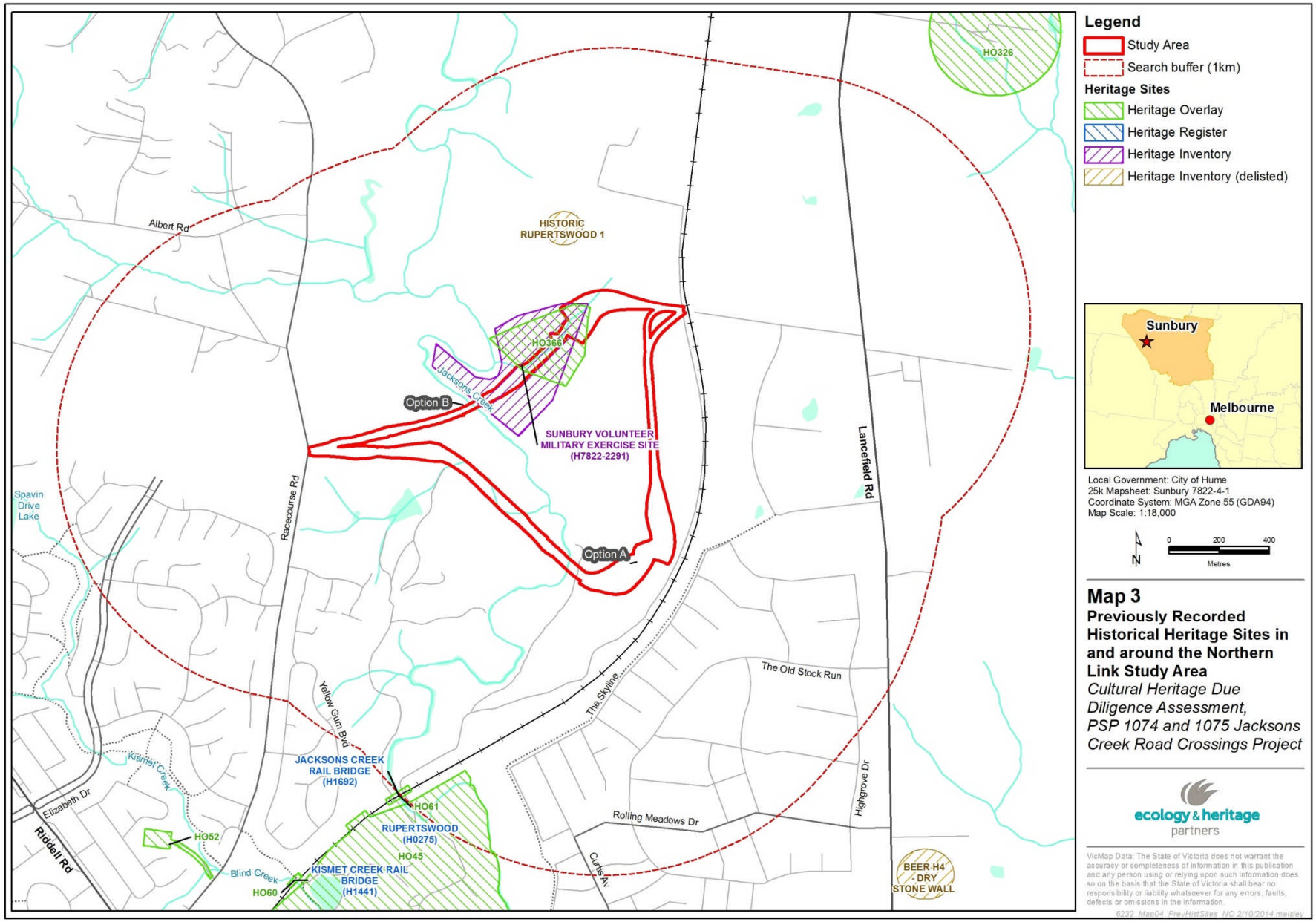
VAHR 7822-0701
VAHR 7822-1902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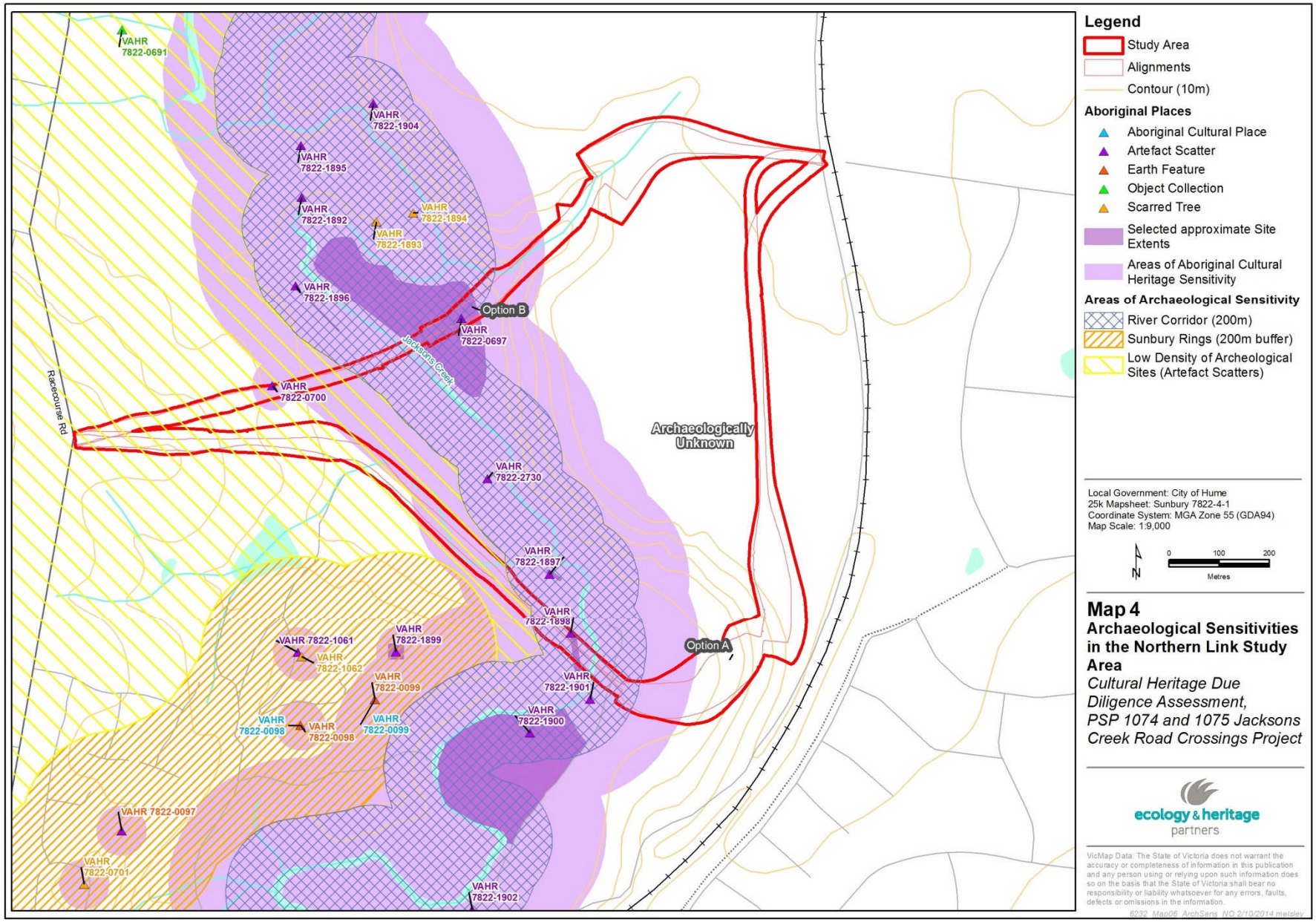
Study Area
Search buffer (1km)
Heritage Sites
Heritage Overlay
Heritage Register
Heritage Inventory
Heritage Inventory (delisted)
HO326
HISTORIC RUPERTSWOOD 1
HO366
Jacksons Creek
Option B
SUNBURY VOLUNTEER MILITARY EXERCISE SITE (H7822-2291)
Option A
Albert Rd
Racecourse Rd
Lancefield Rd
Spavin Drive Lake
Yellow Gum Blvd
JACKSONS CREEK RAIL BRIDGE (H1692)
HO61
RUPERTSWOOD (H0275)
HO45
KISMET CREEK RAIL BRIDGE (H1441)
HO60
HO52
Kismet Creek
Blind Creek
Elizabeth Dr
Riddell Rd
The Skyline
The Old Stock Run
Rolling Meadows Dr
Highgrove Dr
Curtis Av
BEER H4 - DRY STONE WALL
Sunbury
Melbourne
Local Government: City of Hume
25k Mapsheet: Sunbury 7822-4-1
Coordinate System: MGA Zone 55 (GDA94)
Map Scale: 1:18,000
0
200
400
Metres
Map 3
Previously Recorded Historical Heritage Sites in and around the Northern Link Study Area
Cultural Heritage Due Diligence Assessment, PSP 1074 and 1075 Jacksons Creek Road Crossings Project
ecology & heritage partners
VicMap Data: The State of Victoria does not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that the State of Victoria shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.
6232_Map04_PrevHistSites_NO 2/10/2014 melsley


VAHR 7822-0691
VAHR 7822-1904
VAHR 7822-1895
VAHR 7822-1892
VAHR 7822-1894
VAHR 7822-1893
VAHR 7822-1896
Option B
VAHR 7822-0697
Jacksons Creek
VAHR 7822-0700
Racecourse Rd
Archaeologically Unknown
VAHR 7822-2730
VAHR 7822-1897
VAHR 7822-1898
VAHR 7822-1061
VAHR 7822-1899
VAHR 7822-1062
VAHR 7822-0099
VAHR 7822-1901
VAHR 7822-0098
VAHR 7822-0098
VAHR 7822-0099
VAHR 7822-1900
Option A
VAHR 7822-0097
VAHR 7822-0701
VAHR 7822-1902
Legend
Study Area
Alignments
Contour (10m)
Aboriginal Places
Aboriginal Cultural Place
Artefact Scatter
Earth Feature
Object Collection
Scarred Tree
Selected approximate Site Extents
Areas of Aboriginal Cultural Heritage Sensitivity
Areas of Archaeological Sensitivity
River Corridor (200m)
Sunbury Rings (200m buffer)
Low Density of Archeological Sites (Artefact Scatters)
Local Government: City of Hume
25k Mapsheet: Sunbury 7822-4-1
Coordinate System: MGA Zone 55 (GDA94)
Map Scale: 1:9,000
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100
200
Metres
Map 4
Archaeological Sensitivities in the Northern Link Study Area
Cultural Heritage Due Diligence Assessment, PSP 1074 and 1075 Jacksons Creek Road Crossings Project
ecology & heritage partners
VicMap Data: The State of Victoria does not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that the State of Victoria shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.
6232_Map06_ArchSens_NO 2/10/2014 melsley

Appendix F

Ecology Assessment Report

ecology & heritage partners

Final Report

Opportunities and Constraints Analysis, Jacksons Creek Road Crossings - Options Assessment for the Northern Link

Prepared for

GTA Consultants Pty Ltd

October 2014

Ecology and Heritage Partners Pty Ltd

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DOCUMENT CONTROL

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Client	GTA Consultants Pty Ltd
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GLOSSARY

Acronym	Description
AVW	Atlas of Victorian Wildlife
BCS	Biodiversity Conservation Strategy for Melbourne's Growth Corridors
CaLP	*Catchment and Land Protection Act 1994*
CMA	Catchment Management Authority
CMP	Conservation Management Plan
CWS	Combined Weighting Score
DEPI	Victorian Department of Environment and Primary Industries
DotE	Federal Department of the Environment (former Department of Sustainability, Environment, Water, Population and Communities)
DTPLI	Victorian Department of Transport, Planning and Local Infrastructure (former Department of Planning and Community Development)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EVC	Ecological Vegetation Class
FFG Act	*Flora and Fauna Guarantee Act 1988*
FIS	Flora Information System
GAA	Growth Areas Authority
GGF	Growling Grass Frog
ISC	Index of Stream Condition
MPA	Metropolitan Planning Authority
NES	National Environmental Significance
PMST	Protected Matters Search Tool (DoE)
PSP	Precinct Structure Plan
SIA	Strategic Impact Assessment
VBA	Victorian Biodiversity Atlas (DEPI)

CONTENTS

1 INTRODUCTION

1.1 Background

This report presents the results of an assessment of ecological opportunities and constraints within the Northern Link study area adopted for the Jacksons Creek Road Crossing Project, located within the Lancefield Road Precinct. The development works have been identified by the Metropolitan Planning Authority (MPA) as part of the Precinct Structure Planning (PSP) process and aim to connect communities either side of Jacksons Creek and facilitate community access to existing and planned infrastructure within the Sunbury Growth Corridor.

