VicRoads

Western Highway Project – Section 3: Ararat to Stawell

Options Assessment Report

February 2012

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For Mapping Products:

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Glossary

AAQ	Ambient Air Quality
AAV	Aboriginal Affairs Victoria
ALA	Andrew Long and Associates
AMP1	Access Management Plan 1 (Freeway Standard)
AMP3	Access Management Plan 3 (Highway Standard)
AQM	Air Quality Management
ARTC	Australian Rail Track Corporation
ASS	Acid Sulphate Soils
CHMP	Cultural Heritage Management Plan
ATHrW	Alluvial Terraces Herb rich Woodland
CHP	Cultural Heritage Permit
CGW	Creekline Grassy Woodland
CVU	Central Victorian Uplands
DPCD	Department of Planning and Community Development
DSE	Department of Sustainability and Environment
DSEWPaC	Department of Sustainability, Environment, Water Population and Communities
EE Act	Environmental Effects Act 1978 (State)
EES	Environmental Effects Statement
EHP	Ecology and Heritage Partners
EPA	Environmental Protection Authority
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth)
EVC	Ecologically Vegetation Classes
FFG Act	Flora and Fauna Guarantee Act 1988 (State)
GDE	Groundwater Dependent Ecosystem

GDF	Grassy Dry Forest
GW	Grassy Woodlands
ha	Hectare
HabHa	Habitat Hectares
HI	Heritage Inventory
HO	Heritage Overlay
HW	Heathy Woodland
LOT	Large Old Trees
LPPF	Local Planning Policy Framework
MNES	Matters of National Environmental Significance
P&E Act	*Planning and Environment Act 1987* (State)
PGW	Plains Grassy Woodland
PLSG	Professional and Local Services Group
Project Area	The corridor area extending 1.5 km to the north and south of the edge of the existing highway road reserve, except around Great Western where it extends 1.8 km
RAP	Registered Aboriginal Parties
SEPP	State Environmental Protection Policy
SPPF	State Planning Policy Framework
TDS	Total Dissolved Salts
TRG	Technical Reference Group
VAHR	Victorian Aboriginal Heritage Register
VHI (HI)	Victorian Heritage Inventory
VHR	Victorian Heritage Register
VKT	Vehicle Kilometres Travelled
WA	Work Authorities

Executive Summary

Background and Context

The Western Highway (A8) is being progressively upgraded as a four lane divided highway between Ballarat and Stawell. As the principal road link between Melbourne and Adelaide, it serves interstate trade and is the key corridor through Victoria's west, supporting farming, grain production, regional tourism and a range of manufacturing and service activities.

The Minister for Planning has determined that an Environment Effects Statement (EES) is to be prepared for VicRoads' proposed duplication of the Western Highway between Ararat and Stawell. The first stage of the EES process was the detailed assessment of alignment options. The objective of the options assessment process is to select alignments which minimise potential adverse environmental, social and economic impacts whilst maximising the benefit to be gained as a result of the project proceeding. This report documents the outcomes of the options assessment and also captures the Technical Reference Group (TRG) and community comments about the outcomes of the assessments.

Options Assessment Approach

In order to address the Project objectives, it was deemed to be necessary to duplicate the Western Highway, following which a detailed analysis of alignment options was undertaken. The assessment of alignment options was undertaken in three phases:

- **Phase 1** involved developing a range of alignment options, followed by a rapid assessment to identify a shortlist to identify a shortlist through a high level consideration of potential impacts and benefits.
- **Phase 2** involved the detailed assessment of the options shortlisted in Phase 1 to identify a proposed alignment through a more detailed consideration of potential impacts and benefits.
- **Phase 3** involved an Environmental Risk Assessment of the recommended alignment option and completion of the specialist impact assessments to identify areas where further micro refinements were required to mitigate potential impacts.

A study area was defined as extending 1.5 kilometres (km) either side of the existing highway, except around Great Western where the study area extends up to 1.8 km, encompassing the extent of alignment options. This was then divided into three zones (Figure 1) with similar environmental, social and economic constraints and physical conditions. The objective was to identify a recommended option in each zone that, on balance, had the lowest potential impact.

Several alignment options were developed within each zone and were refined through community consultation. These refined alignment options were assessed against 'evaluation criteria', based on objectives described in the Draft EES Scoping Requirements, and divided amongst technical specialists of the following relevant disciplines:

- Traffic and Transport
- Biodiversity and Habitat
- Cultural Heritage
- Surface Water
- Planning and Land use
- Economic
- Visual and Landscape
- Soils and Geology

- Social
- Noise
- Groundwater
- Air Quality.

The options assessment utilised an Impact Ratings Framework to define the magnitude of positive or negative impacts. The ratings were assigned a numerical score value between one and nine, with one for 'Very Poor', to nine for 'Very Well'. Each criterion was assigned a weighting multiplier to reflect its relative importance.

Following an inter-disciplinary workshop to review each rating for consistency in approach, the weighted scores were combined in a matrix and totalled for each alignment option. A higher score indicates that, on balance, the alignment option provides a more favourable outcome than those with lower scores in the same zone. The alignments were then assigned an ascending rank beginning with the preferred option in each zone. Community consultation outcomes guided the assessment, and assisted in identifying perceived impacts.

An equal weighting was applied to the assessments by each of the disciplines (i.e.: no discipline was rated higher than another). Following comments provided by DSE and DPCD, the overall flora and fauna objective was separated into two overall objectives due to the range and complexity of legislation and policy to be addressed (ie. by separating out the compliance with 'net gain' and wildlife corridor protection requirements under Victoria's Native Vegetation Management – A Framework for Action from the legislative requirements for minimising impacts on listed species and communities).

Phase 1 and 2 Outcomes

A long list of alignment options was developed and assessed during Phase 1. The options were rated against a set of objectives described, which were derived from the Project Objectives and the draft EES Evaluation Objectives. Some of the long list options within each zone were eliminated from further consideration leaving a short list for assessment in Phase 2.

The outcomes of the options assessment were presented to TRG and at community consultation sessions to seek comment on the recommended options within each zone. The comments provided by the TRG and community have been incorporated into the assessment documented in this report.

The objective of the Phase 2 assessment was to identify a recommended option in each zone that, on balance, had the lowest potential impact. The recommended options in each zone that were combined to create the proposed alignment assessed in Phase 3 and the EES include:

- Zone 1 - A combination of Options 1A and 1E was recommended selecting components of each option with the lower impacts on flora and fauna values.
- Zone 2 - Option 2B was recommended providing a north-east bypass of Great Western. Option 2B was considered to have has less potential impacts than Option 2C.
- Zone 3 - Option 3B was recommended initially, however it was only marginally better than to Option 3A. Through Phase 3 the recommended option was changed to 3A to address landowner concerns with 3B and the acceptance of the landowner affected by 3A.

The proposed alignment utilises the existing highway corridor on either side of Great Western in part to reduce the potential impacts on landowners, Aboriginal cultural heritage values and the environment.

A bypass of Great Western is proposed to the north-east, which impacts on a large area of native vegetation of high and very conservation significance. A bypass to the south-west would have less

impact on native vegetation, however, have more impact on confirmed and potential Golden Sun Moth habitat and scattered large and very large old trees.

The proposed bypass to the north-east was assessed as having lower potential social and economic impacts through less land severance; provides better connectivity to Great Western with interchanges on either side of the town, and would not restrict the future growth of Great Western, or place additional pressure upon services proposed by Council due to land severance.

Overall, it was considered that the potential impacts associated with a bypass to the south-west were, on balance, more substantial than the impacts to significant native vegetation from a north-east bypass of Great Western.

A key consideration for selection of the proposed alignment between Great Western and Stawell was the potential impacts to cultural heritage values. Sisters Rocks is a ceremonial Aboriginal heritage site (although not listed on the Aboriginal Heritage Register) that is located adjacent to the intersection of the existing highway and London Road. There is a visual connection between Sisters Rocks and the Black Range, located to the south-west and outside the Project area, which has high Aboriginal cultural significance. Sisters Rocks also have historical cultural significance and is listed on the DSE heritage register.

The proposed alignment has lower potential impact on Aboriginal cultural heritage values than the other options as it would minimise the impact on the visual connection between Sisters Rocks and Black Range.

Phase 3 Outcomes

The impacts of the proposed alignment were assessed through the environmental risk assessment and impact assessment. The risk assessment was used as a tool to identify potentially significant risk events for more detailed assessment of impact and mitigation measures. The process enabled activities and events with relatively high levels of risk to be prioritised from those with a lower level of risk or which were easily managed.

Through the risk assessment it was identified that the alignment could be refined to reduce the potential impact, particularly on flora and fauna values and to landowners.

The proposed alignment impacts on areas of native vegetation, however this could be reduced through such measures as restricting the construction footprint in sensitive areas. A conservative footprint for the alignment was adopted for the options assessment which has been refined through the impact assessment and would be further refined during detailed design.

The alignment refinements adopted following the Phase 3 risk assessment and landowner consultation include:

- Wide medians and service roads set further away from carriageways in cleared farmland to protect roadside vegetation;
- Narrow medians and construction footprint to reduce impacts to landowners as well as flora and fauna values;
- The alignment in zone 3 was altered to be a combination of 3B and 3A to address landowner concerns with 3B and the acceptance of the landowner affected by 3A;
- Additional service roads to provide access under the ultimate upgrade (freeway) standard;

- Protection of roadside vegetation (in DSE managed reserves) north of Churchill Crossing Road and London Road by realigning the highway alignment into cleared farmland and excluding the vegetation from the construction footprint; and
- To reduce the width of the cut for the bypass of Great Western, 2:1 batter slopes have been proposed

The design standard was also changed from AMP3 to AMP1 for the last length of Section 3 from Harvey Lane to Gilchrist Road. An interchange was developed at London Road to provide improved access and meet AMP1 design standards. The interchange was located in cleared farmland to minimise potential impacts on significant vegetation on the western side of the existing highway.

The proposed alignment assessed in the EES is show in Figure 1.

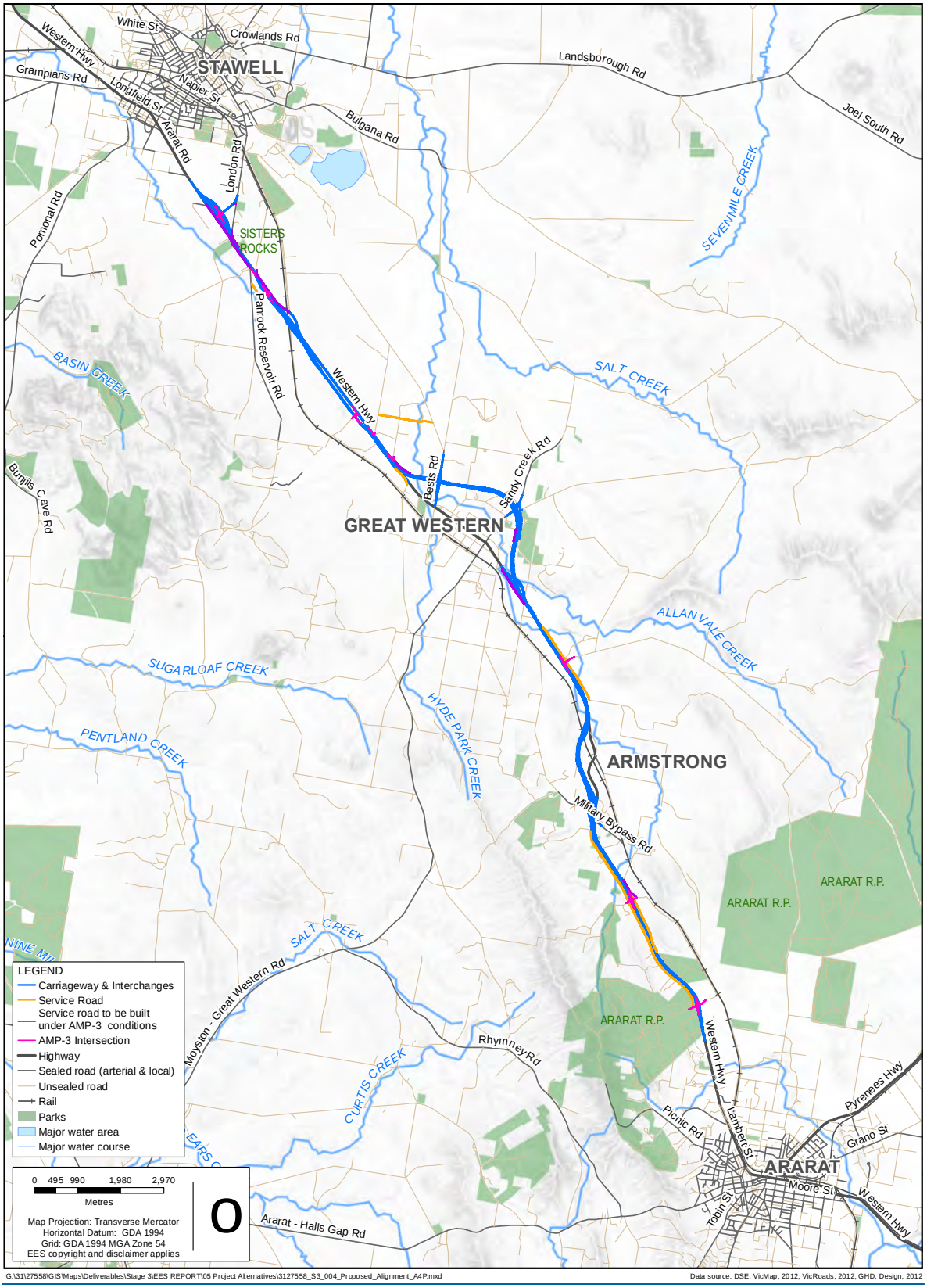


Figure 1 Alignment recommended for further consideration in the EES process

1. Introduction

1.1 Background

The Western Highway Project (the Project) is a key project for Western Victoria supported by the Victorian and Australian Governments. VicRoads proposes to duplicate the Western Highway between Ballarat and Stawell in Western Victoria.

Section 3 of the Western Highway project commences to the south-east of Pollard Lane, Ararat and extends for approximately 24 kilometres (km) to the south-east of Gilchrist Road, Stawell. It includes a bypass of the township of Great Western and crossing of the Australian Rail Track Corporation's (ARTC) interstate rail line which experiences both freight movements and interstate passenger movements.

In October 2010, the Minister for Planning determined that VicRoads should prepare an Environment Effects Statement (EES) under the *Environment Effects Act 1978* (EE Act) to document the potential environmental effects of Section 3 of the Project. In making this decision, the Minister noted the following reasons:

- *The project is likely to result in significant adverse effects on biodiversity, including on native vegetation, listed flora and fauna species and ecological communities;*
- *The project could have significant effects on Aboriginal and non-Aboriginal cultural heritage;*
- *The project could have significant effects on existing land uses, infrastructure and communities, including on amenity and landscapes;*
- *The opportunities to avoid or minimise significant effects through the selection of the roadway alignment and design, as well as mitigation and offsetting measures, requires further investigation; and*
- *An integrated assessment of environmental effects associated with alternative alignments is needed to inform decision making.*

The Project was also referred to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The delegate for the Minister for Sustainability, Environment, Water, Population and Communities, determined the Project to be a controlled action that requires assessment and approval under the EPBC Act in December 2010. The relevant controlling provisions for the Project under the EPBC Act are:

- *Threatened species and ecological communities (Sections 18 and 18A).*

The EES process is to be applied as an accredited process under the EPBC Act in accordance with the bilateral agreement between the Commonwealth and Victoria Governments.