The findings of this report build on the *Preliminary Opportunities and Constraints Analysis* (Ecology and Heritage Partners Pty Ltd 2014a) completed in June 2014, which adopted a broad study area associated with concept alignment options. The preliminary study contributed to the development of alignment options subject to this assessment. The overarching aim of this assessment is to facilitate the process of informed route selection and contribute to the broader feasibility study, which incorporates a suite of environmental, social and economic criteria (e.g. cultural heritage values).

Specifically this report aims to:

- Provide a summary of key ecological values within the study area, based on a review of relevant desktop information and field surveys;
- Outline a likely approvals pathway and identify key implications associated with the *Biodiversity Conservation Strategy for Melbourne's Growth Corridors* (BCS) (DEPI 2013a) and other relevant biodiversity legislation;
- Identify issues raised through consultation with key project stakeholders, including the Victorian Department of Environment and Primary Industries (DEPI), Parks Victoria, Hume City Council, 'Friends of' groups and the broader community;
- Confirm the requirement and scope of supplementary flora and fauna assessments/ surveys; and,
- Support project planning and development through the provision of detailed and accurate information in accordance with the expectations of state and Commonwealth regulators.

In order to delineate preferred scenarios, two alignment options for each of the following road categories have been compared with reference to ecological criteria developed in consultation with key project stakeholders (Section 2.3):

- Arterial Road - Four-lane, 80km/hr, 8% maximum grade - Options Nth_Art_Opt.A and Nth_Art_Opt.B
- Collector Road - Two-lane, 60km/hr, 9% maximum grade - Options Nth_Coll_Opt.A and Nth_Coll_Opt.B

The four alignment options are illustrated in Figures 4a-4d.

1.1.1 Context under the Biodiversity Conservation Strategy

The Northern Link study area lies entirely within the Lancefield Road PSP (1075). Any development activities within the PSP area are subject to the provisions of the BCS (DEPI 2013a). The BCS and associated sub-regional species' strategies for Growling Grass Frog and Golden Sun Moth will also be implemented as required (DEPI 2013b; 2013c; 2013d). The sub-regional species' strategies provide an alternative framework for biodiversity management within Melbourne's four Growth Corridors and were initiated through the Victorian Government's agreement with the Commonwealth Government to undertake a Strategic Impact Assessment (SIA) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in June 2009 (DSE 2009).

The assessment of development projects and calculation of biodiversity offset obligations is streamlined under the BCS, with native vegetation assessed and time-stamped across entire PSP areas (Section 3.2), thereby avoiding incremental and potentially inconsistent vegetation surveys. Offset obligations associated with the removal of native vegetation and impacts on Matters of National Environmental Significance (NES) under the EPBC Act are calculated proportionally according to the extent of native vegetation/habitat removal. Through direct payment to DEPI, proponents avoid the requirement to source and secure individual offsets.

While the study area is subject to the BCS and the streamlined assessment process, it is recognised that a primary objective of the project is to avoid and minimise impacts on key ecological values. Based on this objective, the assessment criteria adopted to compare the alignment options relate to both approvals/costs (e.g. offset obligations) and impact avoidance and minimisation (e.g. impact on verified native vegetation patches) (Section2.3).

2 METHODS

This chapter details the desk-based and field methods used in surveying the current environment and comparing each alignment option.

2.1 Desktop Assessment

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

- The DEPI Biodiversity Interactive Map (DEPI 2014a) for:
  - Time-stamped data for remnant vegetation patches and habitat for significant species;
  - The extent of historic Ecological Vegetation Classes (EVCs);
  - Conservation Management Areas; and,
  - The location of sites of biological significance within the region.
- The Victorian Biodiversity Atlas (VBA) (DEPI 2014b), Flora Information System (FIS) (Viridans 2013a) and Atlas of Victorian Wildlife (AVW) (Viridans 2013b) for previously documented flora and fauna records within the project locality (10 kilometres of the study area);
- The Commonwealth Department of the Environment (DotE) Protected Matters Search Tool (PMST) for matters of NES protected under the EPBC Act (DotE 2014);
- The Victorian Department of Transport, Planning and Local Infrastructure (DTPLI) Planning Maps Online to ascertain current zoning and environmental overlays (DTPLI 2014);
- Relevant federal and State legislation and policies, including the EPBC Act and *Flora and Fauna Guarantee Act 1988* (FFG Act);
- Aerial photography of the study area; and,
- Relevant reports, documents and literature, including the following:
  - *Preliminary Opportunities and Constraints Analysis* (Ecology and Heritage Partners Pty Ltd 2014a)
  - *Biodiversity Conservation Strategy for Melbourne's Growth Corridors* (DEPI 2013a)
  - *Targeted Surveys for the Growling Grass Frog Litoria raniformis in Jacksons Creek, Sunbury* (Ecology and Heritage Partners Pty Ltd 2010)
  - *Scattered Tree Assessment, PSP 1074 Sunbury South* (Ecology and Heritage Partners Pty Ltd 2014b)
  - *Scattered Tree Assessment, PSP 1075 Lancefield Road* (Ecology and Heritage Partners Pty Ltd 2014c)
  - *Biodiversity Assessment for Area 1074, Sunbury South, Victoria* (Ecology and Heritage Partners Pty Ltd 2012).

A list of threatened flora and fauna species previously recorded, or predicted to occur within the project locality is provided in Appendices A and B, respectively.

2.2 Field Assessments

Inspections of the study area were completed on 18 June and 15 September 2014 with key regulatory stakeholders present to document ecological values within the site. The inspections sought primarily to provide ground-truthing of information provided by the desktop assessment, particularly in relation to native vegetation and habitat for significant flora and fauna species. The site inspection completed in September involved a walkover of the four alignment options, with patches of remnant native vegetation and other significant features recorded. This broad-scale vegetation mapping forms part of the adopted assessment criteria (Section 2.3).

2.3 Options Assessment

The alignment options developed for each road category (arterial and collector) have been compared with reference to the criteria listed in Table 1 (Figures 4a-4b). The weightings for each criterion have been attributed based on professional judgement and the relative performance of each compared option has been determined according to the categories listed in Table 2.

The scores for each criterion have been used to calculate the following:

- % Sum - The proportion of the score relative to the total (combined score for the subject criterion)
- Weighted Score - The proportion of the % Sum to the assigned weighting percentage

Overall performance has been determined through a comparison of Combined Weighted Scores.

Table 1 Adopted Assessment Criteria

Criteria	Measurement	Notes	Weighting
Approvals and Costs			
Time-stamped native vegetation	Extent (hectares) within alignment footprint (cut and fill)	Native vegetation in the study area has been time-stamped as part of the (former) Growth Areas Authority (GAA) mapping of properties within the Urban Growth Zone. Time-stamped vegetation within the Lancefield Road PSP (1075) is derived from DEPI modelling and does not necessarily represent the actual extent and condition of native vegetation on-ground. The extent of time-stamped vegetation contributes to the applicable offset obligations under the BCS (DEPI 2013a) (Section 4.1.1).	**5%** - Based on modelled data. Contributes to the indicative offset costs criterion.
Scattered trees	Number of trees within alignment footprint	In 2014, Ecology and Heritage Partners were commissioned by MPA to undertake Scattered Tree Assessments within the Lancefield Road PSP (1075). The surveys recorded 44 Scattered Trees within the vicinity of the assessed alignments (Ecology and Heritage Partners 2014b) (Figures 4a - 4d). It is noted that the results of the scattered tree assessment are not exhaustive, as the surveys were constrained by property access.	**5%** - Limited sample range. Contributes to the indicative offset costs criterion.
Conservation Area 21 (Growling Grass Frog)	Extent (ha) within alignment footprint	The value of Jacksons Creek in providing habitat for the nationally significant Growling Grass Frog *Litoria raniformis* is evidenced by the classification of Conservation Area 21 under the BCS (DEPI 2013a). This conservation area is applied as a variable buffer along the entire length of Jacksons Creek within the study area and has been developed to protect important populations of Growling Grass Frog and ensure connectivity between populations within the Sunbury Growth Corridor (Figures 4a-4d).	**10%** - Identified as a significant issue during consultation with DEPI. The condition of habitat and other ecological values within the reserve have not been ground-truthed.
Conservation Area 20 (Grassy Eucalypt Woodland)		Conservation Area 20 has been applied by DEPI under the BCS (DEPI 2013a) to protect areas of woodland within practically manageable areas. It is noted that this reserve has been developed based on estimated data due to property access constraints and that detailed surveys have not yet been undertaken to determine which areas require protection for their biodiversity values (DEPI 2013a).	**10%** - As above.
Indicative offset costs	Offset costs applicable to the alignment footprint	Under the BCS (DEPI 2013a), biodiversity obligations are set according to the extent of time-stamped native vegetation, scattered trees and habitat for significant species within the project footprint. Within the Sunbury Growth Corridor, offset obligations apply to the following values: native vegetation, scattered trees, Spiny Rice-flower *Pimelea spinescens* subsp. *spinescens* habitat, Golden Sun Moth *Synemon plana* habitat and Growling Grass Frog habitat. Further detail regarding biodiversity offset obligations is provided in Section 4.1.1.	**25%** - Large sample range.

Criteria	Measurement	Notes	Weighting
Impact Avoidance and Minimisation			
BioSites	Extent (ha) within alignment footprint	A BioSite is a physical area of land or water containing biological assets with particular attributes, such as the presence of rare or threatened flora, fauna or habitat required for their survival and/or rare or threatened vegetation communities. While there are no direct legislative implications associated with the classification, the identification of BioSites allows for the prioritisation of conservation management and reservation, and incorporation of these assets into regional and local planning procedures.	**5%** - BioSites predominately encompass values which are already protected (e.g. Conservation Area 21).
Field mapped Remnant Patches		As noted in Section 2.2, a broad-scale survey of native vegetation patches was undertaken during the site inspection completed 15 September 2015 (Figures 4a-4d). This information provides a better indication of actual impacts than the time-stamped dataset, which is based on modelling. It is noted that the inspection did not record all areas of native vegetation within the study area and that the dataset is suitable for use during preliminary comparisons only.	**20%** - Represents actual impacts on native vegetation.
Significant areas for the Growling Grass Frog		During project consultation, DEPI indicated that the consideration of future road crossing applications will focus on whether the proposed works avoid and minimise impacts on biodiversity values within Conservation Areas 20 and 21. Within the broader boundary of Conservation Area 21, areas have been identified to support proposed metapolulations and wetland construction activities (Biosis Research Pty Ltd 2012).	**20%** - Identified as a significant issue during consultation with DEPI. Represents areas known or predicted to provide important values for the Growling Grass Frog.

Table 2 Performance Ratings

Level of Performance
Significant Higher Performance
Higher Performance
Neutral / Same Performance
Lower Performance
Significant Lower Performance

2.4 Assessment Qualifications and Limitations

This assessment aims to provide an overview of key ecological values and provide the basis for further detailed studies during the planning and approvals phase. It is acknowledged that the findings of this assessment are primarily based on a desktop review and that detailed field surveys are required to accurately confirm the ecological values on ground and qualify known and potential impacts (Section 6).

Notwithstanding the above, information obtained from relevant sources (e.g. biological databases and relevant literature) and the preliminary site inspections are considered adequate to provide an overview of the ecological values within the study area at this stage of project development.

3 RESULTS

3.1 Setting

The study area is located in the Victorian Volcanic Plain Bioregion, within the management boundaries of the Port Phillip and Western Port Catchment Management Authority (CMA) and Hume City Council. The four alignment options traverse and adjoin areas subject to a variety of land uses, including agriculture (pasture), residential development (high density and rural) and conservation reserves.

The *Growth Corridor Plan* (Growth Areas Authority 2012) notes the following in regard to biodiversity values within the Sunbury Growth Corridor:

> *The Sunbury/Diggers Rest Growth Corridor includes areas of significant biodiversity values, particularly along Jacksons and Emu Creek, both of which provide important corridors for flora and fauna, including the Growling Grass Frog. The Holden Flora Reserve is an important asset and adjoins the Jacksons creek to the south of Sunbury.*

The project will involve the construction of a bridge structure over Jacksons Creek, which begins near Gisborne and flows through Sunbury before joining Deep Creek near Melbourne Airport (Melbourne Water 2014). According to the most recent state-wide Index of Stream Condition (ISC) Assessment completed by DEPI, the reach of Jacksons Creek traversed by the study area is in poor condition (DEPI 2013f). The ISC Assessment references data collected over the six year period between 2004 and 2010 and is based on the survey of five sub-indices. The sub-indices and results of the ISC assessment are provided in Table 3.

Table 3 Results of the Merri Creek ISC Assessment (DEPI 2013f)

Sub-indices and Metrics	Score (Max. 10)
Hydrology refers to the amount of water that is within the river channel at a particular point in time at a particular location. A minimum of 15 years of monthly flow data is used	1
Physical form takes into account the river bank condition as well as instream habitat (logs or 'snags') and major barriers to fish migration, such as dams and artificial weirs	9
Streamside zone measures characteristics of the woody vegetation within 40 metres of the river's edge	5
Water quality is the quality of water in the river (Total Phosphorus, turbidity, Salinity and pH)	N/A – Not assessed
Aquatic life is based on the number and type of aquatic macroinvertebrates found within the river.	N/A – Not assessed


Inset 1: Jacksons Creek, looking south-east

There are no Parks Victoria managed reserves or internationally/nationally significant wetlands within or immediately adjacent to the study area. The value of Jacksons Creek in providing habitat for the nationally significant Growling Grass Frog is evidenced by the classification of Conservation Area 21 under the BCS (DEPI 2013a) (Table 1 and Figures 4a-4d). The study area also traverses Conservation Area 20, which has been applied by DEPI to protect areas of woodland within practically manageable areas (Table 1 and Figures 4a-4d).

The following BioSites are present within the vicinity of the study area (Table 1 and Figures 4a-4d):

- BioSite 3527: Northern Rail Reserve, north of Sunbury (Grass PPBU009)- Regional Significance
- BioSite 4630: Jacksons Creek, Sunbury - State Significance
- BioSite 5188: Salesian College Woodlands & Escarpment - Regional Significance

Although much of the study area has been highly modified by agricultural activities and surrounding residential development, a number of ecological values persist, including remnant vegetation and known/ potential habitat for significant flora and fauna species. These values are further described in the following sections.

3.2 Vegetation Communities

A review of the DEPI Biodiversity Interactive Map (DEPI 2014a) indicated that prior to European settlement the study area is likely to have supported three EVCs (Table 4). Native vegetation in the study area has been previously assessed and time-stamped as part of the (former) GAA mapping of properties within the Urban Growth Zone. Time-stamped vegetation within the Lancefield Road PSP (1075) is derived from DEPI modelling and does not necessarily represent the actual extent and condition of native vegetation present. According to the Biodiversity Interactive Map, the four alignments traverse four EVCs (Table 4 and Figures 4a - 4d). The time-stamped remnant patches are relatively fragmented, which can be attributed to historic land clearing, urban expansion and on-going agricultural activities.

Table 4. DEPI Modelled EVCs Traversed by the Alignment Options

Mapped EVC[1]	Bioregional Conservation Status	Present pre-1750[1]	Time-stamped EVCs[1]
Valley Grassy Forest (EVC 47)	Vulnerable	✓	-
Plains Grassy Woodland (EVC 55)	Endangered	✓	-
Box Ironbark Forest (EVC 61)	Depleted	-	✓
Plains Grassy Wetland (EVC 125)	Endangered	-	✓
Plains Woodland (EVC 803)	Endangered	-	✓
Stream Bank Shrubland (EVC 851)	Endangered	✓	✓

Note: 1) Source: DEPI 2014a

In 2014, Ecology and Heritage Partners were commissioned by the MPA to undertake Scattered Tree Assessments within the Lancefield Road PSP (1075). The surveys recorded 44 scattered trees within the vicinity of the alignments (Ecology and Heritage Partners Pty Ltd 2014c). It is noted that the results of the scattered tree assessments are not exhaustive, as the surveys were constrained by property access. The recorded scattered trees are illustrated in Figures 4a-4d and attribute data is provided in Appendix C.

3.3 Threatened Biodiversity and Other Matters of Significance

This section outlines biodiversity matters of national, state and regional significance. Table 5 outlines the significance criteria adopted for this assessment.

Table 5 Criteria for Defining Ecological Significance

National Significance
Flora and Fauna: National conservation status is based on the EPBC Act list of taxa considered threatened in Australia (i.e. Extinct, Critically Endangered, Endangered and Vulnerable).
State Significance
Flora: Species listed as threatened under the FFG Act. Species listed on the DSE Advisory List (DSE 2005) as Endangered, Vulnerable or Rare. **Fauna**: Species listed as threatened under the FFG Act. Species listed on the DSE Advisory List (DSE 2013) as Critically Endangered, Endangered or Vulnerable.
Regional Significance
Flora: Species listed on the DSE Advisory List (DSE 2005) as Poorly Known in Victoria. **Fauna:** Species listed on the DSE Advisory List (DSE 2013) as Near Threatened of Data Deficient.

It is noted that the presence of ecological values which are not accounted for in the time-stamped vegetation dataset or Conservation Areas, such as threatened ecological communities and habitat for threatened species, is relatively negligible in terms of project approvals and offset calculations. While these implications are largely predetermined under the BCS, additional ecological values are discussed below in order to inform the selection of appropriate alignment options and meet MPA's objectives for environmental management.

Ecological values of the Lancefield Road PSP (1075) have not been assessed on a precinct-wide scale. The results below are based on a review of relevant databases and literature listed in Section 2 and the preliminary site inspections.

3.3.1 Matters of National Environmental Significance

Five significant ecological communities under the EPBC Act are known or predicted to occur within the project locality (within 10 kilometres of the study area) (DotE 2014) (Table 6). EVCs mapped within the study area potentially correspond with these communities.

Table 6 EPBC Act Listed Ecological Communities Predicted to Occur in the Project Locality

Threatened Ecological Community	EPBC Act Status	Potentially Corresponding EVCs
Grassy Eucalypt Woodland of the Victorian Volcanic Plain	Critically Endangered	Plains Grassy Woodland (EVC 55)
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Plains Grassy Woodland (EVC 55), Grassy Woodland (EVC 175)
Natural Temperate Grassland of the Victorian Volcanic Plain	Critically Endangered	Plains Grassland (EVC 132)
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland	Critically Endangered	Plains Grassy Wetland (EVC 125)
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native	Critically Endangered	Grassy Dry Forest (EVC 22), Valley Grassy Forest (EVC 47), Plains Grassy Woodland (EVC 55) and Grassy Woodland (EVC 175)

Based on a review of the VBA (DEPI 2014b) and FIS (Viridans 2013a), five EPBC Act-listed flora species have been recorded in the project locality, none of which have been mapped within the vicinity of the four alignments (Figure 2). The PMST (DotE 2014) nominated an additional six nationally significant species which have not been recorded in the locality but have the potential to occur (Table A1, Appendix A).

The VBA (DEPI 2014b) and AVW (Viridans 2013b) indicate that eight EPBC Act-listed fauna species (three birds, one mammal, one reptile, one frog, one fish and one invertebrate) have been recorded in the project locality, none of which have been mapped within the vicinity of the assessed alignments (Figure 3, Table B1, Appendix B).

Migratory species are protected under the international agreements to which Australia are a signatory, including JAMBA, CAMBA, RoKAMBA and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. A review of the VBA (DEPI 2014b), AVW (Viridans 2013a) and EPBC Act PMST (DotE 2014) indicated that several migratory species have been previously recorded or are predicted to occur within the study area (Table B1, Appendix B). While a small number of migratory species are likely to inhabit or use habitat resources within the study area on occasions, there is considered to be no 'important habitat' as defined under the EPBC Act *Policy Statement 1.1 Principal Significant Impact Guidelines* (DotE 2013).

3.3.2 Matters of State Significance

A review of the modelled FFG Act Communities data layer contained in the DEPI Biodiversity Interactive Map (DEPI 2014a) indicated that one FFG Act listed ecological community - Western Basalt Plains (River Red Gum) Grassy Woodland, is predicted to occur across the study area. According to the listing advice prescribed by DotE, no time-stamped EVCs within the study area have the potential to correspond with this ecological community.

Based on a review of the VBA (DEPI 2014b) and FIS (Viridans 2013a), 11 state significant flora species have been recorded in the project locality, none of which have been mapped within the vicinity of the alignments (Figure 2 and Table A1, Appendix A). The site inspections identified the potential for Melbourne Yellow-gum *Eucalyptus leucoxylon* subsp. *connata* to occur within the study area. This species is listed as Vulnerable on the Advisory List (DSE 2005).

The VBA (DEPI 2014b) and AVW (Viridans 2013b) indicate that 22 state significant fauna species (17 birds, two mammals, two frogs and one fish) have been recorded in the project locality, none of which have been mapped within the vicinity of the assessed alignments (Figure 3 and Table B1, Appendix B).

3.3.3 Matters of Regional Significance

Based on a review of the VBA (DEPI 2014b) and FIS (Viridans 2013a;2013b), six regionally significant flora species and eight regionally significant fauna species (six birds, one mammal and one fish) have been recorded in the project locality, none of which have been mapped within the vicinity of the alignments (Figures 4a and 4d and Appendices A and B).

4 LEGISLATIVE AND POLICY IMPLICATIONS

The study area is subject to the provisions of the BCS (DEPI 2013a), which provides an alternative process for assessing certain environmental impacts and for the calculation and procurement of biodiversity offsets. The implications of the BCS and other relevant Acts and policies are described in the following sections.

4.1 Biodiversity Conservation Strategy

In June 2009 the Victorian Government entered into an agreement with the (former) Commonwealth Government Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) to undertake a SIA under the EPBC Act (DSE 2009). The SIA Program Report (DSE 2009) is the primary document identifying potential impacts of the proposed program of urban development on matters of NES. The Program Report includes a commitment to develop and implement a strategy for Melbourne's Growth Corridors which would inform the preparation of Growth Corridor Plans and PSPs.

The BCS (DEPI 2013a) and associated sub-regional species' strategies (DEPI 2013b; 2013c; 2013d) identify conservation outcomes and offset consolidation strategies for Victoria's native vegetation and matters of NES, including mechanisms for how these outcomes will be delivered. The draft BCS was released in November 2011, was finalised in May 2013, and approved by the Commonwealth in September 2013.

The study area is located within the Sunbury Growth Corridor and as such, the following matters of ecological significance considered under the BCS apply to the site: native vegetation (including scattered trees), Spiny Rice-flower habitat, Golden Sun Moth habitat and Growling Grass Frog habitat. Within the Sunbury Growth Corridor, the removal of any native vegetation or designated habitat for the above noted species triggers the requirement to pay a habitat compensation fee to DEPI to account for the loss. Compensation fees fund the securement and management of the proposed Western Grasslands Reserve (a future reserve between Werribee and Melton) and other Conservation Areas (i.e. Conservation Areas 20 and 21). A proponent is required to pay this fee regardless of whether the native vegetation or threatened species habitat in question occurs at the site.

4.1.1 Offsets under the Biodiversity Conservation Strategy

Offsets and habitat compensation fees associated with removal of native vegetation and fauna habitat under the BCS are based on the *Habitat Compensation under the Biodiversity Conservation Strategy* (DEPI 2013d). Offset obligations applicable to the study area relate to the following specifications:

Native vegetation:

- Offset obligations for patches of native vegetation are based on the time-stamped dataset, with all native vegetation considered to be Very High conservation significance. Clearance of native vegetation invokes an offset fee $95,075.00 per hectare cleared. Clearance of scattered trees invokes an offset fee of $13,218.00 per tree removed.

Spiny Rice-flower:

- All native vegetation patches within the Sunbury Growth Corridor invoke a compensatory habitat fee of $7,937.00 to cover the cost of securing and managing conservation reserves for Spiny Rice-flower. This is additional to the abovementioned offset for clearance of native vegetation.

Golden Sun Moth:

- All habitat within the Sunbury Growth Corridor (native and non-native grassland and woodlands) and excluding any areas identified as Growling Grass Frog habitat are deemed to be "confirmed habitat". However only non-native habitat invokes a compensatory habitat fee as fees for native habitat have been built in to the price of native vegetation offsets. All non-native habitat cleared invokes a compensatory habitat fee of $7,914.00 per hectare cleared.

Growling Grass Frog:

- Habitat mapped as Category 2 will invokes compensatory habitat fee of $7,529.00 per hectare cleared or impacted (e.g. drained) to cover the cost of securing and managing Growling Grass Frog corridors identified in the species' sub-regional strategy.

4.1.2 Conservation Areas

Approval from the Commonwealth Minister for Environment, Heritage and Water is required for any proposed action affecting land within the boundaries of Conservation Areas 20 and 21. This trigger is pursuit to Condition 2 of the 2013 approval for Melbourne's urban development under the EPBC Act. Condition 2 requires that persons must not take actions, resulting in a net loss of habitat for listed ecological communities and listed species in the BCS conservation areas unless agreed to by the Commonwealth Minister. DEPI has administrative responsibility for coordinating applications and endorsing proposed works that require Commonwealth approval.

Assuming that the impacts on Conservation Areas 20 and 21 cannot be avoided, DEPI would require the following works to support the federal application:

- Conservation Area 21: An ecological assessment including:
  - Survey of native vegetation type and condition(in habitat hectares) in areas where time-stamping data is based on estimation;
  - Survey for presence of any ecological communities listed under the EPBC Act;
  - Assessment and mapping of Growling Grass Frog habitat;
  - Assessment and mapping of habitat for any other fauna species classified as a Matter of NES that has a potential to occur within the conservation area; and,
  - Surveying for and mapping of locations of any flora and fauna species classified as a Matter of NES that has a potential to occur within the conservation area.