1.2 Purpose of this Document

This report documents the outcomes of the options assessment process for Section 3 of the Project. Details are provided of the specialists' assessments for Phase 1 and 2. A separate report (refer to EES Technical Appendix Q) has been prepared documenting the approach and detailed outcomes of Phase 3, which are summarised in this report.

The outcomes of the assessments presented in this report informed the selection of the preferred alignment that was assessed in detail for the EES. Options that were discounted from the short list were not further assessed in the EES.

This report was initially prepared to allow the EES Technical Reference Group (TRG) to understand the details for the assessment of alignment options and to be able to provide comments on the assessment outcomes. The initial outcomes of the options assessment were also provided to the community for comment. Both TRG and community comments have been considered in the assessment of alignment options and the proposed alignment, and are captured in this report.

The assessments presented in this report are based on conditions encountered and information reviewed at the date of preparing the Report. GHD has no re sponsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the Report was prepared. The assessments presented are not detailed impact assessments and are for the purposes of informing selection of the preferred alignment for the EES only. The assumptions and reference information utilised by each specialist are presented in Appendix G to Appendix R.

A separate report was prepared for assessment of Section 2 (Beaufort to Ararat) of the Western Highway.

1.3 Document Structure

The alignment options were assessed in three Phases against the EES Scoping Requirements evaluation objectives.

A description of the alignment options in each zone is followed by a summary of findings across disciplines. This inter-disciplinary approach identifies the key considerations necessary for the balanced selection of the option with the best overall balance of maximising positive impacts and minimising negative impacts.

1.4 Project Overview

The Western Highway (A8) is being progressively upgraded as a four lane divided highway for approximately 100 km between Ballarat and Stawell. As the principal road link between Melbourne and Adelaide, the Western Highway serves interstate trade between Victoria and South Australia and is the key transport corridor through Victoria's west, supporting farming, grain production, regional tourism and a range of manufacturing and service activities. Currently more than 5500 vehicles travel the highway west of Ballarat each day, including 1500 trucks. The Project involves the staged duplication of the Western Highway between Ballarat and Stawell. The Project consists of three stages, as shown in Figure 2:

- Section 1: Ballarat to Beaufort;
- Section 2: Beaufort to Ararat; and
- Section 3: Ararat to Stawell.

Works on an initial 8 km section between Ballarat and Burrumbeet (Section 1A) commenced in April 2010 and will be completed in 2012. Construction for Section 1B (Burrumbeet to Beaufort-Carngham Road) commenced in early 2012 and is expected to be completed by June 2014. The last 3 km section from Beaufort-Carngham Road to Smiths Lane in Beaufort (Section 1C) commenced in late 2011 and will

finish in 2012. Separate Environment Effects Statements (EESs) and Planning Scheme Amendments (PSAs) must be prepared for both Sections 2 and 3. It is expected that Sections 2 and 3 will be completed and opened in stages through to 2016, subject to future funding.

Town bypasses of Beaufort and Ararat are not included in the current proposals but are currently being considered in separate studies commissioned by Pyrenees and Ararat Councils respectively.

The EES will focus on assessment of the proposed ultimate upgrade of the Western Highway between Beaufort and Stawell to a duplicated highway standard complying with the road category 1 (freeway) of VicRoads Access Management Policy (AMP1). The Project includes a duplicated road to allow for two lanes in each direction separated by a central median.

The objectives of the Project specified by VicRoads are to:

- Provide safer conditions for all road users by:
  - Reducing the incidence of head-on and run-off-road crashes;
  - Improving safety at intersections; and
  - Improving safety of access to adjoining properties.
- Improve efficiency of freight by designing for High Productivity Freight Vehicles.
- Provide adequate and improved rest areas.
- Locate alignment to allow for possible future bypasses of Beaufort and Ararat.

As stated above, this report deals with the assessment of shortlisted options to select a preferred alignment for Section 3 of the Project.

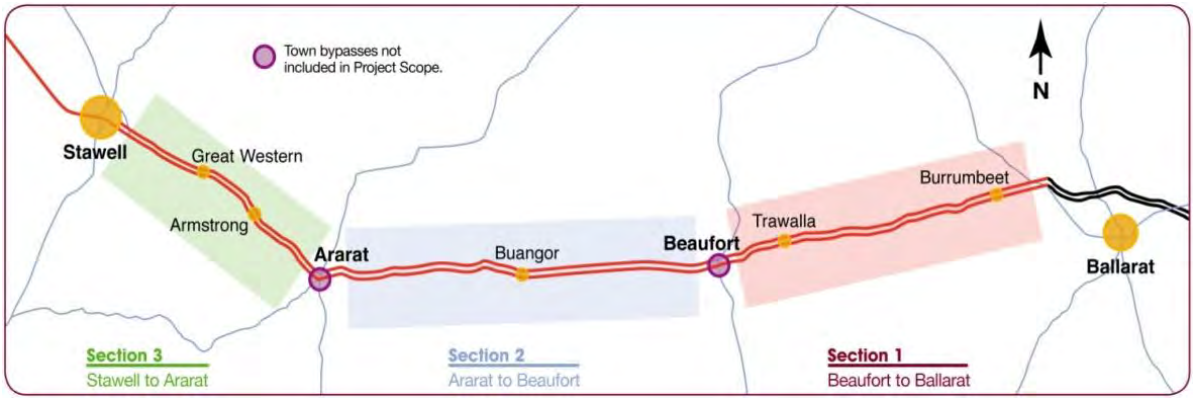


Figure 2 Western Highway - Project Overview

1.4.1 Project Rationale

The broader Western Highway Project is being implemented to deliver key benefits to the community, freight industry and the State. The importance of the identified key benefits is outlined as:

- **Reducing the operating costs of the freight industry and business –** improved efficiency of the road by an increased speed limit, safer overtaking opportunities and improved grades will make it more economical to trade between Victorian and South Australia as well as within Western Victoria.
- **Improving road safety** – a reduced number of traffic accidents leads to a reduction in road trauma. In addition to the obvious benefit of saving lives, there are flow on benefits to the economy through

avoiding productivity loss, and benefits to the health system by reducing demand for emergency and ongoing health services.

These drivers form key aspects of Victorian Government transport policies, as well as the VicRoads operating charter. This chapter expands on the key policy documents which define the need for this Project, which are consistent with the broader Project drivers.

VicRoads is proposing the Project to assist in meeting the objectives of the:

- National Transport Links - Growing Victoria's Economy strategy
- AusLink 2 – Roads to Recovery Program
- Melbourne-Adelaide Corridor Strategy
- Western Highway M8/A8 Corridor Strategy
- Arrive Alive (Victoria's Road Safety Strategy).

1.5 Preliminary Investigations by VicRoads

This section outlines the extent of existing conditions assessment, preliminary planning and community consultation already carried out by VicRoads prior to commencement of the EES process.

Following the declaration of funding for planning of the project, VicRoads personnel carried out preliminary investigations of the existing conditions of the highway and its corridor including:

- Land use
- Planning controls
- Public land status
- Road conditions (highway standard, structures and pavement)
- Public transport
- Railway crossings
- Bicycle facilities
- Pedestrian facilities
- Rest sites
- Traffic volumes
- Casualty crashes
- Utility services.

VicRoads personnel also carried out consultation with relevant authorities regarding planned future land use and development, future road network and future public transport. Current and predicted traffic volumes were sourced from the Traffic Analysis prepared by CPG Australia Pty Ltd in August 2009. Future traffic volumes were based on the Commonwealth Department of Infrastructure, Transport, Regional Development and Local Government growth rates between Ballarat and Horsham (1.59% for the Highway and 1.00% for intersecting roads, for the design outlook period to 2040 (CPG Australia Pty Ltd, August 2009)).

The following specialist studies were also commissioned by VicRoads to inform the options selection process:

- Planning Study by BECA
- Flora and Fauna Assessment by Ecology Partners
- Cultural Heritage Assessment by Dr Vincent Clarke & Associates

1.5.1 Community Consultation

A community meeting was held in Great Western on 11 November 2009 to inform the community of the Western Highway duplication between Ararat and Stawell. No alignment options were presented at this meeting, but rather the community was invited to highlight issues and constraints at round table discussions.

A second meeting was held in Great Western on 10 February 2010 to display draft alignment options to the community for Section 3, Ararat to Stawell, and to seek community feedback. Potentially affected landowners were consulted ahead of this community meeting.

A third meeting was held in Great Western on 21 July 2010 to give the community an opportunity to discuss issues with VicRoads staff.

Further direct consultation was undertaken for alignment options in critical locations involving land severance impacts.

1.6 Consideration of Relevant Alternatives

As part of the Project, VicRoads considered a number of solutions alongside duplication of the existing freeway to improve connectivity and efficiency between Ballarat and Stawell. The potential solutions considered include:

- Use of an alternate route;
- Use of an alternative transport mode;
- Construction of a greater number of overtaking opportunities; or
- Duplication of the Western Highway.

1.6.1 Use of an alternate route

In addition to the Western Highway corridor, another possible corridor would be the Sunraysia Highway through the towns of Learmonth, Waubra and Lexton connecting to the Pyrenees Highway via Elmhurst to the north of the Ararat Hills Regional Park into Great Western and then along the Western Highway into Stawell. While this corridor could be marginally shorter (depending on the final route chosen), at 106 km, compared with 108 km for the existing Western Highway corridor this alternative was not considered for further investigation due to:

- The Sunraysia and Pyrenees Highways are classified as B routes under the Linking Victoria Strategy and would require significant upgrades to the vertical and horizontal alignments to meet the M road standard;
- It would require considerable construction of new roads (through hilly and environmentally sensitive landscapes) to be completed between the Sunraysia Highway and Pyrenees Highway and Western Highway before such a corridor could be available for interstate traffic. This would have a substantial social impact as there would a large length of road that would be through “greenfield” sites as there is not an existing road corridor. While the planning and land severance impacts would be far greater for a “greenfield” option, this option would also be far more expensive as it would not make use of the existing Western Highway corridor and infrastructure; and

- The current Western Highway corridor better serves the major towns of Beaufort and Ararat, as well as the major Grampians tourist area and therefore an alternative corridor would not get maximum use. The proposed option provides improved access to popular tourist areas which in turn will create economic opportunities. If an alternative corridor to the north was used, the existing Western Highway would have to be maintained as a high standard parallel

The option of using alternative routes was also not considered feasible because alternative roads are not constructed to the standard required for the traffic. The cost of upgrading an alternative route would be far in excess of the option of duplicating the existing highway and it would provide a detrimental impact to existing major towns on the highway through leaving the existing travel time and safety issues on the existing highway unresolved.

1.6.2 Use of an alternative transport mode

The upgrade of the existing railway was considered and it was identified that 75% of the freight between Melbourne and Adelaide being non-bulk items. The need for these items to be collected from and distributed to many different locations means that there is a reliance on flexibility in the delivery chain that is provided by on road solutions.

1.6.3 Construction of a greater number of overtaking opportunities

The Western Highway between Ballarat and Stawell has a number of overtaking lanes along the route. It was determined that constructing more overtaking lanes along the Western Highway between Ballarat and Stawell alone was not adequate for the following reasons:

- Although overtaking lanes provide some relief to congestion, they are not as effective in addressing the road safety issues along the highway. Opposing directions of traffic are not separated so the risk of head on crashes remains high unless a median barrier is introduced. While a median barrier is a hazard in itself and also provides maintenance issues, it is also not considered appropriate in this case due to the high proportion of trucks and the fact that trucks may still penetrate the barriers.
- Overtaking lanes will not allow the speed limit to be raised to 110 kilometres per hour (km/h).
- Overtaking lanes do not cater for overtaking of vehicles that can travel at or near the speed limit on shallow gradients.

While this was a potentially cheaper response, this alternative does not fully address the travel time issue as the posted speed would have to remain at 100 km/h and there would still be delays behind slow moving vehicles in the sections that did not have overtaking lanes. More significantly, the opposing directions of traffic are not separated under this option therefore the current safety issue associated with head on crashes is not treated leaving this risk within this corridor.

1.6.4 Duplication of the Western Highway

This option involves the construction of a second carriage way and increasing the number of lanes on the highway to four lanes.

This option doubles the capacity of the highway and provides for safer overtaking opportunities. The separation of the two directions of traffic would reduce the likelihood of head on crashes and reduce the chances of rear end crashes by allowing vehicles to use the extra lane to move around slow or stationary vehicles on the highway.

The duplication of the Western Highway would allow safer access to and from adjoining local roads and private properties through the construction of wide median treatments at existing intersections and some private properties. The wide median intersections would allow safe turning movements to and from local roads or private entrances.

For the above reasons, it has been determined that the duplication of the Western Highway between Ballarat and Stawell, including Section 3 (between Ararat and Stawell), would be the most appropriate means of addressing safety and efficiency

1.7 Overview of Alignment Options

The alignment options for Section 3 of the Project are within a project area of 1.5 km from the existing highway, except around Great Western where the options are within 1.8 km of the highway.

The alignment options assessment for Section 3 occurred in three phases:

- Phase 1: Long list alignments
- Phase 2: Shortlist alignments
- Phase 3: Assessment of recommended alignments

A long list of alignment options was initially developed, followed by a rapid assessment to refine them into a shortlist for a more thorough consideration in Phase 2 (shortlist). The objective was to identify a single recommended option in each zone that, on balance, had the lowest potential impact. This would then provide an overall recommend alignment from the beginning to end of Section 3.

Each of the alignment options is within 1500m of the existing highway except around Great Western where the options are within 1800m of the highway to allow for a potential bypass of the town, as shown in Figure 4**.** Ararat Regional Park and the Sisters Rocks Bushland Reserve were excluded from consideration for all alignment options.

1.7.1 Long list (Phase 1)

For the purposes of options assessment, the Section 3 corridor was divided into three zones with similar environmental, social and physical conditions, and to allow for evaluation of options in a localised and relevant context. These zones are:

- Zone 1 – Ararat (end of 80 km/h speed zone near Pollard Lane) to Allanvale Road (this zone includes the town of Armstrong);
- Zone 2 – Allanvale Road to Briggs Lane (this zone includes Great Western); and
- Zone 3 – Briggs Lane to start of 80 km/h speed zone (Gilchrist Road) south-east of Stawell

Prior to the commencement of the EES, VicRoads had established some initial options through preliminary environmental and engineering investigations, and initial consultation with the community and regulatory agencies (see Appendix A). This information was used to generate additional alignment options in a workshop in April 2011 involving specialist traffic engineers, environmental scientists and town planners, together with VicRoads staff. Feasibility, performance, planning and environmental factors were taken into account. A rapid assessment of the options was then applied to exclude the 'worst' options. The alignment options that were excluded through the Phase 1 assessment are summarised in Table 1. Further descriptions of the alignment options assessed in Phase 1 are provided in Chapter 3. Up to five options in each zone were identified for the long list.