- Conservation Area 20: An ecological assessment including:
    - Survey of native vegetation type and condition(in habitat hectares) in areas where time-stamping data is based on estimation;
    - Survey for and map 'very large or large old' and 'medium old' scattered trees (using ground-truthed remnant patches to identify scattered trees);
    - Survey of the extent and condition of Grassy Eucalypt Woodland as defined under the EPBC Act;
    - Mapping and descriptions of any other ecological communities listed under the EPBC act; and,
    - Assessment and mapping of any flora and fauna species classified as a Matter of NES that has a potential to occur within the conservation area.

4.2 Other Applicable Legislation and Policies

Table 7 Legislative Implications

Relevant Legislation	Implications
Flora and Fauna Guarantee Act 1988	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. Site development would not trigger the permitting provisions of the FFG Act, as the study area comprises private land.
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 clause under 52.17-6 of the Victorian Planning Schemes applies or a subdivision is proposed with lots less than 0.4 hectares. The removal of native vegetation (including scattered native trees) across the study area would trigger the requirement to prepare and submit an application to remove, destroy or lop native vegetation to Hume City Council. The permit application would be completed as part of the broader project planning permit process.
Catchment and Land Protection Act 1994	The *Catchment and Land Protection Act 1994* (CaLP Act) contains provisions relating to catchment planning, land management, noxious weeds and pest animals. Essentially the CaLP Act establishes a framework for the integrated management and protection of catchments, and provides a framework for the integrated and coordinated management, which aims to ensure that the quality of the State's land and water resources and their associated plant and animal life are maintained and enhanced. A number of weeds listed as noxious under the CaLP Act were recorded during the site inspections. Similarly, it is likely that the study area is occupied by several pest fauna species listed under the Act. Landowners are responsible for the control of any infestation of noxious weeds and pest fauna species. To meet CaLP Act requirements listed noxious weeds and pests should be appropriately controlled during any construction activities to minimise their spread and impact on ecological values.

Relevant Legislation	Implications
Wildlife Act 1975	The *Wildlife Act 1975* (and associated Wildlife Regulations 2002) is the primary legislation in Victoria providing for protection and management of wildlife. The Act requires people engaged in wildlife research (e.g. fauna surveys, salvage and translocation activities) to obtain a permit under the Act to ensure that these activities are undertaken in a manner consistent with the appropriate controls. 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*. Any persons engaged to remove, salvage, hold or relocate native fauna during development activities must hold a current Management Authorisation under the *Wildlife Act 1975*.
Water Act 1989	The purposes of the *Water Act 1989* are manifold but (in part) relate to the orderly, equitable, efficient and sustainable use of water resources within Victoria. This includes the provision of a formal means of protecting and enhancing environmental qualities of waterways and their in-stream uses as well as catchment conditions that may affect water quality and the ecological environments within them. A 'works on waterways' permit from the Port Phillip and Westernport CMA is likely to be required where any action impacts on waterways within the study area. Additionally, where structures are installed within or across waterways that potentially interfere with the passage of fish or the quality of aquatic habitat, these activities should be referred to DEPI with the CMA included for comment.

5 OPTIONS ASSESSMENT

In order to identify preferred scenarios, alignment options developed for the arterial and collector road categories have been reviewed against the adopted assessment criteria and assigned a performance ranking. Overall performance has been determined with reference to the criteria weightings listed in Table 1. The methods adopted for the options assessment are detailed in Section2.3 and the findings are presented in the following tables.

Table 8 Assessment of the Arterial Road Options

	Nth_Art_Opt.A	Offsets			Nth_Art_Opt.B	Offsets		
		Unit	Rate[1] ($)	Cost ($)		Unit	Rate[1] ($)	Cost ($)
Approvals and Costs								
Time-stamped native vegetation (Ha)	0.05				1.28			
Scattered Trees (#)	0.00				1.00			
Conservation Area 21 (GGF) (Ha)	2.31				1.22			
Conservation Area 20 (Grassy Eucalypt Woodland) (Ha)	2.13				0.33			
Indicative offset costs	TS Patches (Ha):	0.05	95075.00	4753.75	TS Patches (Ha):	1.28	95075.00	121696.00
	Scattered Trees (#):	0.00	13218.00	0.00	Scattered Trees (#):	1	13218.00	13218.00
	Spiny Rice-flower habitat (Ha):	0.05	7937.00	396.85	Spiny Rice-flower habitat (Ha):	1.28	7937.00	10159.36
	Golden Sun Moth habitat (Ha):	4.85	7914.00	38390.87	Golden Sun Moth habitat (Ha):	0.57	7914.00	4534.58
	Growling Grass Frog habitat (Ha):	6.92	7529.00	52100.68	Growling Grass Frog habitat (Ha):	5.91	7529.00	44491.22
	Total Cost:			**$95,642.15**	**Total Cost:**			**$194,099.16**
Impact Avoidance and Minimisation								
BioSites (Ha)	2.59				0.14			
Field mapped Remnant Patches (Ha)	0.06				0.22			
Significant areas for the GGF (Ha)	1.42				0.32			

Notes: 1) Source: *Habitat Compensation under the Biodiversity Conservation Strategy: Melbourne Strategic Assessment* (DEPI 2013d).

Table 9 Performance of Arterial Road Options

Criteria	Nth_Art_Opt.A	Weighting Score	% Sum	Nth_Art_Opt.B	Weighted Score	% Sum
Approvals and Costs						
Time-stamped native vegetation	Significant Higher Performance	5	3.76	Significant Lower Performance	-	96.36
Scattered Trees	Higher Performance	5	0.00	Lower Performance	-	100.00
Conservation Area 21 (GGF)	Lower Performance	-	65.53	Higher Performance	10	34.47
Conservation Area 20 (Grassy Eucalypt Woodland)	Significant Lower Performance	-	86.75	Significant Higher Performance	10	13.25
Indicative offset costs	Higher Performance	25	33.01	Lower Performance	-	66.99
Impact Avoidance and Minimisation						
BioSites	Significant Lower Performance	-	95.00	Significant Higher Performance	5	5.00
Field mapped Remnant Patches	Significant Higher Performance	20	22.21	Significant Lower Performance	-	77.79
Significant areas for the GGF	Significant Lower Performance	-	81.55	Significant Higher Performance	20	18.45
	Combined Weighted Score (CWS)	**55**			**45**	

Notes:
1) % Sum = Proportion of score relative to total of scores (Section 2.3)
2) WS = Weighting % expressed as a score for the best performing option (Section 2.3)

From an approvals/ costs perspective, option Nth_Art_Opt.A (Combined Weighting Score [CWS] of 35) performs better than Nth_Art_Opt.B (CWS 20). With respect to the criteria relating to impact avoidance/minimisation, option Nth_Art_Opt.B (CWS 25) performs better than Nth_Art_Opt.A (CWS 20). Overall, based on the adopted weightings, Nth_Art_Opt.A (Total CWS 55) performs better than option Nth_Art_Opt.B (Total CWS 45).

Table 10 Assessment of the Collector Road Options

	Nth_Coll_Opt.A	Offsets			Nth_Coll_Opt.B	Offsets		
		Unit	Rate[1] ($)	Cost ($)		Unit	Rate[1] ($)	Cost ($)
Approvals and Costs								
Time-stamped native vegetation (Ha)	0.10				1.12			
Scattered Trees (#)	0.00				2.00			
Conservation Area 21 (GGF) (Ha)	1.89				1.06			
Conservation Area 20 (Grassy Eucalypt Woodland) (Ha)	1.87				0.24			
Indicative offset costs	TS Patches (Ha):	0.10	95075.00	9340.79	TS Patches (Ha):	1.12	95075.00	106594.93
	Scattered Trees (#):	0.00	13218.00	0.00	Scattered Trees (#):	2	13218.00	26436.00
	Spiny Rice-flower habitat (Ha):	0.10	7937.00	779.78	Spiny Rice-flower habitat (Ha):	1.12	7937.00	8898.70
	Golden Sun Moth habitat (Ha):	4.12	7914.00	32640.22	Golden Sun Moth habitat (Ha):	0.41	7914.00	3229.79
	Growling Grass Frog habitat (Ha):	5.59	7529.00	42094.04	Growling Grass Frog habitat (Ha):	4.46	7529.00	33616.23
	Total Cost:			**$84,854.83**	**Total Cost:**			**$178,775.65**
Impact Avoidance and Minimisation								
BioSites (Ha)	2.40				0.10			
Field mapped Remnant Patches (Ha)	0.05				0.17			
Significant areas for the GGF (Ha)	1.13				0.29			

Notes: 1) Source: *Habitat Compensation under the Biodiversity Conservation Strategy: Melbourne Strategic Assessment* (DEPI 2013d).

Table 11 Performance of Collector Road Options

Criteria	Nth_Coll_Opt.A	Weighted Score	% Sum	Nth_Coll_Opt.B	Weighted Score	% Sum
Approvals and Costs						
Time-stamped native vegetation	Significant Higher Performance	5	8.06	Significant Lower Performance	-	91.94
Scattered Trees	Higher Performance	5	0.00	Lower Performance	-	100.00
Conservation Area 21 (GGF)	Lower Performance	-	64.13	Higher Performance	10	35.87
Conservation Area 20 (Grassy Eucalypt Woodland)	Significant Lower Performance	-	88.55	Significant Higher Performance	10	11.45
Indicative offset costs	Higher Performance	25	32.19	Lower Performance	-	67.81
Impact Avoidance and Minimisation						
BioSites	Significant Lower Performance	-	96.11	Significant Higher Performance	**5**	3.89
Field mapped Remnant Patches	Significant Higher Performance	**20**	23.94	Significant Lower Performance	-	76.06
Significant areas for the GGF	Significant Lower Performance	-	79.61	Significant Higher Performance	**20**	20.39
	Combined Weighted Score (CWS)	**55**			**45**	

Notes:
1) % Sum = Proportion of score relative to total of scores (Section 2.3)
2) WS = Weighting % expressed as a score for the best performing option (Section 2.3)

From an approvals/ costs perspective, option Nth_Coll_Opt.A (Combined Weighting Score [CWS] of 25) performs better than Nth_Coll_Opt.B (CWS 20). With respect to the criteria relating to impact avoidance/minimisation, option Nth_Coll_Opt.B (CWS 25) performs better than Nth_Coll_Opt.A (CWS 20). Overall, based on the adopted weightings, Nth_Coll_Opt.A (Total CWS 55) performs better than option Nth_Coll_Opt.B (Total CWS 45).

6 CONCLUSION AND RECOMMENDATIONS

The study area exists within a predominantly rural environment which is under increasing pressure from the effects of expanding development, including habitat fragmentation, the introduction and spread of weed and pest species and impacts on local waterways. Although much of the study area has been highly modified by agricultural activities and surrounding residential development, a number of significant ecological values persist and these should be referenced when siting and designing project infrastructure in order to avoid and minimise ecological impacts wherever possible.

The assessment identified the following ecological values/ constraints within the study area:

- Time-stamped native vegetation;
- Scattered Trees;
- Conservation Area 21 (Growling Grass Frog);
- Conservation Area 20 (Grassy Eucalypt Woodland);
- Indicative offset costs;
- BioSites;
- Field mapped Remnant Patches; and,
- Significant areas for the Growling Grass Frog.

In assessing the ecological constraints and selecting preferred alignments, it is important to recognise the contrast between constraints relating to approvals under the BCS and those relating to MPA's objectives for impact avoidance and minimisation. Ecological constraints such as habitat for significant species, Jacksons Creek etc., are of very high conservation significance but do not represent significant constraints in terms of project approvals under the BCS.

The findings of the Options Assessment are presented in Section 5. From an approvals/ costs perspective, the Option A alignments for the arterial and collector road categories (Nth_Art_Opt.A and Nth_Coll_Opt.A) perform better than the Option B equivalents (Nth_Art_Opt.B and Nth_Coll_Opt.B). With respect to the criteria relating to impact avoidance/minimisation, The Option B alignments rate slightly better than the Option A equivalents.

Overall, based on the adopted weightings, the Option A alignments perform better than the Option B alignments. It is however noted that the A and B Options for each road type have clear advantages and disadvantages, and that performance is entirely based on the weightings assigned.

In the absence of mitigation measures, the project has the potential to impact upon ecological values within the study area and surrounding landscape. It is recommended that the final siting and design process references the findings of detailed assessments and that ecological impacts are avoided and minimised wherever possible. As part of future project planning it is recommended that detailed mitigation measures be developed and presented in a Construction Environmental Management Plan (or similar document/s) relating to the construction and operation of the project.