Table 1 Summary of alignment options excluded during Phase 1

Zone	Revised Option Number	Description of *Excluded* Option
1	1B	Deviation from current highway alignment at Pollard Lane with new dual carriageway highway to head in a northerly direction across paddocks to the railway line near The Majors Road, then heads alongside the south-west of the railway reserve to join Option 2D.
	1CD	Deviation from current highway alignment at Pollard Lane with a new dual carriageway highway to head in a northerly direction across paddocks to cross the railway line near The Majors Road, then heads alongside the north-east of the railway reserve to re-join the existing highway alignment near Kimbarra Road.
2	2A	Duplication of the existing highway through Great Western.
	2E	New dual carriageway highway to provide a second south-western bypass of Great Western. As for Option 2D, 2E is also a continuation of Option 1E, however it travels further north before diverting to the west. It follows a slightly different alignment up to Moyston-Great Western Road, where it then follows Option 2D alignment. Rather than re-joining the existing highway near St George Road, Option 2E stays on the western side of the railway and joins to Option 3C.
	2F	Option 2F is a continuation of Option 1A and bypasses Great Western to the west following. Once 2F crosses the railway line it then follows the same alignment as 2D.
3	3DC	New dual carriageway highway (with divided south-bound and north-bound lanes) from Option 2C at Churchill Crossing Road along the south-west side of the railway line and then running north through pasture, across Panrock Reservoir Road and south-west of the golf course to join the existing highway near Gilchrist Road, Stawell.

1.7.2 Shortlist (Phase 2)

The alignment options within the three zones that were assessed in detail during Phase 2 are summarised in Table 2 and further details are provided in later sections of this report and Appendix C.

Table 2 Summary of shortlisted options assessed during Phase 2

Zone	Option	Brief Description
1	1A	Duplication generally following the eastern side of the existing highway and using the Armstrong Deviation across the railway.
	1E	Duplication generally following the existing highway (partly on the east side and partly west side) and heading north at the Armstrong Deviation, not crossing the railway.
	1C	A new dual carriageway that heads north-east away from the existing highway across the railway, through farmland and then re-joining the existing highway near Kimbara Road.
2	2B	New dual carriageway highway to provide a north-eastern bypass of Great Western starting from just north-west of Delahoy Road and going through the quarry, adjacent to the former Great Western landfill, to re-join the existing highway near Briggs Lane.

Zone	Option	Brief Description
2	2C	New dual carriageway highway to provide a north-eastern bypass of Great Western starting just south-west of Delahoy Road and running around the quarry and the former Great Western landfill to re-join the existing highway near Briggs Lane.
	2D	New dual carriageway to provide a south-western bypass of Great Western. The bypass is a continuation of Option 1E, which stays west of the railway line before deviating further south-west, dissecting many local roads. The option follows St George Road in a northerly direction, crossing the railway line just before the alignment re-joins the existing highway near Briggs Lane.
	2E^	New dual carriageway highway to provide a second south-western bypass of Great Western. As for Option 2D, this is also a continuation of Option 1E. It follows the same alignment however rather than re-joining the existing highway near St Georges Road, Option 2E stays on the western side of the railway and joins to Option 3C. ^ Following the Phase 1 assessment, Option 2E (as a variation of Option 2D) was added in Zone 2 to provide connection with options in Zone 1 and 3 located on the western side of the existing highway and railway.
3	3A	Duplication on south-west side of the existing highway for north-bound lanes and use of existing highway for south- bound lanes from near Briggs Lane to the north side of the railway and then duplication with a narrow median to Gilchrist Road, Stawell.
	3B	Duplication on north-east side of the existing highway from Briggs Lane to just north-west of Harvey Lane and the railway line and then as for Option 3A to Stawell.
	3C	New dual carriageway highway from Option 2D at St George Road along the south-west side of the railway line to re-join the existing highway near Harvey Lane and then as for Option 3A to Stawell.
	3DC*	New dual carriageway that extends from Option 2E along the south-west side of the railway line and then heading north, crossing Panrock Reservoir Road, around the golf course and across Pleasant Creek to then re-join the existing highway near Gilchrist Road.
	3AD*	New dual carriageway that starts from Option 3A or 3B and heads north west, crossing the railway and Panrock Reservoir Road to join Option 3DC.
		* In discussion with the TRG, alignment Options 3DC and 3AD were added to Zone 3 to provide an alternative to following the existing highway past Sister Rocks and the Stawell Park Caravan Park.

1.7.3 Proposed Alignment (Phase 3)

Through Phase 2 of the assessment, an alignment option was recommended in each zone to create the proposed alignment assessed in Phase 3 and the EES.

The proposed alignment consists of the following alignment options in each zone:

- Zone 1 - A combination of Options 1A and 1E was recommended selecting components of each option with the lower impacts on flora and fauna values.
- Zone 2 - Option 2B was recommended providing a north-east bypass of Great Western. Option 2B was considered to have has less potential impacts than Option 2C.
- Zone 3 - Option 3B was recommended initially, however it was only marginally better than to Option 3A. Through Phase 3, the recommended option was changed to 3A to address landowner concerns with Option 3B and the acceptance of the landowner affected by Option 3A.

Western Highway, Armstrong Deviation - looking north

2. Overall Methodology

Generally, biodiversity and social values are competing in the selection of a preferred alignment for linear infrastructure projects, and this project is not an exception. For Zone 3 within Section 3 of the Western Highway however, cultural heritage values were also a key consideration in the selection of the alignment.

2.1 Overview

As required by the Minister's Decision requiring an EES, an integrated assessment of environmental effects was undertaken to assess alternative alignments and to select the proposed alignment.

The objective of the options assessment process is to select alignments which minimise potential adverse environmental, social and economic impacts whilst maximising the benefit to be gained as a result of the project proceeding. The options are considered against the 'base case' option of doing nothing (not upgrading the highway).

Through the assessment, an alignment option was recommended in each zone in order to determine the proposed alignment assessed in the EES. A staged approach was adopted for the identification, assessment and progressive refinement of alignment options considered in each zone and the proposed alignment.

The options assessment for Section 3 involved three phases (Figure 3);

- **Phase 1**: Long list alignments - involved developing a range of alignment options, followed by a rapid assessment to identify a shortlist to identify a shortlist through a high level consideration of potential impacts and benefits.
- **Phase 2**: Shortlist alignments - involved the detailed assessment of the options shortlisted in Phase 1 to identify a proposed alignment through a more detailed consideration of potential impacts and benefits.
- **Phase 3**: Assessment of recommended alignment- involved an Environmental Risk Assessment of the recommended alignment option and completion of the specialist impact assessments to identify areas where further micro refinements were required to mitigate potential areas of impact.

Each phase involved a more detailed level of assessment of the options. The steps within each phase of assessment included:

Phase 1 – Development of long list and selection of short list of options

1. Brainstorming to develop a long list of potential alignment options.
2. 'Rapid Assessment' Workshop to select a short list of alignment options.

Phase 2 - Detailed assessment of a shortlist to select a proposed alignment

3. Technical Reference Group and community feedback on shortlisted options.
4. Assessment of short listed options by specialists in relevant biophysical, social and economic disciplines.
5. Options Assessment Workshop with specialists in relevant biophysical, social and economic disciplines.

Phase 3 – Environmental risk assessment of proposed alignment

6. Identify risk pathways and develop draft risk register for an Environmental Risk Assessment.
7. Risk Assessment Workshop with all specialist disciplines.
8. Technical Reference Group review and community feedback on recommended alignment options.
9. Selection of proposed alignment.

This report provides a description of, and documents the outcomes of Phase 1 and 2 in detail. The outcomes of Phase 3 are summarised in this report and further details are provided in Technical Appendix Q to the EES.

This report brings together the assessment from each specialist to allow consideration of the positive and negative impacts across social, environmental and economic disciplines. Compiling the assessments from each specialist allows alignment options in each zone to be identified that have, on balance, the lowest level of potential impact.

Western Highway, Oddfellows Bridge - looking north

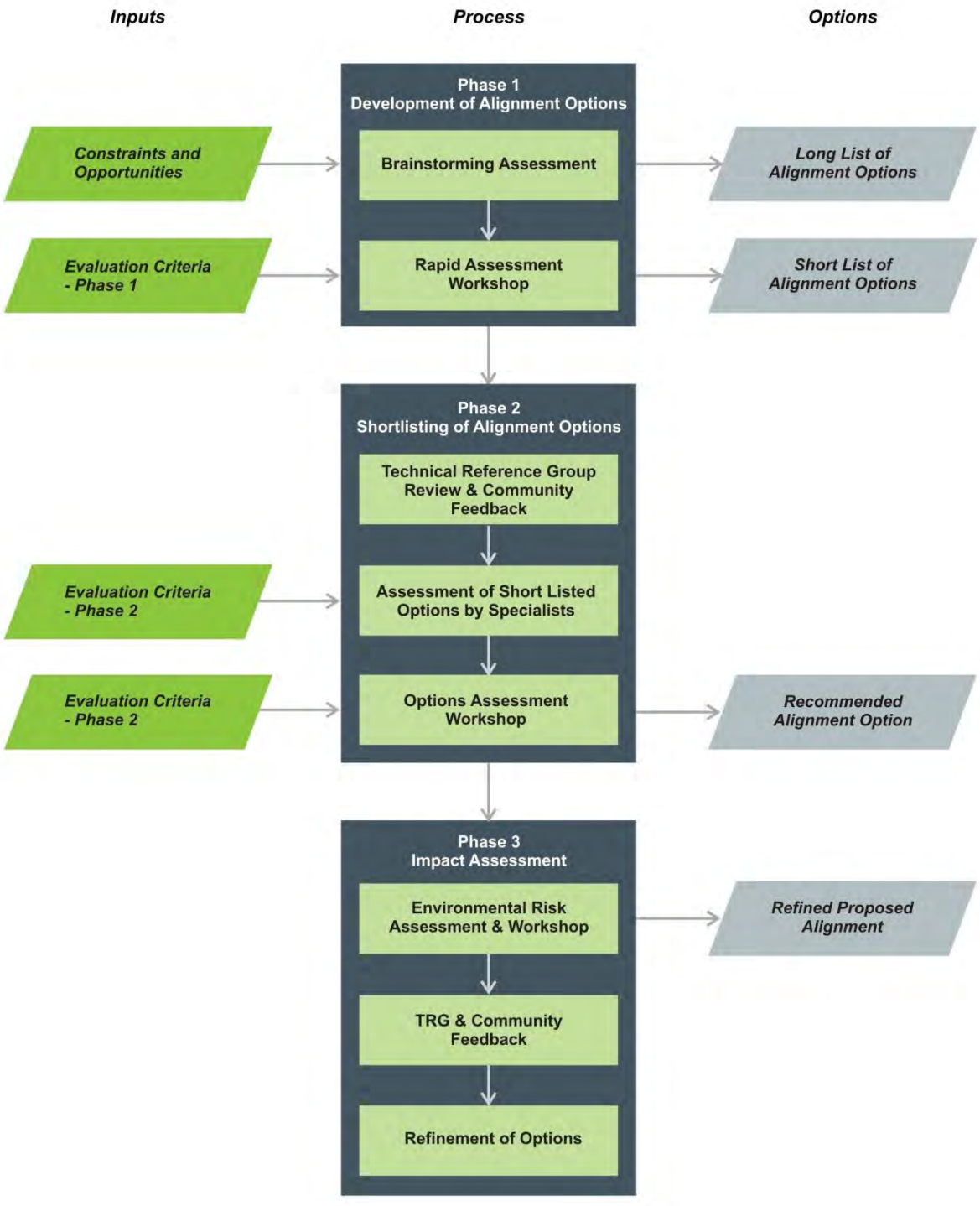


Figure 3 Preferred Alignment Selection Process

2.2 Project Area and Excluded Areas

A Project area boundary was set to restrict potential option alignments to those that could potentially meet Project objectives and constraints efficiently. This boundary was set at 1500m either side of the existing highway, except around Great Western where the Project area extended to 1800m to allow for a potential bypass of the town.

The Ararat Regional Park and the Sisters Rocks reserve and adjacent land were considered unacceptable areas to accommodate the Project, due to the presence of high quality, contiguous remnant vegetation and habitat for flora and fauna species, and were therefore excluded. Refer to Figure 4 for the Project area.

Preference was for the existing carriageway to be retained and utilised where possible in accordance with the VicRoads Sustainability and Climate Change Policy, to reduce cost and minimise the overall impact.

A number of factors and features within the Project area influenced the development of the initial 'long-list' Phase 1 alignment alternatives. These included:

- the need for an appropriate connection with the existing highway,
- allowing for the future bypass of Ararat,
- ensuring design and safety standards are achieved,
- optimising use of existing infrastructure, and
- minimising cultural heritage, ecological and social impacts.

2.2.1 Assessment by Zone

In the initial project planning process VicRoads divided the Ararat and Stawell section of the project into 13 individual alignment segments (A to M), each segment covering a different part of the overall route (Appendix A). Using a similar approach to that for Section 2 (Beaufort to Ararat) of the Project, GHD divided the Section 3 corridor into three zones, which include:

- Zone 1 – Ararat (end of 80 km/h speed zone near Pollard Lane) to Allanvale Road.
- Zone 2 – Allanvale Road to Briggs Lane (this zone includes Great Western).
- Zone 3 – Briggs Lane to end of 80 km/h speed zone (Gilchrist Road) south-east of Stawell.

These zones reflect areas of the corridor with similar environmental and social constraints, and allowed for evaluation of options in a localised and relevant context as each zone had different issues to consider.

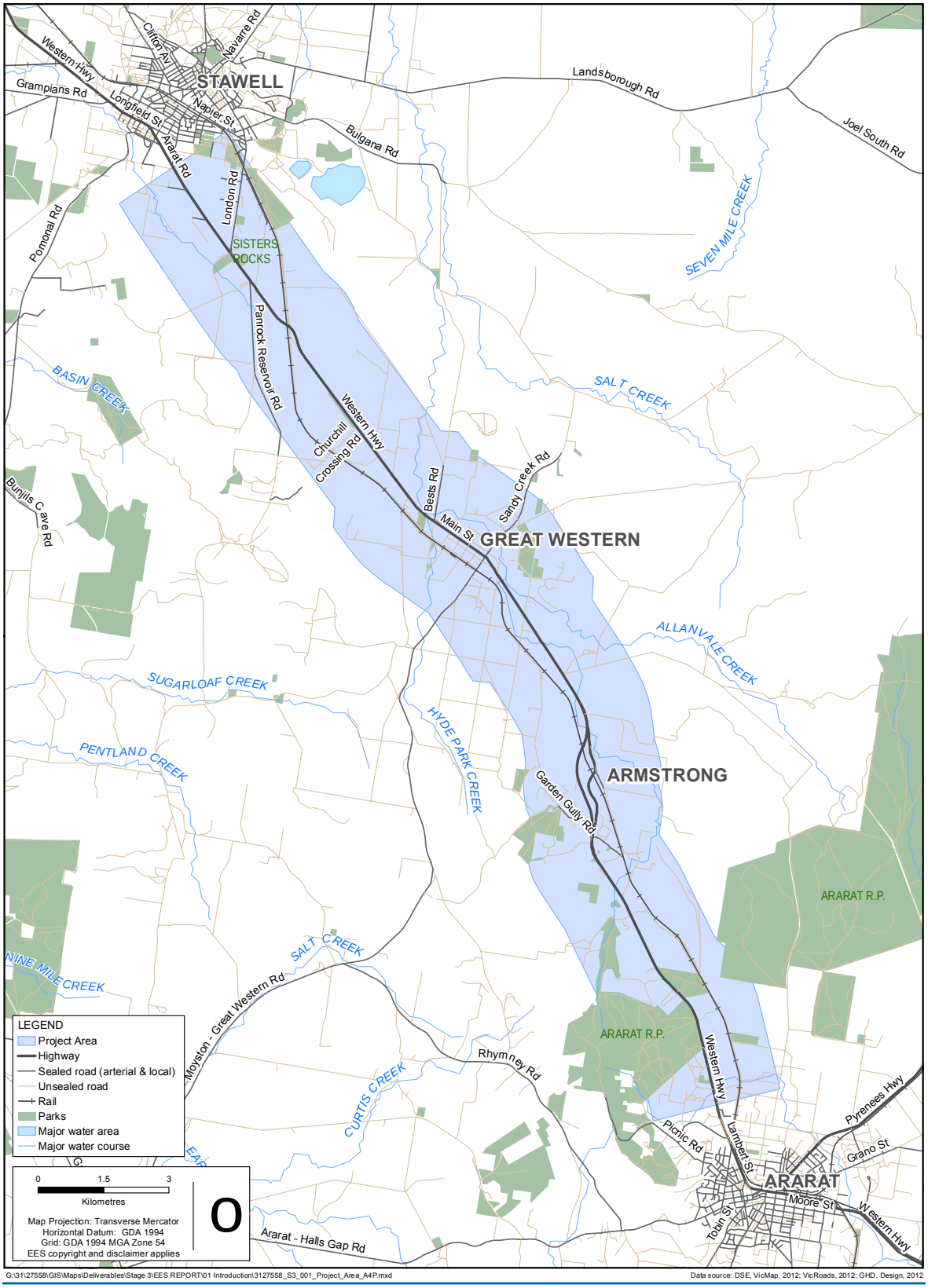


Figure 4 Western Highway, Section 3 Project Area

2.3 Evaluation Criteria

Evaluation criteria were developed for Phase 1 and 2 of the alignment selection process. The key inputs to development of the evaluation criteria of alignment options include:

- Objectives of relevant legislation, policy and guidelines;
- EES Scoping Requirements for the EES developed by the Department of Planning and Community Development (DPCD); and
- VicRoads Project Objectives.

The objectives from each these inputs were used to develop indicator evaluation criteria to allow for a comparative assessment of the alignment options in Phase 1. Indicator evaluation criteria were developed for each objective and used at the 'Brainstorming' Workshop to assist in the assessment of options to meet the EES Evaluation Objectives and to allow comparison between options. These indicator evaluation criteria are shown in Appendix D. The criteria become more detailed for assessment of the short list of options in Phase 2.

Assessment of the long list of alignment options was undertaken in the 'Rapid Assessment' Workshop. This assessment (Stage 2) considered:

1. If the alignment options met the project objectives; and
2. How each option rated against the draft EES Evaluation Objectives.

Detailed evaluation criteria were then developed for the Options Assessment Workshop in Phase 2 to allow for a more detailed comparative assessment of each short listed alignment option against the EES Evaluation Objectives. The criteria were developed with inputs from technical specialists to confirm that they are both relevant to the existing conditions and values of the project area, as well as being relevant to each objective and where possible, measureable.

The evaluation criteria used for the assessment of the short listed alignment options are provided in Table 3. The legislation, policies or guidelines that are relevant to EES Scoping Requirements and the evaluation are contained in Appendix E.

Table 3 Draft EES Evaluation Objectives and *Phase 2* Evaluation Criteria*

Draft EES Evaluation Objective	Evaluation Criteria	Discipline
To avoid or minimise effects on species and ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) and/or the *Flora and Fauna Guarantee Act 1988* (Vic)	• Extent of impacts to Matters of National Environmental Significance (MNES). • Extent of impacts to species, communities and processes listed under the FFG Act.	Flora and Fauna

Draft EES Evaluation Objective	Evaluation Criteria	Discipline
To comply with requirements and best meet the objectives of 'Victoria's Native Vegetation Management – A Framework for Action' and to minimise impacts on wildlife corridors.	• Net gain requirements for removal of native vegetation • Extent of impact to native habitat and vegetation which is of very high conservation significance. • Extent of impact on wildlife corridors (considering extent, connectivity and known species records).	Flora and Fauna
To protect Aboriginal and non-Aboriginal cultural heritage	• Extent of impact on registered and potential Victorian Aboriginal Heritage Register (VAHR) places ***excluding*** mortuary trees and burnt mounds. • Impact on registered and potential Victorian Heritage Inventory (VHI) places, local planning schemes Heritage Overlay (HO) places, Victorian Heritage Register (VHR) places and other Historical Heritage Registers. • Impact on registered and potential mortuary trees and burnt mounds (VAHR places).	Cultural Heritage (Aboriginal and Non-Aboriginal)
To avoid or minimise disruption and other adverse effects on infrastructure, land use (including agriculture and residential) and households, as well as road users during construction and/or resulting from the highway alignment.	• Extent of impact on major utility services. • Extent and impact of change to existing land use (consistency with applicable planning policies). • Extent and impact of change to future land use (consistency with applicable planning policies).	Land use Planning
	• Extent of impact on access, mobility, social severance. • Extent of impact of the full or partial acquisition of properties. • Impacts from dislocation effects. • Extent of impacts from amenity changes. • Extent of impacts on community facilities. • Community Context: The expressed concerns of local people.	Social
	• Number and significance of businesses (including agricultural) affected by full or partial acquisition. • Extent of impact on accessibility for industry and tourism opportunities. • Extent of impact on rail operations during construction.	Economic
	• Extent of impact on road safety. • Travel times for road users during construction phase and consideration of impact on rail users. • Impact on travel times for road users during operation phase. • Degree to which AMP3 design (with provisions for upgrade to AMP1) requirements are met.	Traffic and Transport
To minimise noise, landscape, visual and other adverse amenity effects on the environment and local residents during the construction and operation of	• Extent of impact on upon the visual amenity of adjacent residents. • Extent of visual impact on upon townships and places of cultural and natural value. • Extent of impact on sensitive landscape character types.	Landscape/ Visual

Draft EES Evaluation Objective	Evaluation Criteria	Discipline
the proposed duplicated highway to the extent practicable.	• Distances from dwellings and other sensitive receptors (e.g. schools) to road alignment for each option.	Noise
	• Extent of impact of construction dust on sensitive receptors within close proximity to the road. • Extent of impact of emissions into the atmosphere as a measure of potential contribution to regional load of air pollutants. • Predicted impact of vehicle emissions on sensitive receptors within a minimum distance as evaluated by AusRoads using expected, indicative traffic emissions and sectional meteorology.	Air Quality
To protect catchment values, surface water and groundwater quality, stream flows and floodway capacity, as well as to avoid impacts on protected beneficial uses.	Extent of potential impact to waterway value taking into account the following: • Beneficial uses of the waterway. • No. of waterway crossings and effective footprint area of waterway affected. • Status of river health of the catchment system (including downstream receiving waterway). • Status of river health (local scale e.g. bank condition, in-stream features). Potential to increase flooding risk taking into account the following: • No. of waterway crossings. • Effective width of floodplain (measured by 100 year flood extent). • Complexity of floodplain interactions.	Surface Water
	• Extent of impact of gross contamination from historic land use (including historic landfills), and potential cost of works. • Extent of exposure to watercourse embankments and river beds (potential triggers for erosion/instability criteria). • Extent of potential impact of poor soils and / or topographic location on road construction or operation activities (unstable, low strength subgrades, wet or poor draining areas).	Soils and Geology
	• Extent of potential impacts (decline/deterioration) to groundwater quality and implications for beneficial uses. • Extent of disruption of groundwater flow (recharge, discharge) i.e. flow paths, availability (for users, environment). Potential for alteration of groundwater levels.	Groundwater

* Phase 1 indicator evaluation criteria provided in Appendix D

2.4 Phase 1

Phase 1 involved developing a long list of feasible alignment options, followed by a rapid assessment to refine them into a shortlist for a more detailed consideration in Phase 2.

All potential alignments assumed a freeway (AMP1) standard design in the ultimate upgrade, and a highway (AMP3) in the interim, in order to realise the benefits from improved travel times and safety.

Phase 1 sought to restrict potential alignment options to those that meet the Project Objectives and avoid known constraints, and were considered feasible.

2.4.1 Development of a long list and selection of a short list of options

At the commencement of the project, a 'Brainstorming' Workshop was held to share information and ideas, describe the options development process used previously by VicRoads and identify any additional alignment options considered to have the potential to meet the project objectives.

Prior to the commencement of the EES, VicRoads had established some initial options through preliminary environmental and engineering investigations, and initial consultation with the community and regulatory agencies (see Appendix A). This information was used to generate additional alignment options in a workshop in April 2011 involving specialist traffic engineers, environmental scientists and town planners, together with VicRoads staff. Feasibility, performance, planning and environmental factors were taken into account. A rapid assessment of the options was then applied to exclude the 'worst' options. The outcome of the workshop was a 'long list' of alignment options for assessment in later stages.

2.4.2 Rapid Assessment Workshop

A rapid assessment workshop was held in May 2011 to act as a 'coarse sieve' to refine the long list into a shorter list of potential and feasible options. Participants included specialist traffic engineers, environmental scientists and town planners, alongside VicRoads Project staff.

The alignment options were rated against a set of objectives, provided in Appendix D and Table 3. These objectives were derived from the Project Objectives and the draft EES Scoping Requirements issued by the Department of Planning and Community Development for the Project. For each objective, a set of initial evaluation criteria was used to establish the degree that the objective could be met in terms of potential project benefits or disbenefits.

Each alignment option was rated against the objectives according to the definitions provided in the ratings table shown in Table 4 (it should be noted that an additional level of rating was added for Phase 2). This approach is consistent with that previously adopted for large scale road projects by VicRoads and endorsed by Planning Panels Victoria.

Impact ratings of each option took into account:

- The scale and geographic extent of potential effects, or by policy/legislative compliance and implication;
- The environmental, social and/or economic significance of the potential effects; and
- The level of uncertainty surrounding the potential effects, taking account of the precautionary principle.

Within each zone the ratings for each option were aggregated, which allowed their preference to be ranked relative to each other. Options that addressed the Project Objectives and Scoping Requirements were shortlisted for further consideration. Options which were clearly less favourable were eliminated and the rationale is described in Section 3.

Following the workshop and further consideration of the options, a shortlist of options was selected for more detailed assessment alongside the 'no project' or 'base case' option. The project area was divided up into three zones to allow for more detailed consideration of local issues.

2.4.3 Technical Reference Group and Community Feedback - Phase 1

The Technical Reference Group (TRG) includes representatives of key government departments and agencies and have been appointed by the Minister for Planning to provide advice to VicRoads during the EES preparation process. The results of the Rapid Assessment Workshop were reported to the TRG and considered at the TRG's meeting on 12th July 2011, following which individual TRG members were invited to provide written comments.

This stage also included Community Information Sessions to advise the local community and provide them with an opportunity to comment on the short listed options. Community concerns along with environmental values will subsequently be considered in the selection of the preferred alignment.

Community Information Sessions were held at Great Western, Stawell and Ararat during July 2011. The purposes of these information sessions were to inform the local community and obtain feedback on the shortlisted options.

2.5 Phase 2

A more detailed assessment of the shortlisted options identified in Phase 1 was undertaken to enable the selection of a proposed alignment in Phase 2. Each specialist assessed the alignment options against the 'no project option' (referred to as the 'base case') of no highway duplication using the detailed criteria that they developed for their discipline area (refer to Section 2.3) using the impacts rating table (Table 4).

The specialist assessments were informed by the existing conditions assessment undertaken for the Project and the design and alignment assumptions (Section 4.2). Where possible, the assessment of alignment options was measureable.

The impact ratings shown in Table 4 were used to rate the short list options against the evaluation criteria listed in Section 2.3. Alignment options were assessed in relation to the base case (not upgrading the highway). Options were rated to be either better than or worse than the base case in relation to each evaluation criteria. This approach avoids discrepancies that can occur when rating options relative to each other.

This impact ratings table is consistent with those previously adopted for assessment of alignment options for large scale road projects and has been previously accepted by Planning Panels Victoria. The ratings table does however contain an additional rating level for consideration of positive and negative impacts at a local level.

Similar to Phase 1, the impact ratings of each option for Phase 2 take into account:

- The scale and geographic extent of potential effects, or policy/legislative compliance and implication;
- The biophysical, social and/or economic significance of the potential effects; and
- The level of uncertainty surrounding the potential effects, taking account of the precautionary principle.

The impact ratings for this assessment generally assumed no mitigation of potential impacts. To assess options with mitigation would require the mitigation measures to be developed in some level of detail for all options and it was considered that this was too detailed for the purpose of options assessment.

Some specialists' assessments have however, considered the ability to mitigate or rectify potential effects. These included:

- Biodiversity and Habitat – where a new carriageway was proposed to be constructed adjacent to the existing highway in land which has been cleared of native vegetation, it was assumed that removal of existing roadside vegetation would be avoided where possible by including it in a wide median or duplicating on the opposite side to significant patches of vegetation.
- Surface Water – where new bridges are required, they would be constructed to span waterways without piers in the waterway.
- Soils and Geology – common engineering solutions and environmental management measures have been assumed. More specifically with respect to managing contamination from the former Great Western Landfill.

Western Highway and Military Bypass Road intersection, Armstrong - looking north

Table 4 Impacts Ratings for Options Comparison

Potential Project Benefits	Rating Colour Code		Potential Project Disbenefits
	Phase 1	Phase 2	
Significant benefit to the State Superior benefit to the region Policy consistency with superior positive impact	VERY WELL 9*		
Moderate benefit to the State Significant benefit to the region Superior benefit to the locality Policy consistency with significant positive impact	WELL 8		
Moderate benefit to the region Significant benefit to the locality Policy consistency with moderate positive impact	MODERATELY WELL 7		
Localised minor benefits for some local areas or individuals		PARTIAL 6	
Minimal benefit at any level	NEGLIGIBLE 5		Minimal disbenefit at any level
		LOW 4	Localised minor impact for some local areas or individuals
	MODERATELY POOR 3		Moderate disbenefit to the region Significant disbenefit to the locality Policy inconsistency with moderate negative impact
	POOR 2		Moderate disbenefit to the State Significant disbenefit to the region Severe disbenefit to the locality Policy inconsistency with significant negative impact
	VERY POOR 1		Significant disbenefit to the State Severe disbenefit to the region Policy inconsistency with severe negative impact

* Rating numbers for Phase 2.