This plan should include, where appropriate, procedures for:

- Detailed design of mitigation measures;
- Staff and contractor inductions to address the location of sensitive ecological values and their roles and responsibilities regarding the protection and/or minimisation of impacts to all ecological values;
- Pre-clearing surveys and fauna salvage/ translocation where practical;
- Vegetation clearing protocols; and,
- Rehabilitation and restoration, including:
    - Establishing rehabilitation protocols
    - Establishing weed control measures
    - Establishing pest management measures.

The management plan would be important for enacting the 'avoid and mitigate' principles during the construction and operational phases. Specific mitigation measures relating to potential impacts should be developed following a detailed assessment of the preferred alignments. The detailed assessment should be completed to further define ecological values and opportunities for impact avoidance and minimisation. In addition to the ecological assessment, the following studies are likely to be required as part of the approvals process:

- Construction Environmental Management Plan (CEMP)
- Ecological Surveys of Conservation Areas 20 and 21,and associated reporting requirements (Section 4.1.2), and,
- Growling Grass Frog Conservation Management Plan (CMP) and Salvage and Translocation within Jacksons Creek.

It is recommended that this assessment is reviewed by the key project stakeholders and that comments are incorporated as appropriate.

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FIGURES

Legend

- Study Area
- Railway
- Collector Road
- Minor Road
- Minor Watercourse
- Permanent Waterbody

Local Government: City of Hume
25k Mapsheet: Sunbury 7822-4-1
Coordinate System: MGA Zone 55 (GDA94)
Map Scale: 1:10,000

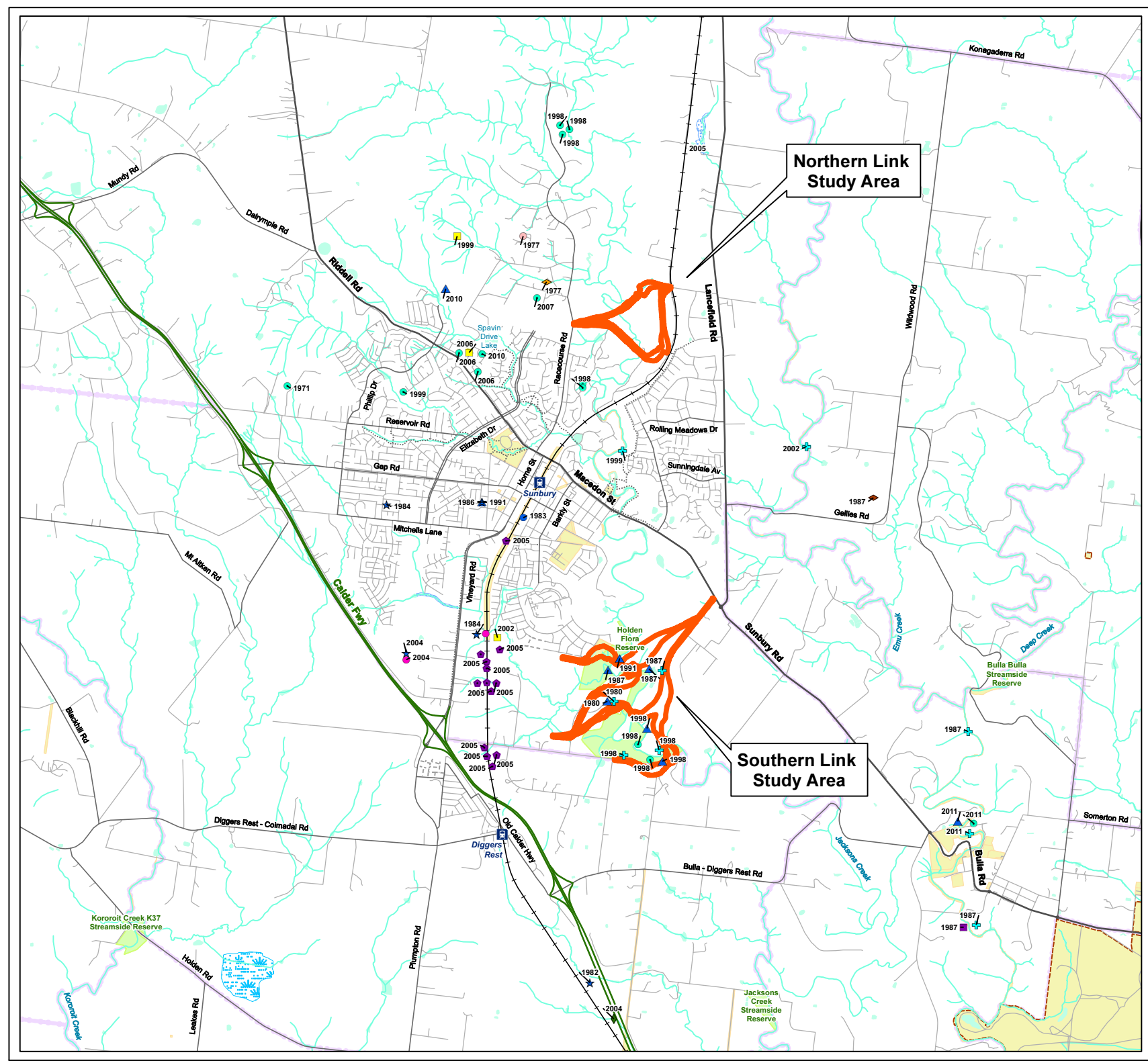
N

0 100 200
Metres

Figure 1
Location of Study Area

Jacksons Creek Road Crossings Project

ecology & heritage partners



Legend

- Study Area

Significant Flora

- Arching Flax-lily
- Austral Tobacco
- Basalt Peppercress
- Black Roly-poly
- Fragrant Saltbush
- Large-headed Fireweed
- Matted Flax-lily
- Melbourne Yellow-gum
- Native Peppercress
- Plains Joyweed
- Rye Beetle-grass
- Slender Tick-trefoil
- Small Milkwort
- Spiny Rice-flower

Figure 2

Previously documented significant flora within 10km of the study areas

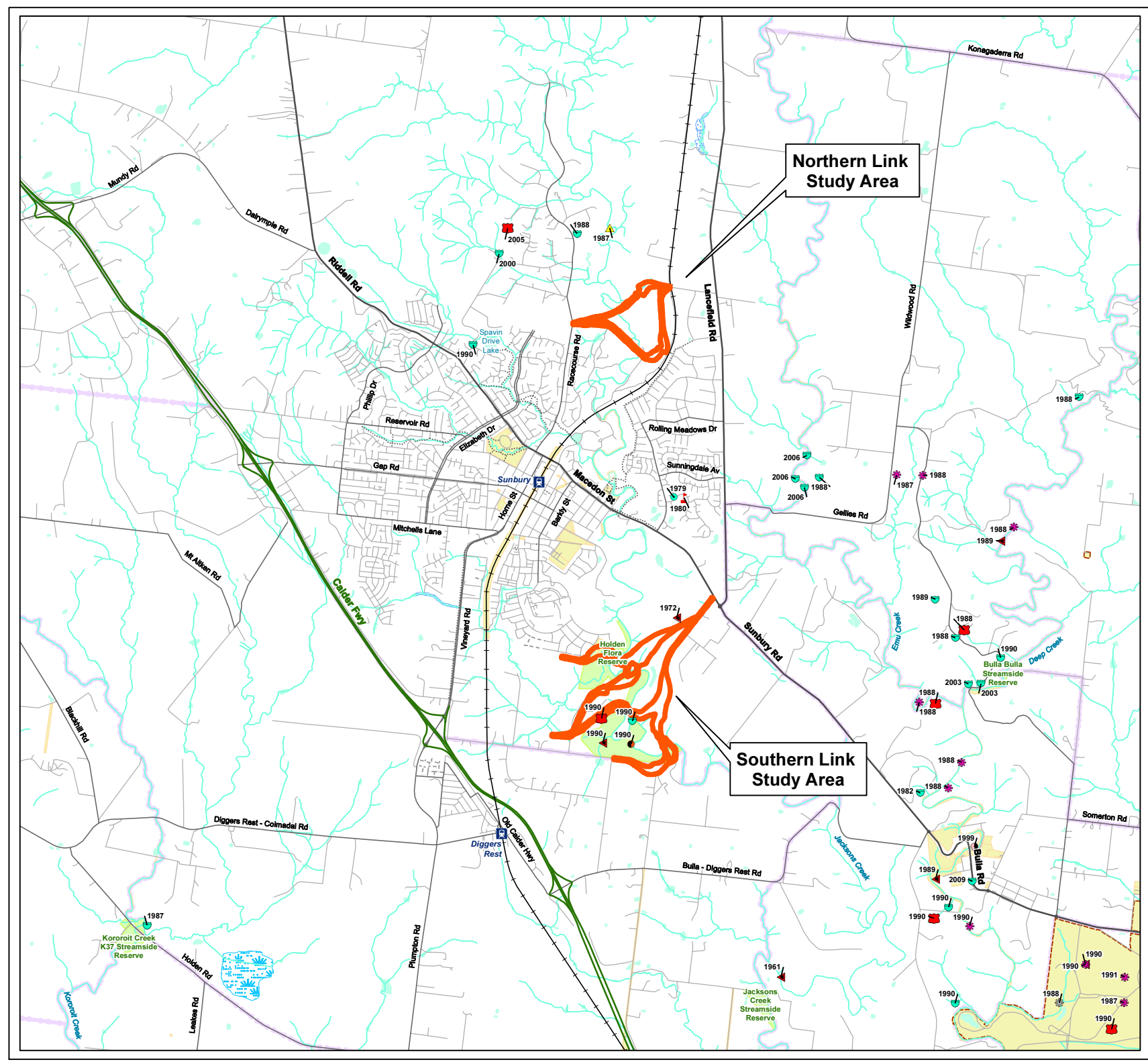
Jacksons Creek Road Crossings Project

N

0 1 2

Kilometres

ecology & heritage partners



Legend

- Study Area

Significant Fauna

- Australasian Bittern
- Azure Kingfisher
- Black-eared Cuckoo
- Brown Toadlet
- Brown Treecreeper (south-eastern ssp.)
- Diamond Dove
- Diamond Firetail
- Eastern Barred Bandicoot
- Eastern Great Egret
- Fat-tailed Dunnart
- Golden Sun Moth
- Grassland Earless Dragon
- Growling Grass Frog
- Hooded Robin
- Latham's Snipe
- Lewin's Rail
- Nankeen Night Heron
- Painted Honeyeater
- Pied Cormorant

Figure 3

Previously documented significant fauna within 10km of the study areas

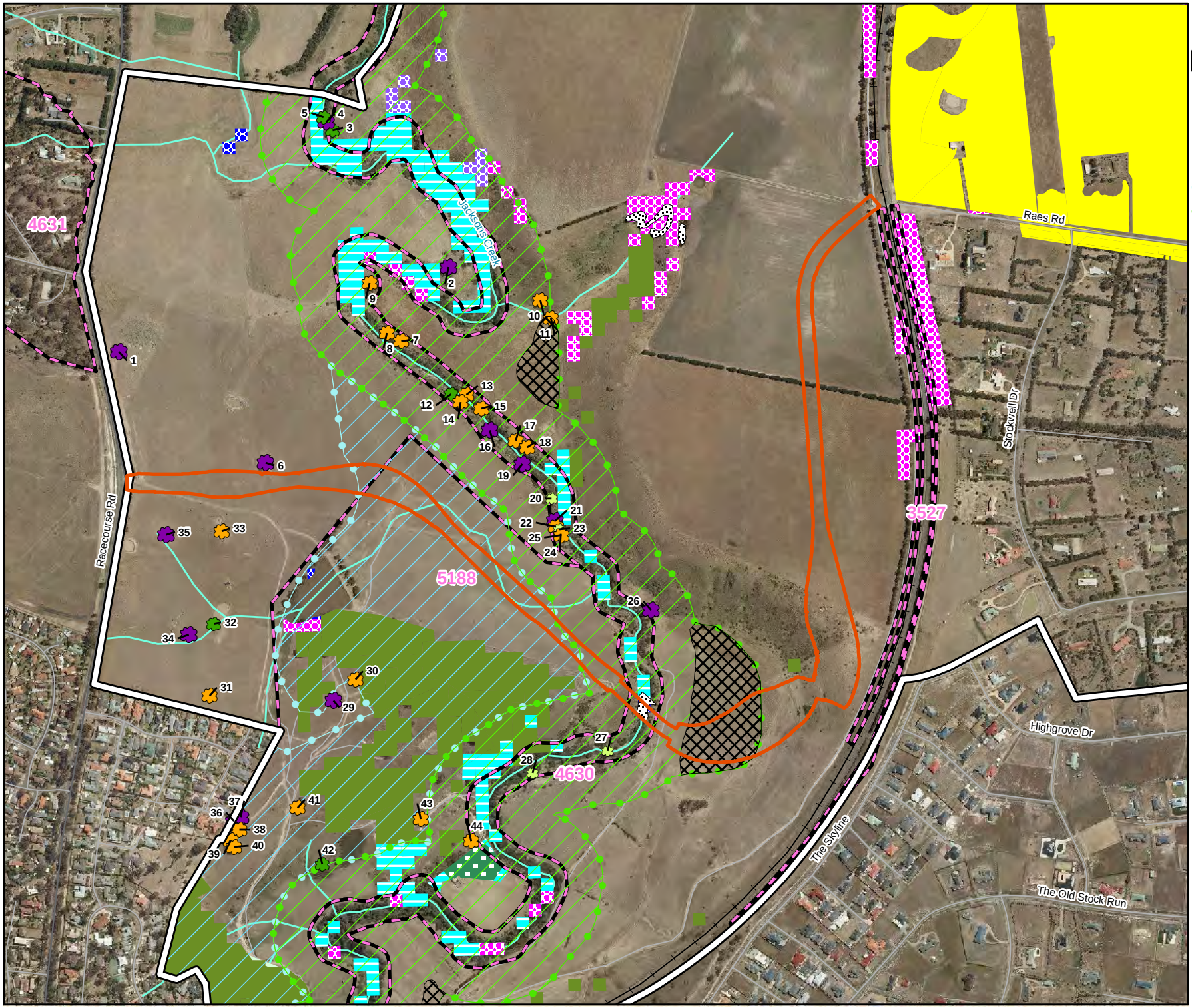
Jacksons Creek Road Crossings Project

N

0 1 2

Kilometres

ecology & heritage partners



Legend

- Option Nth_Art_Opt.A
- PSP Boundary
- BioSite Boundaries
- Field mapped Remnant Patches
- Significant areas for the GGF