2.5.1 Analysis of Specialists Assessments

The objective of the alignment options assessment for the EES is to select alignment optoins that minimise potential adverse environmental, social and economic impacts whilst maximising the benefit to be gained as a result of the project proceeding. To allow for a balanced consideration of the outcomes of each assessment, the following activities were undertaken.

Options Assessment Workshop

The objective of the Options Assessment Workshop was to review the ratings of each technical specialist in a collaborative process and to cross check consistent application of the impact ratings.

The outcomes of specialists' assessments were compiled and reviewed at a workshop involving the following key specialist disciplines:

- Traffic and Transport (transport engineer)
- Flora and fauna (ecologist)
- Cultural Heritage (archaeologist)
- Surface Water (hydrologist)
- Social (social scientist)
- Planning and Land use (town planner)
- Economic (economist)
- Visual (landscape architect)
- Road Design (civil engineer)

Key members of the VicRoads and GHD project management team also participated in the workshop.

The groundwater, soils and geology, air and noise specialists were not included in the workshop as the outcomes of their assessments were not considered to be key drivers in the selection of alignments.

Compiling specialist assessments into the Options Assessment Matrix

Following the Options Assessment Workshop, the specialist teams reviewed and updated their options assessments. The outcomes of the individual specialists' assessments were compiled to create an assessment matrix of criteria and alignment options.

To allow for consideration of each of the assessments and the weighting assigned to the criteria, the following was undertaken to prepare the Options Assessment Matrix:

1. Impact ratings were assigned a score from 'Very Poor", being 1, to 'Very Well', being 9.
2. The rating for each criterion was multiplied by the criteria weighting to give a weighted score. The criteria weighting for each specialist area (apart from flora and fauna) added up to 1 with the specialist determining which criteria should have a heavier weighting applied
3. The weighted scores were totalled for each alignment.
4. The alignments were ranked in each zone based on the total weighted score.

Based on this approach to considering the rating and weighting of each criterion, the higher score indicates that, on balance, the alignment options have lower negative impacts.

There was an equal weighting applied to the assessments by each of the disciplines against each objective. Following comments provided by DSE and DPCD, the flora and fauna objective was separated into two overall objectives due to the range and complexity of legislation and policy to be addressed (ie. by separating out the compliance with 'net gain' and wildlife corridor protection requirements under Victoria's Native Vegetation Management – A Framework for Action from the legislative requirements for minimising impacts on listed species and communities).

An illustration of the approach used to develop the Options Assessment Matrix is shown in Table 5. The Options Assessment Matrix is presented in Chapter 9.

Table 5 Options Assessment Matrix Example

Criteria	Weighting	Option A		Option B	
	(Weighting out of 1)	Rating (score)	Weighted Score (weighting x score)	Rating (score)	Weighted Score (weighting x score)
Criteria 1	0.25	Low (4)	1	Negligible (5)	1.25
Criteria 2	0.25	Negligible (5)	1.25	Partial (6)	1.5
Criteria 3	0.5	Low (4)	2	Low (4)	2
Total Weighted Score			**4.25**		**4.75**
	Rank		**2**		**1**

2.5.2 Technical Reference Group and Community Feedback - Phase 2

The outcomes of the Phase 2 options assessment were presented to TRG for comment in November 2011. The TRG comments were then discussed in December 2011 to confirm they were understood and the report was then finalised. The TRG comments and how they were addressed are provided in Appendix S.

Community consultation sessions were held in November 2011, March 2012 and May 2012 to seek comment on the assessments and about the recommended within each zone which makes up the proposed alignment further assessed in the EES. The comments provided have been incorporated into the assessment documented in this report and are provided in Chapter 7 (Stakeholder and Community Engagement) of the EES. The Stakeholder and Community Consultation Report for the project was provided on the DPCD website.

2.6 Phase 3

Following the Phase 2 assessment, there was one option within each zoned recommended for further assessment. These options were combined to create the proposed alignment which was then evaluated through the risk and impact assessment for the EES.

In January 2012, an Environmental Risk Assessment Workshop was held with specialists to identify potential risks associated with the preferred alignment identified in Phase 2.

Whilst risks were broadly considered with the impacts of alignment options, a detailed risk assessment was undertaken for the proposed alignment.

A detailed risk assessment was undertaken to identify the activities that could lead to pathways which impact on environmental, social or economic values of the Project area. The risk assessment was used as a tool to identify potentially significant risk events for more detailed assessment of impact and mitigation measures. The process enabled activities and events with relatively high levels of risk to be prioritised from those with a lower level of risk or which were easily managed.

The impact assessment then verifies the impact pathway, considers and evaluates the measures available to mitigate the effect, reviews the probability of the effect materialising through the pathway, and determines the net impact from the pathway. The purpose of the impact assessment is to draw conclusions, on balance, as to the likely impacts of the Project in the context of existing conditions and identified measures available to mitigate likely impacts.

As many environmental risks are difficult to quantify, a semi-quantitative risk assessment was undertaken. This means that risks have been quantified where possible, however if that is not possible without significant assumptions, then a qualitative assessment has been made by relevant technical specialists.

The scope of the risk assessment included construction and operational risks of the Project in relation to social, environmental and economic values on both a local and regional scale. The risk assessment did not consider risks of project delays or reputational, financial or organisational effectiveness risks posed to VicRoads or the contractor(s) managing or undertaking the project.

An initial risk assessment was undertaken for each impact pathway as identified by specialists for the proposed option for Section 3. This initial rating assumed implementation of the standard VicRoads environmental management procedures and design measures. After each risk was assigned a rating, proportional management and mitigation measures were developed. The risk rating was then re-evaluated, taking into account the additional management and mitigation measures, to identify the residual risk from the Project.

Once a preliminary risk register was completed by each technical specialist, a risk workshop was held to discuss the key risks. This workshop allowed technical specialists from each discipline to collectively discuss risks which were interrelated.

As a result of the outcomes from the Environmental Risk Workshop, alignments refinements were made to the proposed option in order to reduce potential impacts. The risk assessment is presented in Technical Appendix Q of the EES. The details of each specialist assessment are provided in Technical Appendices C to P of the EES.

3. Phase 1: Development and Assessment of Long List Options

3.1 Brainstorming Workshop to Develop Long List Options

The Options Assessment process commenced with a 'Brainstorming' Workshop held on 28 April 2011 and involved participants from both VicRoads (Planning Engineers) and the GHD project team (Project Director, Project Manager, Principal Road Design Engineer, Senior Road Design Engineer, Principal Ecologist, Senior Ecologist, Senior Environmental Scientist, Principal Town Planner and GIS Specialist). The purpose of the workshop was to share information and ideas, describe the options development process used to date by VicRoads and identify additional alignment options considered to have the potential to meet the project objectives.

In preparation for the workshop, participants inspected the project corridor and reviewed available information (such as aerial photography, detailed flora and fauna survey report, cultural heritage due diligence report and table with issues identified at community meetings) to become familiar with key issues and constraints.

The outcome of the workshop was the long list of options shown in Table 6 to Table 8 (Appendix B). Several options were developed in addition to those already developed by VicRoads and its consultants, as shown in the tables.

The long list of alignment options are listed in Table 6 to Table 8 and shown in Appendix B. The options taken forward to the second stage of the options assessment process, as described in Chapter 4, are also identified in Table 6 to Table 8. The reasons for exclusion of longlist options from the shortlist are provided in Table 9.

Table 6 Longlist Options Zone 1: Ararat to Allanvale Road

Revised Option Number	Former VicRoads Option	Description of Option	Status
1A	Segments A & D	Duplication on north-east side highway for east-bound lanes and use of existing highway for west bound lanes – to near Allanvale Road to join to option 1C.	Shortlisted
1E	Segments A & part Segment F	Duplication of existing highway (partly north side and partly south side) and joining with Option 2D just before the Armstrong Deviation railway bridge.	Shortlisted
1B		Deviation from current highway alignment at Pollard Lane with new dual carriageway highway to head in a northerly direction across paddocks to the railway line near The Majors Road, then heads alongside the south-west of the railway reserve to join Option 2D.	Excluded

Revised Option Number	Former VicRoads Option	Description of Option	Status
1C	Segment C	Deviation from current highway alignment at Pollard Lane with new dual carriageway highway to head in a northerly direction across paddocks to cross the railway line near The Majors Road, then head in a north-westerly direction alongside Railway Loop Road, then in a northerly direction alongside an unused road reserve, and then through agricultural properties to re-join the existing highway near Allanvale Road.	Shortlisted
1D		Deviation from current highway alignment at Pollard Lane with a new dual carriageway highway to head in a northerly direction across paddocks to cross the railway line near The Majors Road, then heads alongside the north-east of the railway reserve to re-join the existing highway alignment near Kimbarra Road.	Excluded

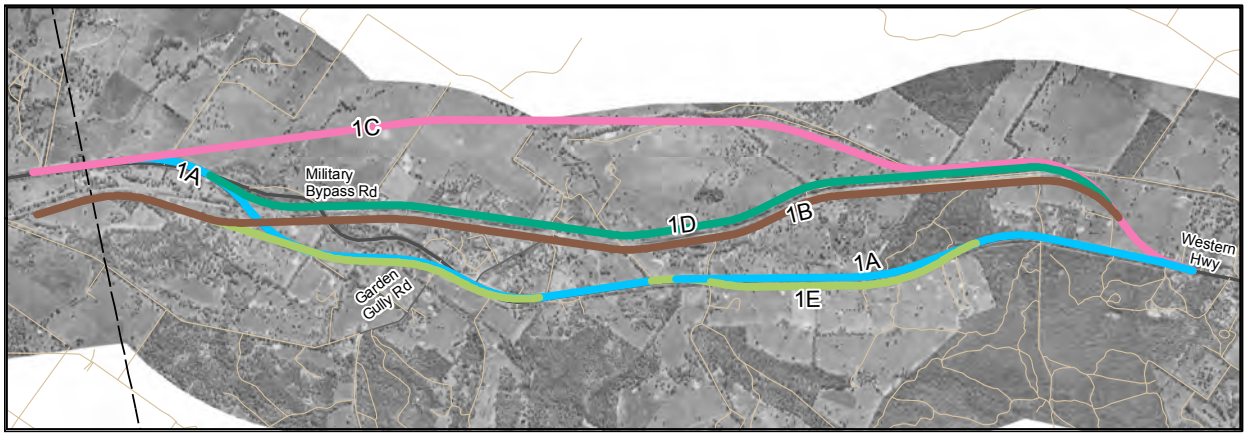


Figure 5 Zone 1 Long list Options

Table 7 Longlist Options Zone 2: Allanvale Road to Briggs Lane

Revised Option Number	Former VicRoads Option	Description of Option	Status
2A		Duplication of the existing highway through Great Western.	Excluded
2B	Segment G	New dual carriageway highway (with divided east-bound and west-bound lanes) to provide a north-eastern bypass of Great Western from just north-west of Delahoy Road, running south-west of the bushland reserve and through the quarry north-east of Western View Road, then across Hurleys Lane and Bests Road to re-join the existing highway near Briggs Lane.	Shortlisted

Revised Option Number	Former VicRoads Option	Description of Option	Status
2C		New dual carriageway highway (with divided east-bound and west-bound lanes) to provide a north-eastern bypass of Great Western from just south-west of Delahoy Road, running north-west of the bushland reserve, across Metcalfe Road, around the quarry north-east of Western View Road, then across Hurleys Lane and Bests Road to re-join the existing highway near Briggs Lane.	Shortlisted
2D	Segment F	New dual carriageway highway (with divided east-bound and west-bound lanes) to provide a south-western bypass of Great Western by leaving the existing highway near Allanvale Road and heading in a westerly direction through farmland and across the railway line and Delahoy, Garden Gully, Roxborough and Moyston-Great Western Roads and then in a northerly direction alongside St George Road and across the railway line to re-join the existing highway near Briggs Lane.	Shortlisted
2E^		New dual carriageway highway to provide a second south-western bypass of Great Western. As for Option 2D, this is also a continuation of Option 1E. It follows the same alignment however rather than re-joining the existing highway near St Georges Road, Option 2E stays on the western side of the railway and joins to Option 3C. ^ Following the Phase 1 assessment, Option 2E (as a variation of Option 2D) was added in Zone 2 to provide connection with options in Zone 1 and 3 located on the western side of the existing highway and railway.	Excluded initially^
2F		Option 2F is a continuation of Option 1A and bypasses Great Western to the west following. Once 2F crosses the railway line it then follows the same alignment as 2D.	Excluded

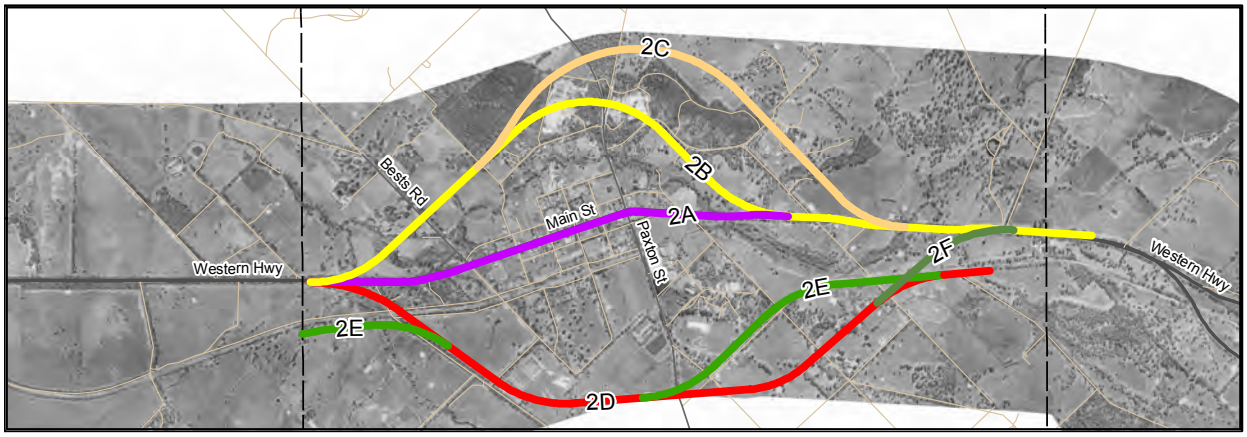


Figure 6 Zone 2 Long list Options

Table 8 Longlist Options Zone 3: Briggs Lane to Gilchrist Road south-east of Stawell