Conservation Areas

- Area 20
- Area 21

Scattered Trees (not exhaustive)

- VLOT
- LOT
- MOT
- ST

Time-stamped Native Vegetation

- 125 Plains Grassy Wetland
- 132 Plains Grassland
- 47 Valley Grassy Forest
- 55 Plains Grassy Woodland
- 61 Box Ironbark Forest
- 641 Riparian Woodland
- 803 Plains Woodland
- 851 Stream Bank Shrubland

N

0 100 200

Metres

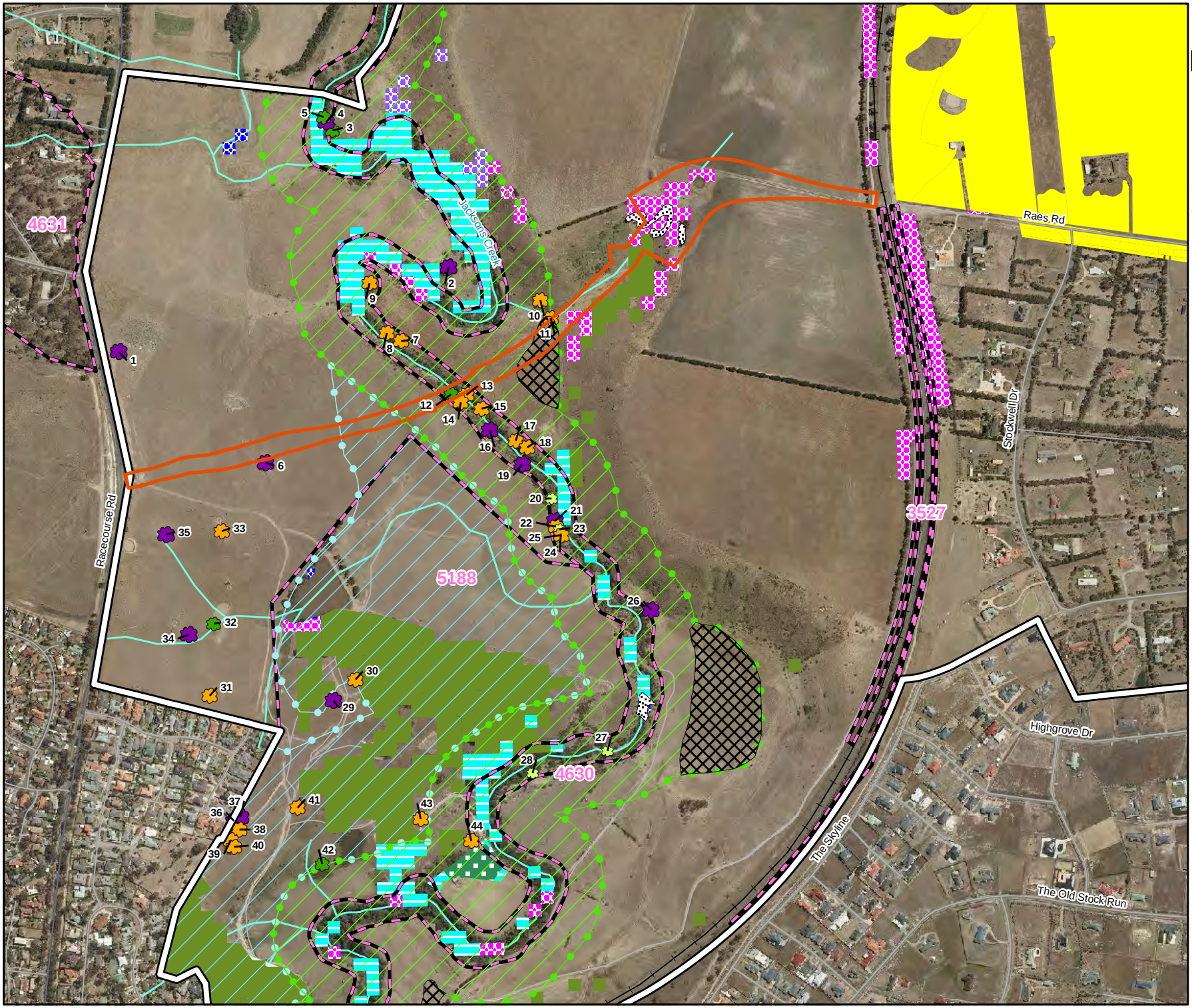
Figure 4a

Ecological Features
Option Nth_Art_Opt.A

Jacksons Creek Road Crossings Project

ecology & heritage partners

5808_NH_Map04a_NO_ArtA 1/10/2014 cbrowning



Legend

- Option Nth_Art_Opt.B
- PSP Boundary
- BioSite Boundaries
- Field mapped Remnant Patches
- Significant areas for the GGF

Conservation Areas

- Area 20
- Area 21

Scattered Trees (not exhaustive)

- VLOT
- LOT
- MOT
- ST

Time-stamped Native Vegetation

- 125 Plains Grassy Wetland
- 132 Plains Grassland
- 47 Valley Grassy Forest
- 55 Plains Grassy Woodland
- 61 Box Ironbark Forest
- 641 Riparian Woodland
- 803 Plains Woodland
- 851 Stream Bank Shrubland

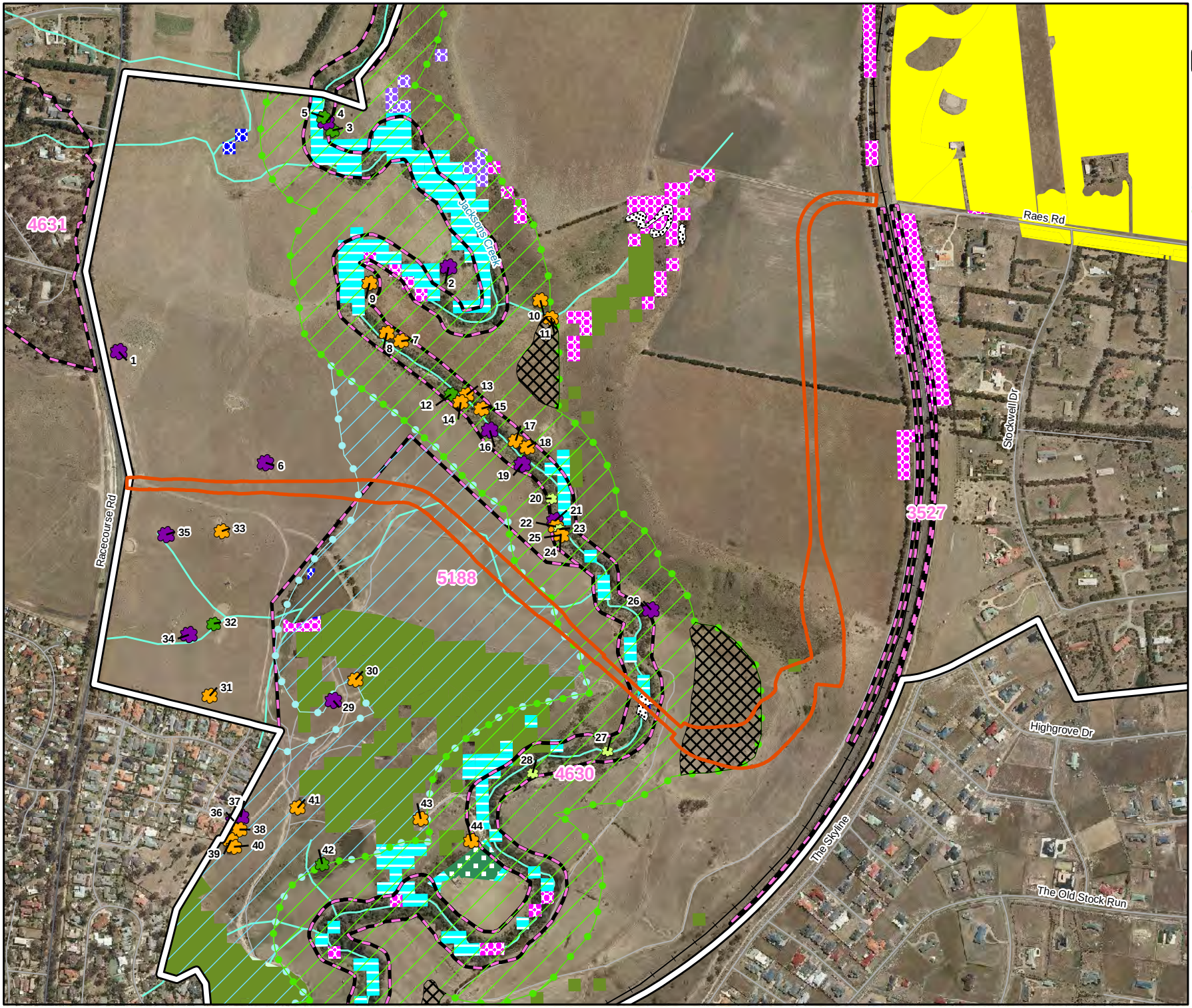
0 100 200
Metres

Figure 4b
Ecological Features
Option Nth_Art_Opt.B

Jacksons Creek Road Crossings Project

ecology & heritage partners

5808_NH_Map04b_NO_ArtB 1/10/2014 cbrowning



Legend

- Option Nth_Coll_Opt.A
- PSP Boundary
- BioSite Boundaries
- Field mapped Remnant Patches
- Significant areas for the GGF

Conservation Areas

- Area 20
- Area 21

Scattered Trees (not exhaustive)

- VLOT
- LOT
- MOT
- ST

Time-stamped Native Vegetation

- 125 Plains Grassy Wetland
- 132 Plains Grassland
- 47 Valley Grassy Forest
- 55 Plains Grassy Woodland
- 61 Box Ironbark Forest
- 641 Riparian Woodland
- 803 Plains Woodland
- 851 Stream Bank Shrubland