Revised Option Number	Former VicRoads Option	Description of Option	Status
3A	Segment L	Duplication on south-west side of existing highway for north-bound lanes and use of existing highway for south bound lanes from near Briggs Lane to Stawell.	Shortlisted
3B		Duplication on north-east side existing highway from Briggs Lane to just north-west of Harvey Lane and the railway line and then as for Option 3A to Stawell.	Shortlisted
3C	Segment M	New dual carriageway highway (with divided east-bound and west-bound lanes) from Option 2D at St George Road, along the south-west side of the railway line to re-join the existing highway near Harvey Lane and then as for Option 3A to Stawell.	Shortlisted
3DC*		New dual carriageway highway (with divided east-bound and west-bound lanes) from Option 2D at Churchill Crossing Road along the south-west side of the railway line and then running south-west through pasture, across Panrock Reservoir Road and south-west of the golf course to join the existing highway near Gilchrist Road, Stawell. * In discussion with the TRG, alignment Options 3DC was re-added to Zone 3 to provide an alternative to following the existing highway past Sisters Rocks and the Stawell Park Caravan Park.	Excluded initially*

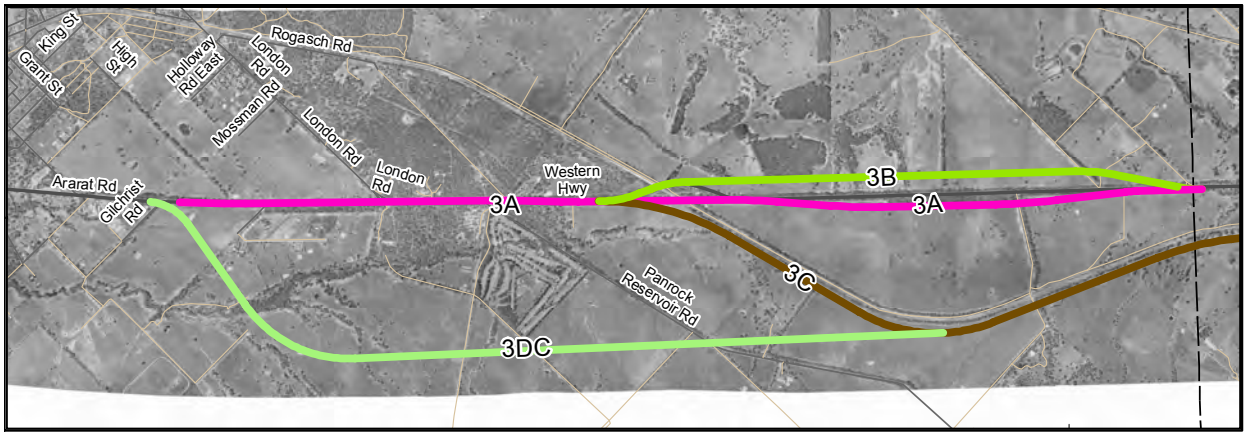


Figure 7 Zone 3 Long list Options

3.2 Assessment of Long List of Options

3.2.1 Rapid Assessment Workshop

At the 'Rapid Assessment' Workshop, held on 20 May 2011, the initial 'long list' of alignment options identified in the 'Brainstorming' Workshop (Appendix B) was assessed and a short list of options selected for detailed assessment along with the 'base case' option (no project). Participants of this workshop were largely the same as for the 'Brainstorming' Workshop and included staff from the VicRoads and GHD teams.

The workshop methodology involved briefly assessing each option against the project objectives listed in the left hand column of Appendix D. These objectives include:

- The six VicRoads' objectives for the project (Objectives 1 – 6 in Appendix D);
- Six of the nine evaluation objectives listed in Sections 1.2 and 3.7 respectively of the Draft EES Scoping Requirements document (Objectives 7 – 12 in Appendix D); and
- Three additional objectives utilized in reports to the VicRoads Project Review Committee (Objectives 13 – 15 in Appendix D).

The following three of the nine evaluation objectives listed in the Draft EES Scoping Guidelines were not used in the rapid assessment workshop because they were not considered to be relevant at this stage of the options assessment:

- Provide for long-term management of retained native vegetation and habitat areas within and adjacent to the road. This objective is relevant to the management of retained native vegetation and habitat after construction of the road duplication works. It will therefore be an objective of the ongoing management framework for the preferred alignment road reserve. The significance of native vegetation and habitat linkages within and adjacent to each option was considered as part of Objective 8 (avoid or minimise effects on species and ecological communities).
- Provide a transparent framework with clear accountabilities for managing environmental effects. This will be addressed through the framework EMP designed for the EES.
- Overall, to identify an alignment that would achieve a balance of economic, environmental and social outcomes consistent with an integrated and sustainable transport system that contributes to an inclusive, prosperous and environmentally responsible State. This objective was considered to be directly relevant to the selection of the preferred option after considering all other objectives.

Each option was ranked against its ability to meet each project objective using the impact ratings in Table 4. The objective was to rank options until nominally, up to four options remain in each zone for more detailed assessment in future stages. The colour scheme used in Table 4 is to provide ease of interpretation of the rating of each option for individual objectives. Numeric values were also allocated to each rating, as shown in Table 4, to assist in obtaining an overall total score for each option. As a general rule, options with the most negative score were deleted from the shortlist unless there were fewer than three or four options for each zone.

It is recognised that such an averaging process cannot generate an accurately quantifiable overall score for each option because the various objectives are so different that they cannot be directly compared and rated on the same scale. However, the process has been used to identify the relative ability of options to meet the objectives and to provide transparency to the shortlisting of options. The

ranking of each option against each project objective, as determined at the workshop, is shown in Appendix F. Comments associated with the rating of each option are also provided in Appendix F.

It should also be noted that the information used at the workshop to assess potential impacts of each option, was not detailed in many instances. Therefore the precautionary principle was adopted in the workshop. This means that where information on environmental, social and economic values is limited, the workshop participants erred on the side of caution where it was reasonable to assume that high values could exist and have exaggerated potential values and hence, potential impacts.

3.2.2 Longlist options excluded through the Rapid Assessment Workshop

At the Rapid Assessment Workshop some options were excluded from further assessment. A summary of the reasons for eliminating long list options from inclusion on the short list are provided in Table 9. The options shown in Appendix C were shortlisted for more detailed assessment in the next phase of the options assessment process. The Options Assessment matrix developed in the Workshop is shown in Appendix F.

Table 9 Reasons for exclusion of long list options

Option	Reasons for exclusion
Zone 1: Pollard Lane to Allanvale Road	
1B	Two new dual carriageways would follow the railway line on the western side. It was considered this alignment option would have a greater impact than the shortlisted options on infrastructure, land use, households and road users. The land required for the new dual carriageways in combination with the land required for the railway line, would impact on more area of private landowners than duplication of the existing highway (options 1A and 1E) or a new dual carriageway not adjacent to the railway (Option 1C). This was considered to be a greater issue in this location because of the lot sizes in the settlement of Armstrong adjacent to this option. It was also considered that this alignment option would have a greater impact on native vegetation than the shortlisted options. With the close proximity of dwellings in Armstrong to the west and the constraint of the railway line to the east, there would be less opportunity (ie: wide medians or realignments) to avoid significant vegetation in the rail reserve than the shortlisted options. Overall, it was considered this alignment option would have a greater impact on amenity at dwellings than the shortlisted options. It was also considered that the impacts to native vegetation were greater than the shortlisted options as there were limited opportunities to be able to alter the alignment and avoid significant vegetation.
1D	Two new dual carriageways would follow the railway line on the eastern side. This alignment option was considered to have similar impacts to Option 1B, with potential impacts on the settlement of Armstrong and similar impact on land severance by being adjacent to the railway. It was also considered that this alignment option would have a greater impact on vegetation than the shortlisted options due to the vegetation adjacent to the railway line and road reserve of Military Bypass Road. Like Option 1B, this option has the potential to displace residences due to the small allotments and their zoning. Note - Option 1C (two new dual carriageways in farmland to the east) also received a low rating overall in Phase 1, however it was included on the shortlist of options for Zone 1 to provide an alternative to Option 1A and 1E which both involve a new carriageway alongside the existing highway between Ararat and Armstrong.

Option	Reasons for exclusion
Zone 2: Allanvale Road to Briggs Lane (Great Western)	
2A	Option 2A would involve duplication of the highway through the centre of Great Western township. This option would potentially impact on: ▪ infrastructure, land use, households & road users located within the township of Great Western and adjacent to the existing highway ▪ the amenity of more houses within the township compacted to the shortlisted options ▪ the access to adjoining properties as the duplication would intersect local roads and significantly limit movements within the town ▪ buildings listed on the Victorian Heritage Register located within the township of Great Western ▪ travel of High Productivity Freight Vehicles as the speed limit would have to reduce as the road travels through the township of Great Western. Consultation undertaken by VicRoads prior to the EES also indicated that the residents of Great Western would prefer the town be bypassed to remove large freight trucks from the town to reduce the amenity impacts and address safety issues caused by these vehicles. The shortlisted options have more potential impact on vegetation and Aboriginal cultural heritage; however it was considered that on balance, the social and amenity impacts to the township of Great Western were greater, therefore Option 2A was excluded from the shortlist. Note – the elimination of Option 2A results in the township of Great Western being bypassed.
Zone 3: Briggs Lane to Gilchrist Road	
3DC	Two new dual carriageways following the railway and on the western side of the Stawell Park Caravan Park to re-join the existing highway just before Stawell. This option was excluded from the shortlist initially because of the impacts to landowners through land severance as the alignment did not follow property boundaries. It was also considered to have greater impacts compared to the shortlisted options due to noise, visual and other amenity effects as the alignment travelled closer to houses than the existing highway. Also, due to topography, the new alignment would be more visible in the landscape. Whilst the shortlisted options had more potential to impact on vegetation in the road reserve, it was considered that these impacts could be managed through realignment or wide medians between carriageways. However, during Phase 2 and following subsequent discussions with the Technical Reference Group (TRG), Option 3DC was re-added to provide an alternative alignment to following the existing highway past Sisters Rocks and the Stawell Park Caravan Park. Note – Option 3C also received a low overall rating in Phase 1, however it was placed on the shortlist of options for Zone 3 to provide an alternative alignment to Option 3A and 3B which both involve a new carriageway alongside the existing highway between Great Western and Stawell.

3.2.3 Bypass of Great Western

Through the Phase 1 assessment, Option 2A was eliminated from further assessment and it was identified that the town of Great Western would be bypassed by the Project. Detailed assessment of the shortlisted options in Phase 2 has determined the proposed location of the bypass.

- The bypass of Great Western would:
- Remove large trucks from travelling through the town which would improve safety for local road users;
- Improve the amenity of the town; and
- Allow more efficient transport movements by avoiding speed restrictions in Great Western.

Also, by not duplicating the highway through the township of Great Western it would:

- Avoid potential impacts to historical buildings located within the township;
- Avoid potential impacts to existing infrastructure, land use, and households located within the town and close to the highway; and
- Minimise disruption to local intersections and prevent restriction of road user movements within the township of Great Western.

3.2.4 Technical Reference Group Feedback

The results of the Rapid Assessment Workshop were reported and considered at the TRG meeting on 12th July 2011, following which individual TRG members were invited to provide written comments.

The TRG and representatives of the Department of Sustainability and Environment (DSE) and Department of Planning and Community Development (DPCD) provided feedback on the Phase 1 Rapid Assessment' Workshop assessment at the TRG meeting and in subsequent written comments. The key comment related to the objectives used to assess each alignment option. There were more objectives relating to road configuration (travel time, safety, construction cost etc) compared with the EES objectives relating to environmental impacts. Also, the Draft EES Scoping Requirements contained two objectives relating to flora and fauna values however only one objective was used initially to rate the options.

Following these TRG comments, a 'sensitivity test' of the relative ranking of options was undertaken. This involved reducing the number of road configuration objectives and increasing the number of environmental objectives, as recommended by DPCD and DSE. To do this, the following changes were made to objectives as shown in Appendix F:

- Combined the two safety objectives (improving safety at intersections and improving safety of access to adjoining properties) into one safety objective;
- Deleted the rest area objective (which in any event had no bearing on overall scores except in the one zone where rest areas existed and in this case, all options were equally rated);
- Deleted the geotechnical objective (which in any event had negligible bearing on overall scores);
- Combined the two objectives relating to road cost (minimizing safety of construction and acquisition cost and maximizing use of the existing highway) into one objective; and
- Added another biological objective (management of retained native vegetation and habitat), as recommended by DSE and DPCD.

The outcome of this 'sensitivity test' with a greater number of environmental objectives than road objectives is shown in Appendix F. This shows that after changing the number of objectives, whilst the overall numerical scores for most options changed, there was no change to the relative ranking of options determined from the rapid assessment workshop. The lowest ranked options which are designated for exclusion from more detailed assessment are still the same.

At the TRG meeting and in subsequent written comments, representatives of the DSE and DPCD also commented that all shortlisted options converged into single corridor adjacent to the Sisters Rocks Bushland Reserve and the Stawell H8A Bushland Reserve. They suggested that this could potentially become a significant issue if the impacts of the highway on the adjacent areas of ecological value are considered to be too great in the next phase of assessment, and then all options may fail.

The TRG also commented that Option 3DC, which had been excluded from the short list, had been considered to have lower ecological impacts than the shortlisted Options 3A and 3BE. It was also commented that it appeared that if it wasn't for the low scores for VicRoads' objectives of minimising construction and acquisition costs and maximising use of the existing highway, then Option 3DC would have rated more highly than Options 3A and 3BE.

As a result of the TRG's comments, VicRoads decided to add Option 3DC to the shortlist in order to provide an alternative corridor alignment to the single corridor which was otherwise shortlisted on the south-eastern outskirts of Stawell. As outlined above, Option 3DC involves construction of a new highway (with divided east-bound and west-bound lanes) from Option 2C at Churchill Crossing Road along the south-west side of the railway line and then running south-west through pasture, across Panrock Reservoir Road and south-west of the golf course to join the existing highway near Gilchrist Road, Stawell. This option provides an alternative to the use of the existing highway corridor adjacent to the Sisters Rocks Bushland Reserve and the Stawell H8A Bushland Reserve.

4. Phase 2: Approach to Specialist Assessments

4.1 Introduction

This section provides details of the methodology adopted by each specialist for assessment of the alignment options. It also provides the weighting assigned to the criteria **within** each specialist discipline.

The outcomes of the specialist assessments are summarised for the alignment options in each zone in the following Chapters 6 to 8. Some specialists' disciplines, including Biodiversity and Habitat, Cultural Heritage, and Visual and Landscape, developed a detailed and specific approach to assigning measureable impact ratings to each option. Other disciplines, however, were comfortable to apply the existing ratings and give reasons for these ratings. Details of the specialists' assessments are provided in Appendix G to Appendix R.

4.2 Design and Alignment Assumptions

The Western Highway EES and Planning Scheme Amendment (PSA) will be seeking Ministerial support for the reservation of sufficient land to construct an AMP1 standard (freeway) road in the future; however the initial upgrade will be to AMP3 standard (highway). To address this in the options assessment, the footprint of each alignment was wide enough for an AMP1 alignment (i.e.: with the required road geometry) and with area allowed for grade separated interchanges and service roads where required.

Assumptions relating to access were also based on both AMP3 (highway) and AMP1 (freeway). A detailed access strategy for AMP1 was not developed, however, because it was considered that this was too detailed for the purposes of options assessment. An access strategy will however be developed for AMP1 standard to undertake the impact assessment for the EES.

The following general assumptions were made for the design and alignment of the short-listed options:

- The duplicated Western Highway will be designed for a 110 km/h speed limit.
- Construction corridor was assumed to be 80-110 metres (m) for a new dual carriageway and approximately 50 m for a new carriage way where the existing highway was being utilised for one carriageway.
- Where the Project involves construction of two new carriageways, a construction corridor of 80-100m would be required. This width was allocated in order to accommodate a wide median (approximately 30m) to allow for turning of B Double trucks at intersections under AMP3 highway conditions. It also allowed for service roads, clear zones and services.
- Where sections of the preferred alignment utilise the existing highway, the existing bi-directional road will be converted to a single direction, and a new a parallel carriageway will be constructed to serve traffic travelling in the other direction.

4.2.1 Interchanges and Intersections

A wider construction corridor was considered at interchange locations to accommodate an AMP1 (freeway) design standard. The interchange locations considered with the options include:

- Garden Gully Road near the village of Armstrong (grade separated interchange);
- North and south of Great Western (half diamond interchanges for eastern bypass options and full diamond interchange at Moyston-Great Western Road for western bypass options); and
- London Road – a full or half diamond interchange was initially excluded from consideration at London Road due to vegetation constraints and impacts on properties. The London Road intersection is however, the busiest on the Western Highway (in Sections 2 and 3) and the intersection will need to be realigned. The area for this was considered in the options assessment and in Phase 3 an intersection arrangement was later developed.

Wide median treatments (30m) were proposed to accommodate AMP3 (highway) intersections and AMP1 (freeway) interchanges. Wide median treatments were proposed to also allow vehicles as large as B-Doubles to turn right on to the highway, with enough room to pause in the median. It was not anticipated that high performance vehicles (over 30m in length) would need to turn off the highway under AMP3 conditions.

For an AMP3 (highway) standard road, left in and left out intersections would replace some minor access points, including driveways to the highway. U-turn facilities would be provided approximately every 2.5 km, depending on the location of driveway accesses.

It should be noted that these are the interchanges that were identified at the options assessment stage in the project only. The interchanges could therefore be subject to change as the impact assessment is progressed and the concept design is refined for the EES.

4.3 Traffic and Transport Assessment

The key differentiators between the alignment options that informed the assessment included:

- Route length;
- Number of rail crossings (new or existing) required; and
- Bypass of areas where road safety issues were identified in the Existing Conditions assessment.

The following was considered to assess each alignment option against the evaluation criteria. Further details of the traffic and transport options assessment is provided in Appendix G.

Extent of impact on road safety

The objective of this criterion is to assess the ability of the alignment options to reduce the risk of casualty crashes occurring compared to the existing highway. It was assumed that the preferred alignment will be appropriately designed in terms of vertical and horizontal road geometry and sight distances and address specific locations with existing crash histories. Therefore, the alignment options will all provide an improvement over the base case of the existing highway.

It was assumed that duplication and the resultant increase to the capacity of the highway (i.e. separating carriageways and providing two lanes in each direction), could have the potential to provide significant benefits to the region and moderate benefits to the State. The assumption has also been

made that the design of the new highway will be to Austroads and VicRoads standards and therefore, will not have disbenefits.

Travel times for road users during construction phase and consideration of impact on rail users

The objective of this criterion is to consider the impact to highway travel times and rail travel times based on the extent of construction occurring on the existing carriageway and rail occupations, respectively. The target for this criterion is to minimise the impact to travel times for both highway and rail users during the construction phase.

Based on impact ratings provided, construction could have up to a low level of impact in some localised areas, such as a rail crossing or where traffic is transferred to the adjacent carriageway. The assumption was made that an engineering solution for the constructability of the rail bridges can be developed to further minimise the rail occupation.

Impact on travel times for road users during operation phase

The objective of this criterion is to consider the impact to highway travel times during the operation phase. As the highway speed limit is to be increased to 110 km/h, it is expected that the project will deliver moderate to significant benefits to the State, given the high volumes of interstate traffic and freight. The change in travel time is considered cumulatively for all vehicles that are expected to use the upgraded Western Highway.

Degree to which AMP3 design (with provisions for upgrade to AMP1) requirements are met

The objective of this criterion is to evaluate the alignment options in light of their ability to be consistent with the Performance Objectives, Standards and Principal Characteristics of VicRoads AMP3. The target for this criterion is to maximise the control of possible turning movements at intersections. Preferred intersection types, in order of rank, are listed in Table 10. Also presented is the anticipated treatment type under AMP1 in the future.

Table 10 Intersection Controls

Preference	AMP3 Treatment	Anticipated AMP1 Treatment
1	Full truncation	Full truncation
2	Left-in/left-out	Full truncation
3	Wide median treatment (all movements possible)	Grade separated interchange

Although the intersection treatments are listed in order of preference to maintain connectivity, the final design treatment will be based on traffic volumes, road safety, and road network access. All intersection treatments will need to be approved corporately by VicRoads as well as the State and Federal Governments prior to construction.

In the road design process, land requirements for an AMP1 type corridor and interchanges are reserved and AMP3 type road and intersections are designed within it. Therefore, the AMP1 design is assumed to have provision for AMP3 requirements.

This criterion relates largely to the locality only, which limits the potential rating. Where proposed intersection arrangements and detail are unknown, the assumption was made that they will be appropriately designed to Austroads and VicRoads standards and therefore, will not have disbenefits.

The traffic and transport assessment methodology for each criterion and its weighting is outlined in Table 11. The assessment compared the alignment options to the existing highway conditions.

Table 11 Traffic and Transport Assessment Method Summary

Criteria	Basis for Assessment	Criteria Weighting
Extent of impact on road safety	Consideration of option with regard to any identified existing road safety concern.	0.325 Improvement to road safety is a Project Objective.
Travel times for highway road users during construction phase	Consideration of impact on construction travel times informed by significance of construction on the existing carriageway and opportunity for staged construction. Consideration of impact on rail users.	0.10 Given that the construction time is a limited and finite period, the weighting for this criterion is lower than others.
Travel times for highway road users during operation phase	Consideration of the effect of duplication in providing additional capacity and removing existing overtaking constraints from highway road users.	0.325 Improvement to travel time is a Project Objective.
Degree to which AMP3 design requirements are met with provision for upgrade to AMP1 standard, which considers the type of intersections and vehicle turning movements.	Review of the alignment options in light of their ability to accord with the Performance Objectives, Standards and Principal Characteristics of VicRoads AMP3. Review ability of options to achieve high level of control over site access points, intersection spacing, vehicle turns and crossing movements. Review ability of options to have right turns and U-turns controlled by medians and median breaks and turning lanes separated from through lanes where warranted.	0.25 Assists in delivering benefits to road safety and highway operations.

4.4 Biodiversity and Habitat Assessment

Ecology and Heritage Partners Pty Ltd (EHP) have been working on the Western Highway Project for VicRoads since 2008. Therefore, the options assessment is based on more detailed information that the other specialists assessments.

EHP were engaged by VicRoads to undertake a flora, fauna and Net Gain assessment of multiple alignment options for the proposed duplication of the Western Highway between Ararat and Stawell (Ecology Partners Pty Ltd 2011a), Victoria. The assessments were required to identify any species or vegetation communities of conservation significance, to record any potential areas of indigenous vegetation that may have Net Gain implications within the study area, and to provide advice in relation to potential impacts and mitigation measures associated with the proposed duplication of the Western Highway. These preliminary surveys identified habitat within the study area for a range of significant flora and fauna species.

Following comments received from the DSE and DPCD, the criteria was modified to assess each alignment option against the following objectives, as defined in the draft EES Scoping Requirements:

- To avoid or minimise effects on flora and fauna species and ecological communities listed under the Flora and Fauna Guarantee Act 1988 (Vic) or the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
- To comply with the requirements and best meet the objectives, of Victoria's Native Vegetation Management — A Framework for Action, and to minimise impacts on wildlife corridors.

The criteria for each objective are explained below.

Extent of impacts to Matters of National Environmental Significance (MNES)

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's principal piece of environmental legislation. Species and communities listed under the Act are considered to be of national environmental significance. As such, areas that support species or communities listed under the EPBC Act have received consideration as part of the Options Assessment.

Extent of impacts to species, communities and processes listed under the FFG Act

The *Flora and Fauna Guarantee Act 1988* (FFG Act) is the primary legislation for the protection of flora and fauna in Victoria. The Act builds on broader national and international policy in the conservation of biodiversity. Species and communities listed under the FFG Act on the Threatened List are considered to be of State significance. In addition to the Threatened List, the DSE Advisory List is maintained by the Department of Sustainability and Environment (DSE) and is based on technical information and advice obtained from a range of experts. Species listed under the Advisory List are considered to be of regional conservation significance, but may also include the same species identified on the Threatened List. Species, communities and hollow bearing trees have been considered under this criterion for the options assessment.

Extent of impact to native habitat and vegetation which is of very high conservation significance

Ecological Vegetation Classes (EVCs) or vegetation communities are assigned different conservation significance ratings depending upon their conservation status within a given bioregion, their site condition score and the presence of significant species. EVCs that receive a rating of Very High generally have a conservation status of Endangered, Vulnerable or Rare, coupled with a high site condition score and/or support rare and threatened flora and fauna species. As such, these areas have received consideration as part of the Options Assessment.

Net gain requirements for removal of native vegetation

The *Planning and Environment Act, 1987* (P&E Act) provides control over the removal of native vegetation including trees, shrubs and groundcover vegetation. Victoria's Native Vegetation Management – A Framework for Action (NRE, 2002) is implemented through the P&E Act by the way of Victoria Planning Provisions and directs responsible authorities administering planning schemes to have regard to the Net Gain policy and require that a Net Gain outcome is achieved when a proposal seeks to remove native vegetation.

The selection of the shortlisted alignment options and the assessment of these options has considered the first two steps of the three step approach to applying 'net gain', being:

- To avoid adverse impacts, particularly through vegetation clearance.
- If impacts cannot be avoided, to minimise impacts through appropriate consideration in planning processes and expert input into project design and management.

The third step of identifying appropriate offset options will be applied following the concept design of the preferred alignment.

Net Gain targets are calculated based on the amount of vegetation to be removed and apply different offset multipliers according to whether the vegetation is of Low (x1), Medium (x1), High (x1.5) or Very High (x2) conservation significance. Rather than using vegetation losses, Net Gain targets were used in the Options Assessment as they take in to account vegetation conservation significance, amplifying numbers for vegetation of High and Very High conservation significance. The scores assigned to this criterion include consideration of impacts on Large Old Trees and Scattered Trees as well as the number of new trees to be recruited.

Extent of impact on wildlife corridors (considering extent, connectivity and known species records)

Wildlife corridors and 'stepping stones' of vegetation have numerous benefits to native fauna populations, particularly in modified landscapes where much of the surrounding vegetation is restricted to linear strips along roadsides or streams. They often constitute valuable habitat in their own right. As such, these areas have received consideration as part of the Options Assessment.

Each alignment option was assigned a score and an impact rating according to each Evaluation Criteria category. Following comments provided by DSE and DPCD, the overall flora and fauna objective was separated into two overall objectives due to the range and complexity of legislation and policy to be addressed (ie. by separating out the compliance with 'net gain' and wildlife corridor protection requirements under Victoria's Native Vegetation Management – A Framework for Action from the legislative requirements for minimising impacts on listed species and communities.

The procedure for assigning scores and associated impact ratings is detailed in Appendix H.

The biodiversity and habitat assessment methodology for each criteria and its weighting is outlined in Table 12.

Table 12 Biodiversity and Habitat Options Assessment Method Summary

Criteria	Basis for Assessment	Criteria Weighting
Objective: *To avoid or minimise effects on flora and fauna species and ecological communities listed under the Flora and Fauna Guarantee Act 1988 (Vic) or the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)*		
Extent of impacts to Matters of National Environmental Significance (MNES).	Presence of flora, fauna species or communities listed under the EPBC Act	0.6 Species listed under the EPBC Act are considered to be of national conservation significance and therefore have the highest weighting for assessment against this objective.
Extent of impacts to species, communities and processes listed under the FFG Act.	Presence of flora, fauna species or communities listed under the FFG Act	0.4 Species listed under the FFG Act / DSE Advisory list are considered to be of regional and State conservation significance, therefore weighted slightly less than the species listed under the EPBC Act
Objective: *To comply with the requirements and best meet the objectives, of Victoria's Native Vegetation Management — A Framework for Action, and to minimise impacts on wildlife corridors.*		
Net gain requirements for removal of native vegetation. Impact to native habitat and vegetation which is of very high conservation significance.	Net gain calculations based on the construction corridor and broad assumptions about the amount of roadside vegetation removed. Conservation significance of native vegetation to be removed. Number of Large Old Trees and scattered trees potentially impacted	0.8 (0.4 assigned to each criteria) Loss of native vegetation was considered to be a highly significant issue for the project. As such, Net Gain and vegetation of high conservation significance have been considered **together** and assigned the highest weighting combined. The criteria have been considered together as vegetation of high conservation significance is a component of Net Gain targets.
Extent of impact on wildlife corridors (considering extent, connectivity and known species records).	Consideration of the impact on wildlife corridors A score out of 10 with 0 = no wildlife corridors impacted; 10 = extreme severance of connectivity (i.e. highway cutting directly through a state park).	0.2 Wildlife corridors and habitat connectivity were assigned a lower weighting because their values are partly considered in other criteria.

4.5 Cultural Heritage Assessment

Andrew Long and Associates (ALA) are the Cultural Heritage Advisors for the EES process. ALA has adopted a risk based approach for options assessment to identify areas with low, medium or high potential for presence of cultural heritage (Aboriginal and non-Aboriginal) values.

An initial set of evaluation criteria was developed for the options assessment with respect to Cultural Heritage values, which was primarily based on registered places. However, after further consideration of existing information, consultation with Registered Aboriginal Parties (RAPs) and Registered Aboriginal Party Applicants, it was determined that the evaluation criteria should include predicted sites and places. This was because the extent of existing information did not capture the extent of

significant Aboriginal cultural values that were identified to be present during preliminary site visits for the EES.

Following advice from Aboriginal Affairs Victoria (AAV) in July 2011 the Cultural Heritage Management Plan (CHMP) process under the *Aboriginal Heritage Act 2006* was initiated for Section 3. The Standard Assessment component of the CHMP is being undertaken to inform options assessment.

4.5.1 Standard Assessment for the CHMP

A Standard Assessment involves non-intrusive field work to survey the study area. For a large study area the field work can be targeted to focus on potentially high risk areas for impacts to cultural heritage values. The Western Highway Project study areas for both Sections 2 and 3 are very large and will take a substantial amount of time to survey, therefore it is important to develop a robust approach for identifying key areas to survey.