N

0 100 200

Metres

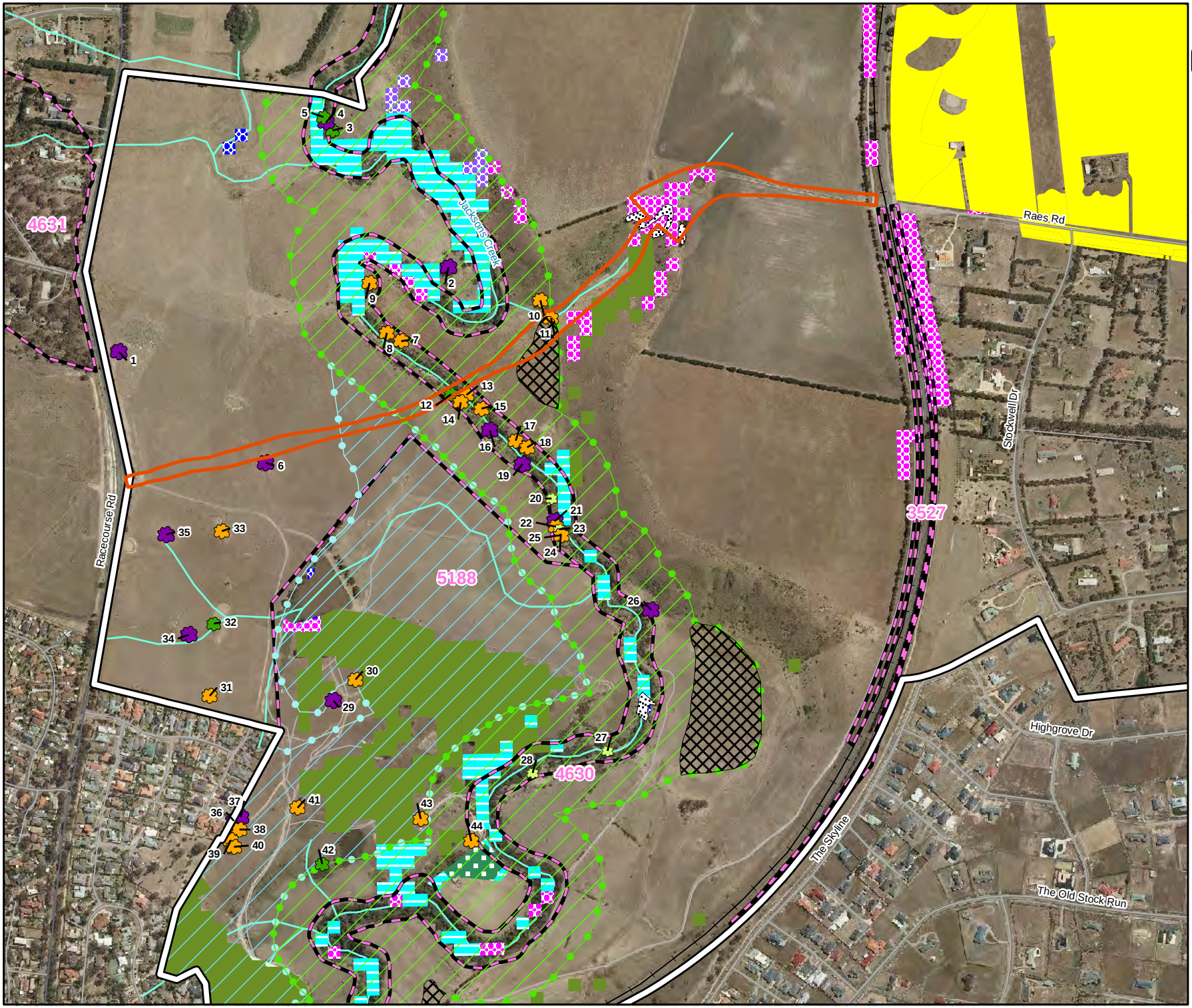
Figure 4c

Ecological Features
Option Nth_Coll_Opt.A

Jacksons Creek Road Crossings Project

ecology & heritage partners

5808_NH_Map04c_NO_CollA 1/10/2014 cbrowning



Legend

- Option Nth_Coll_Opt.B
- PSP Boundary
- BioSite Boundaries
- Field mapped Remnant Patches
- Significant areas for the GGF

Conservation Areas

- Area 20
- Area 21

Scattered Trees (not exhaustive)

- VLOT
- LOT
- MOT
- ST

Time-stamped Native Vegetation

- 125 Plains Grassy Wetland
- 132 Plains Grassland
- 47 Valley Grassy Forest
- 55 Plains Grassy Woodland
- 61 Box Ironbark Forest
- 641 Riparian Woodland
- 803 Plains Woodland
- 851 Stream Bank Shrubland

N

0 100 200
Metres

Figure 4d
Ecological Features
Option Nth_Coll_Opt.B

Jacksons Creek Road Crossings Project

ecology & heritage partners

APPENDICES

APPENDIX A - SIGNIFICANT FLORA SPECIES

Table A1 Significant Flora Recorded within 10 Kilometres of the Study Area

Scientific name	Common name	Total number of documented records	Last documented record	EPBC Act[1]	FFG Act[2]	DEPI[3]
NATIONAL SIGNIFICANCE						
# Amphibromus fluitans	River Swamp Wallaby-grass	-	-	VU	-	-
# Carex tasmanica	Curly Sedge	-	-	VU	L	v
Dianella amoena	Matted Flax-lily	1	1998	EN	L	e
Diuris basaltica	Small Golden Moths	1	1904	EN	L	v
# Glycine latrobeana	Clover Glycine	-	-	VU	L	v
Lepidium hyssopifolium	Basalt Peppercress	1	1977	EN	L	e
Pimelea spinescens subsp. spinescens	Spiny Rice-flower	2	2004	CR	L	e
# Prasophyllum frenchii	Maroon Leek-orchid	-	-	EN	L	e
# Rutidosis leptorhynchoides	Button Wrinklewort	-	-	EN	L	e
Senecio macrocarpus	Large-headed Fireweed	5	2004	VU	L	e
# Xerochrysum palustre	Swamp Everlasting	-	-	VU	L	v
STATE SIGNIFICANCE						
Comesperma polygaloides	Small Milkwort	2	1984	-	L	v
Dianella sp. aff. longifolia (Benambra)	Arching Flax-lily	39	2005	-	-	v
Dianella tarda	Late-flower Flax-lily	1	2005	-	-	v
Eucalyptus leucoxylon subsp. connata	Melbourne Yellow-gum	15	2011	-	-	v
**Geranium sp. 3*	Pale-flower Crane's-bill	2	2012	-	-	r
Nicotiana suaveolens	Austral Tobacco	12	2011	-	-	r
**Podolepis sp. 1*	Basalt Podolepis	1	2004	-	-	e
Pterostylis truncata	Brittle Greenhood	1	1770	-	L	e

Scientific name	Common name	Total number of documented records	Last documented record	EPBC Act[1]	FFG Act[2]	DEPI[3]
Rhagodia parabolica	Fragrant Saltbush	10	2011	-	-	r
Senecio cunninghamii var. cunninghamii	Branching Groundsel	2	1901	-	-	r
Tripogon loliiformis	Rye Beetle-grass	1	1987	-	-	r
REGIONAL SIGNIFICANCE						
Alternanthera sp. 1 (Plains)	Plains Joyweed	1	2004	-	-	k
**Clematis decipiens*	Slender Clematis	1	1900	-	-	k
**Convolvulus angustissimus subsp. omnigracilis*	Slender Bindweed	3	2012	-	-	k
Desmodium varians	Slender Tick-trefoil	3	2006	-	-	k
Lepidium pseudohyssopifolium	Native Peppercress	1	1977	-	-	k
Sclerolaena muricata var. muricata	Black Roly-poly	3	1987	-	-	k

Notes: 1) Listed as Critically Endangered (CR), Endangered (E) or Vulnerable (V) under the EPBC Act

2) Listed (L) under the FFG Act

3) Listed as Endangered (e), Vulnerable (v), Rare (r) or Status Poorly Known (k) on the Victoria Advisory List (DSE 2005)

- Records only identified from the EPBC Act Protected Matters Search Tool

APPENDIX B - SIGNIFICANT FAUNA SPECIES

Table B1 Significant Fauna within 10 Kilometres of the Study Area

Common name	Scientific name	Total number of documented records	Last documented record	EPBC Act[1]	FFG Act[2]	DEPI[3]
NATIONAL SIGNIFICANCE						
Birds						
Australasian Bittern	*Botaurus poiciloptilus*	1975	2	EN	L	en
Swift Parrot	*Lathamus discolor*	2007	6	EN	L	en
Regent Honeyeater	*Anthochaera phrygia*	1975	2	EN	L	cr
# Australian Painted Snipe	*Rostratula australis*	-	-	VU, M	L	cr
# Fairy Tern	*Sternula nereis*	-	-	VU	L	en
Mammals						
Spot-tailed Quoll	*Dasyurus maculatus maculatus*	1883	1	EN	L	en
# Grey-headed Flying-fox	*Pteropus poliocephalus*	-	-	VU	L	vu
# New Holland Mouse	*Pseudomys novaehollandiae*	-	-	VU	L	vu
Reptiles						
Grassland Earless Dragon	*Tympanocryptis pinguicolla*	1990	1	EN	L	cr
# Pink-tailed Worm-Lizard	*Aprasia parapulchella*	-	-	VU	L	en
# Striped Legless Lizard	*Delma impar*	-	-	VU	L	en
Amphibians						
Growling Grass Frog	*Litoria raniformis*	2009	20	VU	L	en
Fish						
Macquarie Perch	*Macquaria australasica*	1970	1	EN	L	en
# Australian Grayling	*Prototroctes maraena*	-	-	VU	L	vu
# Dwarf Galaxias	*Galaxiella pusilla*	-	-	VU	L	vu
Invertebrates						
Golden Sun Moth	*Synemon plana*	2008	5	CR	L	cr
STATE SIGNIFICANCE						
Birds						
Musk Duck	*Biziura lobata*	1976	3	-	-	vu
Australasian Shoveler	*Anas rhynchotis*	1977	2	-	-	vu
Hardhead	*Aythya australis*	1975	1	-	-	vu
Diamond Dove	*Geopelia cuneata*	1999	1	-	L	nt
White-throated Needletail	*Hirundapus caudacutus*	1990	6	M	-	vu
Eastern Great Egret	*Ardea modesta*	1980	10	M	L	vu
Intermediate Egret	*Ardea intermedia*	1975	1	-	L	en

Common name	Scientific name	Total number of documented records	Last documented record	EPBC Act[1]	FFG Act[2]	DEPI[3]
Black Falcon	*Falco subniger*	1977	2	-	-	vu
Baillon's Crake	*Porzana pusilla palustris*	1975	3	-	L	vu
Common Greenshank	*Tringa nebularia*	1977	1	M	-	vu
Red-chested Button-quail	*Turnix pyrrhothorax*	1956	1	-	L	vu
Powerful Owl	*Ninox strenua*	1975	1	-	L	vu
Barking Owl	*Ninox connivens connivens*	1975	1	-	L	en
Masked Owl	*Tyto novaehollandiae novaehollandiae*	1975	1	-	L	en
Brown Treecreeper (south-eastern ssp.)	*Climacteris picumnus victoriae*	1990	7	-	-	nt
Speckled Warbler	*Chthonicola sagittatus*	1990	4	-	L	vu
Diamond Firetail	*Stagonopleura guttata*	2005	5	-	L	nt
Mammals						
Brush-tailed Phascogale	*Phascogale tapoatafa*	1985	1	-	L	vu
Common Dunnart	*Sminthopsis murina murina*	1990	1	-	-	vu
Amphibians						
Brown Toadlet	*Pseudophryne bibronii*	1990	12	-	L	en
Southern Toadlet	*Pseudophryne semimarmorata*	1960	1	-	-	vu
Fish						
Southern Pygmy Perch	*Nannoperca australis*	2005	6	-	-	vu
REGIONAL SIGNIFICANCE						
Birds						
Nankeen Night Heron	*Nycticorax caledonicus hillii*	1976	2	-	-	nt
Whiskered Tern	*Chlidonias hybridus javanicus*	1975	1	-	-	nt
Azure Kingfisher	*Alcedo azurea*	1987	2	-	-	nt
Spotted Quail-thrush	*Cinclosoma punctatum*	1975	3	-	-	nt
Royal Spoonbill	*Platalea regia*	1975	1	-	-	nt
Latham's Snipe	*Gallinago hardwickii*	1979	3	M	-	nt
Mammals						
Fat-tailed Dunnart	*Sminthopsis crassicaudata*	1913	4	-	-	nt
Fish						
River Blackfish	*Gadopsis marmoratus*	1981	1	-	-	dd

Notes: 1) Listed as Critically Endangered (CR), Endangered (E), Vulnerable (V) or Migratory (M) under the EPBC Act

2) Listed (L) under the FFG Act

3) Listed as Critically Endangered (cr), Endangered (e), Vulnerable (v), Near Threatened (nt) or Data Deficient (dd) on the Victoria Advisory List (DSE 2009a, DSE 2013)

- Records only identified from the EPBC Act Protected Matters Search Tool

APPENDIX C - SCATTERED TREE DATA

Table C1. Northern Link - Scattered Trees (refer Figures 4a-4d)

Parcel SPI	Tree #	Scientific name	Common name	DBH (cm)	Size Class	Conservation Significance	Bioregion	EVC	Latitude	Longitude
Q\PS435007	1	*Eucalyptus leucoxylon subsp. connata*	Melbourne Yellow Gum	160	VLOT	High*	VVP	EVC 61	-37.55516	144.73442
	2	*Eucalyptus camaldulensis*	River Red Gum	110	VLOT	High	VVP	EVC 851	-37.55378	144.74186
	6	*Eucalyptus leucoxylon subsp. connata*	Melbourne Yellow Gum	145	VLOT	High*	VVP	EVC 61	-37.55720	144.73765
	7	*Eucalyptus camaldulensis*	River Red Gum	96	LOT	High	VVP	EVC 851	-37.55509	144.74076
	8	*Eucalyptus camaldulensis*	River Red Gum	97	LOT	High	VVP	EVC 851	-37.55493	144.74044
	9	*Eucalyptus camaldulensis*	River Red Gum	72	LOT	High	VVP	EVC 851	-37.55403	144.74008
	10	*Eucalyptus camaldulensis*	River Red Gum	73	LOT	High	VVP	EVC 851	-37.55442	144.74391
	11	*Eucalyptus leucoxylon subsp. connata*	Melbourne Yellow Gum	71	LOT	High*	VVP	EVC 61	-37.55474	144.74413
	12	*Eucalyptus camaldulensis*	River Red Gum	65	MOT	High	VVP	EVC 851	-37.55606	144.74185
	13	*Eucalyptus camaldulensis*	River Red Gum	75	LOT	High	VVP	EVC 851	-37.55608	144.74219
	14	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	92	LOT	High	VVP	EVC 851	-37.55621	144.74206
	15	*Eucalyptus camaldulensis*	River Red Gum	83	LOT	High	VVP	EVC 851	-37.55633	144.74253
	16	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	128	VLOT	High	VVP	EVC 851	-37.55672	144.74270
	17	*Eucalyptus camaldulensis*	River Red Gum	95	LOT	High	VVP	EVC 851	-37.55691	144.74328
	18	*Eucalyptus camaldulensis*	River Red Gum	80	LOT	High	VVP	EVC 851	-37.55704	144.74353
	19	*Eucalyptus* spp.	Stag	115	VLOT	High	VVP	EVC 851	-37.55733	144.74342
	20	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	35	ST	High	VVP	EVC 851	-37.55796	144.74405
	21	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	110	VLOT	High	VVP	EVC 851	-37.55837	144.74412
	22	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	90	LOT	High	VVP	EVC 851	-37.55847	144.74414

Parcel SPI	Tree #	Scientific name	Common name	DBH (cm)	Size Class	Conservation Significance	Bioregion	EVC	Latitude	Longitude
	23	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	22	ST	High	VVP	EVC 851	-37.55852	144.74421
	24	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	22	ST	High	VVP	EVC 851	-37.55859	144.74424
	25	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	98	LOT	High	VVP	EVC 851	-37.55862	144.74425
	26	*Eucalyptus viminalis subsp. viminalis*	Manna Gum	115	VLOT	High	VVP	EVC 851	-37.55999	144.74623
	27	*Eucalyptus camaldulensis*	River Red Gum	41	ST	High	VVP	EVC 851	-37.56250	144.74517
	28	*Eucalyptus camaldulensis*	River Red Gum	35	ST	High	VVP	EVC 851	-37.56286	144.74348
	29	*Eucalyptus camaldulensis*	River Red Gum	108	VLOT	Medium	VVP	EVC 61	-37.56149	144.73904
	30	*Eucalyptus melliodora*	Yellow Box	96	LOT	Medium	VVP	EVC 61	-37.56111	144.73955
	31	*Eucalyptus melliodora*	Yellow Box	86	LOT	Medium	VVP	EVC 61	-37.56134	144.73627
	32	*Eucalyptus* spp.	Stag	69	MOT	Medium	VVP	EVC 61	-37.56006	144.73640
	33	*Eucalyptus leucoxylon subsp. connata*	Melbourne Yellow Gum	91	LOT	High*	VVP	EVC 61	-37.55840	144.73663
	34	*Eucalyptus* spp.	Stag	180	VLOT	Medium	VVP	EVC 61	-37.56024	144.73584
	35	*Eucalyptus leucoxylon subsp. connata*	Melbourne Yellow Gum	110	VLOT	High*	VVP	EVC 61	-37.55845	144.73538
5~8\PP2174	36	*Eucalyptus microcarpa*	Grey Box	90	LOT	High	VVP	EVC 803	-37.54855	144.75021
	37	*Eucalyptus microcarpa*	Grey Box	100	LOT	High	VVP	EVC 803	-37.54841	144.75005
	38	*Eucalyptus melliodora*	Yellow Box	81	LOT	High	VVP	EVC 803	-37.54773	144.75079
	39	*Eucalyptus melliodora*	Yellow Box	95	LOT	High	VVP	EVC 803	-37.54726	144.75065
	40	*Eucalyptus melliodora*	Yellow Box	89	LOT	High	VVP	EVC 803	-37.54432	144.75004
	41	*Eucalyptus melliodora*	Yellow Box	55	MOT	High	VVP	EVC 803	-37.54429	144.74991
	42	*Eucalyptus melliodora*	Yellow Box	62	MOT	High	VVP	EVC 803	-37.54406	144.75005
	43	*Eucalyptus melliodora*	Yellow Box	65	MOT	High	VVP	EVC 803	-37.54390	144.75005
	44	*Eucalyptus melliodora*	Yellow Box	76	LOT	High	VVP	EVC 803	-37.54381	144.74981

Appendix G

Broad Level Costings

14M1881006 - Jackson's Creek Crossing Concept Costing

North

Arterial

Alignment A

Civil Works				
Item	**Description**	**Quantity**	**Rate**	**Total**
1.0	**Bulk Earthworks**			
1.01	Excavation to proposed formation levels, including trimming, rolling, cutting and shaping, compaction of subgrades, removal and disposal of spoil, surplus unapproved soil, etc. This item is to incorporate subgrade preparation and the supply, placement and compaction of fill material as specified.	447000m3	$60.00/m3	$26,820,000.00
	Other items not listed above as deemed to be required by the works, please specify			
2.0	**Pavements, Flexible**			
	The supply and installation of the following compacted depth asphalt wearing courses including labour, materials, compaction and bituminous prime coat, to relevant specifications and as specified.			
2.01	Full-depth asphalt pavement	61000m2	$250.00/m2	$15,250,000.00
	Other items not listed above as deemed to be required by the works, please specify			
	Sub Total - Civil			**$42,070,000.00**
	Total with 15% Contingency			**$48,380,500.00**

Assumptions and exclusions:

1. Insurances and bank guarantees have been excluded.
2. Preliminary allowances for existing services relocations, lowering or realignment thereof have been included.
3. Protection of underground services during construction has been excluded
4. The above opinion of probable cost is for initial planning only and must not be relied upon for quoting, budgeting or construction purposes. It is recommended that you seek a detailed cost estimate from a suitably qualified quantity surveyor.
5. A 15% contingency has been applied to the opinion of probable costs. The contingency is assumed to cover the following: Line marking and signage, lighting (not including design), roadside drianage (assumed to be grassed swales with rock energy dissipation beaching), run-off treatment (assumed to be pre-made drop in GPT type units), guard fences (assumed to be minimal as 1 in 6 grade has been adopted adjacent to road shoulder) and landscaping
6. Specific construction works including rock boring, rock blasting or rock excavation and removal have been excluded as geotechnical conditions may vary on site.
7. This estimate also excludes an allowance for abnormal weather conditions.
8. GST is excluded.
9. Price escalation is excluded.
10. Cost of property acquisitions is excluded

14M1881006 - Jackson's Creek Crossing Concept Costing

North

Arterial

Alignment B

Civil Works				
Item	**Description**	**Quantity**	**Rate**	**Total**
1.0	**Bulk Earthworks**			
1.01	Excavation to proposed formation levels, including trimming, rolling, cutting and shaping, compaction of subgrades, removal and disposal of spoil, surplus unapproved soil, etc. This item is to incorporate subgrade preparation and the supply, placement and compaction of fill material as specified.	295000m3	$60.00/m3	$17,700,000.00
	Other items not listed above as deemed to be required by the works, please specify			
2.0	**Pavements, Flexible**			
	The supply and installation of the following compacted depth asphalt wearing courses including labour, materials, compaction and bituminous prime coat, to relevant specifications and as specified.			
2.01	Full-depth asphalt pavement	37000m2	$250.00/m2	$9,250,000.00
	Other items not listed above as deemed to be required by the works, please specify			
	Sub Total - Civil			**$26,950,000.00**
	Total with 15% Contingency			**$30,992,500.00**

Assumptions and exclusions:

1. Insurances and bank guarantees have been excluded.
2. Preliminary allowances for existing services relocations, lowering or realignment thereof have been included.
3. Protection of underground services during construction has been excluded
4. The above opinion of probable cost is for initial planning only and must not be relied upon for quoting, budgeting or construction purposes. It is recommended that you seek a detailed cost estimate from a suitably qualified quantity surveyor.
5. A 15% contingency has been applied to the opinion of probable costs. The contingency is assumed to cover the following: Line marking and signage, lighting (not including design), roadside drianage (assumed to be grassed swales with rock energy dissipation beaching), run-off treatment (assumed to be pre-made drop in GPT type units), guard fences (assumed to be minimal as 1 in 6 grade has been adopted adjacent to road shoulder) and landscaping
6. Specific construction works including rock boring, rock blasting or rock excavation and removal have been excluded as geotechnical conditions may vary on site.
7. This estimate also excludes an allowance for abnormal weather conditions.
8. GST is excluded.
9. Price escalation is excluded.
10. Cost of property acquisitions is excluded

14M1881006 - Jackson's Creek Crossing Concept Costing

North

Connector

Alignment A

Civil Works				
Item	**Description**	**Quantity**	**Rate**	**Total**
1.0	**Bulk Earthworks**			
1.01	Excavation to proposed formation levels, including trimming, rolling, cutting and shaping, compaction of subgrades, removal and disposal of spoil, surplus unapproved soil, etc. This item is to incorporate subgrade preparation and the supply, placement and compaction of fill material as specified.	350000m3	$60.00/m3	$21,000,000.00
	Other items not listed above as deemed to be required by the works, please specify			
2.0	**Pavements, Flexible**			
	The supply and installation of the following compacted depth asphalt wearing courses including labour, materials, compaction and bituminous prime coat, to relevant specifications and as specified.			
2.01	Full-depth asphalt pavement	42500m2	$250.00/m2	$10,625,000.00
	Other items not listed above as deemed to be required by the works, please specify			
	Sub Total - Civil			**$31,625,000.00**
	Total with 15% Contingency			**$36,368,750.00**

Assumptions and exclusions:

1. Insurances and bank guarantees have been excluded.
2. Preliminary allowances for existing services relocations, lowering or realignment thereof have been included.
3. Protection of underground services during construction has been excluded
4. The above opinion of probable cost is for initial planning only and must not be relied upon for quoting, budgeting or construction purposes. It is recommended that you seek a detailed cost estimate from a suitably qualified quantity surveyor.
5. A 15% contingency has been applied to the opinion of probable costs. The contingency is assumed to cover the following: Line marking and signage, lighting (not including design), roadside drianage (assumed to be grassed swales with rock energy dissipation beaching), run-off treatment (assumed to be pre-made drop in GPT type units), guard fences (assumed to be minimal as 1 in 6 grade has been adopted adjacent to road shoulder) and landscaping
6. Specific construction works including rock boring, rock blasting or rock excavation and removal have been excluded as geotechnical conditions may vary on site.
7. This estimate also excludes an allowance for abnormal weather conditions.
8. GST is excluded.
9. Price escalation is excluded.
10. Cost of property acquisitions is excluded

14M1881006 - Jackson's Creek Crossing Concept Costing

North

Connector

Alignment B

Civil Works				
Item	**Description**	**Quantity**	**Rate**	**Total**
1.0	**Bulk Earthworks**			
1.01	Excavation to proposed formation levels, including trimming, rolling, cutting and shaping, compaction of subgrades, removal and disposal of spoil, surplus unapproved soil, etc. This item is to incorporate subgrade preparation and the supply, placement and compaction of fill material as specified.	201000m3	$60.00/m3	$12,060,000.00
	Other items not listed above as deemed to be required by the works, please specify			
2.0	**Pavements, Flexible**			
	The supply and installation of the following compacted depth asphalt wearing courses including labour, materials, compaction and bituminous prime coat, to relevant specifications and as specified.			
2.01	Full-depth asphalt pavement	26000m2	$250.00/m2	$6,500,000.00
	Other items not listed above as deemed to be required by the works, please specify			
	Sub Total - Civil			**$18,560,000.00**
	Total with 15% Contingency			**$21,344,000.00**

Assumptions and exclusions:

1. Insurances and bank guarantees have been excluded.
2. Preliminary allowances for existing services relocations, lowering or realignment thereof have been included.
3. Protection of underground services during construction has been excluded
4. The above opinion of probable cost is for initial planning only and must not be relied upon for quoting, budgeting or construction purposes. It is recommended that you seek a detailed cost estimate from a suitably qualified quantity surveyor.
5. A 15% contingency has been applied to the opinion of probable costs. The contingency is assumed to cover the following: Line marking and signage, lighting (not including design), roadside drianage (assumed to be grassed swales with rock energy dissipation beaching), run-off treatment (assumed to be pre-made drop in GPT type units), guard fences (assumed to be minimal as 1 in 6 grade has been adopted adjacent to road shoulder)
6. Specific construction works including rock boring, rock blasting or rock excavation and removal have been excluded as geotechnical conditions may vary on site.
7. This estimate also excludes an allowance for abnormal weather conditions.
8. GST is excluded.
9. Price escalation is excluded.
10. Cost of property acquisitions is excluded

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