A risk based approach was adopted by ALA to define areas with the potential for the location of Aboriginal cultural values, and to define a targeted field work program for the Standard Assessment. A Predictive Model was developed that uses environmental features and cultural values which could have had a modifying influence on the Aboriginal occupation and are likely to have resulted in variations in the distribution and density of sites in the project area.

This risk based approach was discussed with the RAPs, RAP Applicants and AAV prior to development of the predictive model. It was agreed that this approach was acceptable to inform the options assessment and to inform development of a targeted field work program for the Standard Assessment. The outcomes of the predictive model have been presented to and endorsed by the RAPs, RAP Applicants and AAV.

Where the identified level of risk of impact on Aboriginal cultural heritage is unlikely to be reduced following further consultation and field work, this is stated in the assessment section on the relevant alignment option.

4.5.2 Predictive Model for Aboriginal Cultural Heritage

The Predictive Model considered various existing spatial datasets including the Victorian Aboriginal Heritage Register (VAHR) (registered Aboriginal cultural heritage places), geomorphological data, Ecological Vegetation Class (EVC) data, hydrological data, ecological data, and created additional datasets utilising Aboriginal community consultation, land use history (disturbance mapping), ethnohistory (observations of Aboriginal lifestyles and activities) and a review of archaeological reports.

A selection of the most relevant attributes from each of these spatial datasets was assessed. Within each of the relevant attributes, ratings were assigned based on the relative distribution and density of Aboriginal places in each attribute unit and considering environmental factors within the study area.

Prior to model construction, three different site types were identified that are expected to be distributed differentially in relation to environmental variables: Aboriginal places in general, burnt mounds and modified trees, (of which mortuary trees are a subtype). Likewise, five relevant spatial datasets were identified: geological units, distance-from-watercourse, elevation, slope and modelled 1750 Ecological Vegetation Classes (see Table 13).

The following datasets were used. These were critical for assessing the pattern of past human occupation across the landscape in relation to their effect on the archaeological record.

Table 13 Cultural Heritage Predictive Model Data Sets

Data	Description
Geology	1:250000 Geology (250k MGA54)
Watercourse	VicMap Watercourses
Elevation	20 x 20 m cell Digital Elevation Model
Slope	20 x 20 m cell slope raster (derived from Elevation_dtm20)
NV1750 EVCBCS	Native Vegetation - Modelled 1750 Ecological Vegetation Classes (with Bioregional Conservation Status)
Distance To Watercourse	Zones at 50 m distance intervals from watercourses, with a separate zone 0-50 m from watercourse confluences (derived from VM_Watercourse)

Each of the data sets was used to create a layer for a model. Three separate models were created including an overall Aboriginal heritage model, a mounds model and a modified trees model. A geometric classification system was used to develop the models with three categories relating to classifications from 1-3 (high potential to low potential).

The outputs of the model are a series of maps that identify areas with low, medium and high potential for the presence of Aboriginal cultural values. The shortlisted alignments considered in the options assessments were overlaid on to the model output and the options assessment was informed by the proportion of the areas that were intersected by the alignment options. This was one of the sources of information used to inform the Options Assessment. The other two were the cultural values maps and the specialist mortuary tree analysis. The cultural heritage assessment was the only specialist discipline weighting their criteria based upon a predicative model rather than actual confirmed impacts. Accordingly, their ratings are more conservative due to the limited field work undertaken at the time of the options assessment.

Further details of the model, its development and how it was applied are provided in Appendix I.

4.5.3 Cultural Values Map and Consultation with Aboriginal Communities

To inform the predictive model, a cultural values map was created through consultation with RAPs and RAP Applicants of the study area. Creation of a cultural values map allowed the quantification of broader and often intangible Aboriginal community values, in addition to the scientific impact assessment of cultural heritage places.

Two Registered Aboriginal Party Applicants exist for the Section 3 study area, the Barengi Gadjin Land Council and the Martang Pty Ltd. It is important to note that the cultural values map is a work in progress and it will be presented to the communities for their review in the final week of October 2011. The cultural values map incorporates cultural values as expressed by these Aboriginal organisations in community consultation workshops and represented in a spatial context.

The cultural values as expressed by the Barengi Gadjin and Martang communities were represented spatially to be considered with information from geological and environmental spatial datasets. This was instrumental for assessing the pattern of past human occupation across the landscape and continuing cultural relevance. Traditional cultural knowledge and scientific knowledge were able to be examined concurrently to better inform decisions for the Options Assessment. Details of the meeting dates and attendees are provided in Appendix I.

4.5.4 Historical Heritage

A ground truthing survey of previously registered historic places within the Western Highway Study Area was undertaken by historical during September 2011. The following registers were consulted prior to the field examination:

- Victorian Heritage Register;
- Victorian Heritage Inventory;
- Register of the National Estate;
- Commonwealth Heritage List;
- National Heritage List;
- Planning Scheme Heritage Overlays; and
- The National Trust List.

The extent of previously registered places was examined and their significance rating assessed. Unregistered historical places were also documented, where possible and recommendations made for further assessment. The results of the survey are presented in the Historical Cultural Heritage Site Assessment Table (Appendix 7 of the report provided in Appendix I to this report).

In order to present the existing research, parish maps of the area were geo-referenced and overlayed with the maps of the proposed alignments. This allowed the research to be visually presented to the local community and Council staff who were being consulted. A tabulated summary of the early ownership and land use history of the parcels of land potentially impacted by the proposed alignments was also presented during the consultations.

Consultation

In addition to the primary source research undertaken and prior to targeted ground proofing surveys, consultation meetings were held with relevant local Councils and historical societies. The objective was to present the existing historical research, seek feedback on this research and identify any additional sites that could potentially be impacted by the proposed highway extensions.

Large format maps were used to note the approximate locations of additional historical sites identified during the consultations. These sites were cross referenced with information gathered during the research phase as well as additional secondary source material that was made available during the community consultations. As a result, it was possible to verify the likely existence of some of the identified sites and whether additional research would be worthwhile. Information about the identified sites is provided in Appendix I.

4.5.5 Evaluation Criteria

The following criteria were considered to assess each alignment option against the evaluation criteria.

Impact on registered and potential mortuary trees and burnt mounds (VAHR places).

Mortuary Trees

Previous research has highlighted that there is the potential for Aboriginal mortuary trees to be present in the Project Area. A mortuary tree is a secondary 'burial' or 'abandonment' of the remains of a deceased person (or persons), which has undergone one or more stages of treatment to de-flesh the skeleton (or skeletons). These are extremely rare and significant cultural heritage places and the environments in which they are known to occur are well represented within the Western Highway Project Area.

The occurrence of a mortuary tree within a preferred alignment option is considered to be a significant risk to the Project. Mortuary trees are classified as 'burial' places, for which there are special provisions in the *Aboriginal Heritage Act 2006*, and there is enhanced protection of burials by prohibiting the granting of any cultural heritage permit (CHP) with respect to Aboriginal human remains (s37). Furthermore, a CHMP is unlikely to fulfil the matters to be considered in relation to a plan (s61) where there is an unmitigated impact to human remains, or where there is a risk that as yet unidentified human remains may be impacted.

The practice of placing disarticulated human remains and grave goods into hollows within trees is well attested in traditional Aboriginal practice in central west Victoria up to the mid-19th century, in particular within the domain of people of the *Djab Wurrung* language group, who occupied the plains and hills bordering the eastern edge of the Grampians from the vicinity of Stawell to Hamilton (Clark 1990). While it is possible that existing hollows have been enlarged to facilitate the placement, it is likely that the majority of mortuary trees are essentially unmarked, except for the caching of human remains.

The project area for Section 3 is considered to contain a relatively low risk of impact to potential mortuary trees, given the current condition of the woodland structures (as expressed in the 1750 EVCs). Although, river red gum is a commonly occurring species, especially in the central and southern part of the project area, the incidence of sufficiently old trees is relatively rare. It is likely that European clearance practices, particularly in association with gold mining, removed most trees of sufficient age (250 years+).

These criteria considered the known and potential locations for mortuary trees. The assessment of potential locations was informed by the predictive model established for the project, which is discussed earlier in this section.

Burnt Mounds

Burnt mounds 'generally occur in circular or oval shapes, can vary considerably in size, and be composed of a mixture of varying amounts of soil, ash, charcoal and burnt clay/stone hear retainers. In a traditional sense, a burnt mound is an artificially elevated nucleus of cultural activity resulting from either prolonged or intense usage' (Edmonds and Long, 1998). They indicate that the location of occupational sites that were repeatedly re-visited over many years.

One indicator for the location of burnt mounds is the proximity to water courses and more specifically, the confluences of water course. Burnt mounds also typically occur in areas with little surface slope. Burnt mounds are difficult to locate as they are only marginally elevated above natural surface level.

This criterion considered the known and potential locations for burnt mounds. The assessment of potential locations was informed by the predictive model established for the project, which is discussed earlier in this section.

Extent of impact on registered and potential Victorian Aboriginal Heritage Register (VAHR) places excluding mortuary trees and burnt mounds.

The Victorian Aboriginal Heritage Register (VAHR) established by the *Aboriginal Heritage Act 2006* is the administrative tool for the management of Aboriginal cultural heritage. The VAHR holds the details of all registered Aboriginal cultural heritage places and objects within Victoria, including their location and description.

This criterion considered the number and significance of known cultural places listed on the VAHR that would be directly affected by the alignment options. Given that there were a limited number of known sites and that there is documented Aboriginal occupation throughout the study area, the potential for unknown sites to be present was also considered in these criteria.

Aboriginal occupation would likely to have taken the form of temporary camps used on a seasonal basis and that made use of diverse resources in the area. The landscape was undoubtedly well known to generations of people and it is probable that associations extended to spiritual attachments.

Mortuary Trees and burnt mounds have been considered separately due to their significance and the difficulties in predicting their location and confirming their existence.

Impact on registered and potential Victorian Heritage Inventory (VHI) places, local planning schemes Heritage Overlay (HO) places, Victorian Heritage Register (VHR) places and other Historical Heritage Registers.

The *Heritage Act 1995* provides for the protection and conservation of places and objects of cultural heritage significance. The Heritage Act also provides for the registration of such places and objects through the administering agency of Heritage Victoria.

The Victorian Heritage Register (VHR) lists the State's most significant heritage places and objects. The Victorian Heritage Inventory, commonly known as the Heritage Inventory (HI), lists all known historical archaeology sites in Victoria. It includes information about sites and artefacts, including a description and assessment of significance.

This criterion considered the number and significance of known cultural places listed on the VHR and HI, and as identified by heritage overlays in the Planning Scheme that would be directly affected by the alignment options. It also considered other historical heritage registers such as the National Heritage List, Department of Sustainability and Environment heritage registers, Parks Victoria heritage registers, and the Commonwealth heritage list.

The location of potential historical heritage sites was also considered to capture the sites that could be present in the study as indicated by the published works about settlement in the region since the early 1840's.

The results of ground truthing of previously registered sites and confirmation of their extents, and the integration of geo-referenced parish maps, and community consultation informed the rating of this evaluation criterion.

The cultural heritage assessment methodology for each criteria and its weighting is outlined in Table 14. Further details of the cultural heritage options assessment is provided in Appendix I.

Table 14 Cultural Heritage Options Assessment Method Summary

Criteria	Basis for Assessment	Criteria Weighting
Impact on registered and potential mortuary trees and burnt mounds (VAHR places).	Predictive Model - Mounds model(additive), Modified trees model (extractive). Cultural Values Map - Aboriginal community consultation expressed in a spatial distribution format. Specialist Input - Existing Conditions Report, Ecology Partners Tree Data and Andrew Long Specialist Tree Report.	0.5 Mortuary trees and mounds are significant site types that have the potential to inhibit the project development or to cause a change in alignments.
Extent of impact on registered and potential Victorian Aboriginal Heritage Register (VAHR) places **excluding** mortuary trees and burnt mounds.	Predictive Model – Overall Aboriginal Heritage model. Cultural Values Map - Aboriginal community consultation expressed in a spatial distribution format. Specialist Input - Existing Conditions Report, Ecology Partners Tree Data and Andrew Long Specialist Tree Report.	0.22 Instead of splitting remainder weighting between VAHR places and historical heritage places a lower weighting (0.22 compared to 0.28) was assigned to this criterion for VAHR places as two significant site types (being mortuary trees and mounds) that fall under this category are already being considered in the third criteria.
Impact on registered and potential Victorian Heritage Inventory (VHI) places, local planning schemes Heritage Overlay (HO) places, Victorian Heritage Register (VHR) places and other Historical Heritage Registers.	Ground truthing of previously registered sites and confirmation of their extents, and the integration of georeferenced parish maps, and community consultation	0.28 As stated above, in relation to VAHR place this criterion for historical heritage was assigned a higher rating as it is not being considered in any other criteria.

4.6 Planning and Land Use Assessment

In undertaking the assessment, the primary consideration, aside from compliance with planning requirements, was the timing of the impacts (i.e. long term or just during construction). If an impact was to occur during construction, it was discounted as the impacts assessed are only longer term. In addition, it was necessary to assess the impacts on an individual land title basis and in relation to existing infrastructure provision.

Focus was placed on the benefits or disbenefits of the proposed alignments on current and future land use, and major utility services compared to a 'do nothing scenario' and to each other. In determining the scale of the impact, each alignment was assessed against the provisions of the relevant Planning Scheme, including: the State Planning Policy Framework (SPPF), Local Planning Policy Framework (LPPF), and Zone and Overlay provisions. This enabled assessment on the impacts on land use at an individual, local, regional and State level.

For the purposes of assessment, the relevant ratings on the 'Impact Ratings Table' were divided into how they relate / comply with planning controls. Accordingly, the ratings were linked back to planning scheme definitions and parts of the planning schemes to determine the level of benefit or disbenefit, such that localised impacts (individual properties) were low or partial, whilst regional impacts (LPPF)

considerations were moderately poor or moderately well. State impacts (SPPF) were considered poor or well and national impacts were very poor or very well.

To assess each alignment option the following tasks were undertaken for the planning and land use assessment:

- Review of relevant Planning Schemes (Pyrenees and Ararat).
- Discussions with Council Planners.
- Obtaining copies of current Planning Permit Applications lodged with Council (Ararat).
- Review of information collated as part of the existing conditions report.
- Inspection of aerial photography.
- Site inspections.

The planning and land use assessment methodology for each criteria and its weighting is outlined in Table 15. Further details of the planning and land use options assessment is provided in Appendix J.

Table 15 Planning and Land Use Options Assessment Method Summary

Criteria	Basis for Assessment	Criteria Weighting
Extent of impact on major utility services.	Desktop assessment of Planning Schemes. Analysis of GIS maps. Review of GIS Mapping , Aerial photographs, some service location information and site inspection of alignment	0.2 This criterion can be managed as part of the construction process and mitigated against. It will not have a longer term impact.
Extent and impact of change to existing land uses (consistency with applicable planning policies).	Desktop assessment of relevant Planning Schemes, SPPF, LPPF, Zones and Overlays. Analysis of GIS maps	0.5 The impact on existing land use is considered the most significant has it will result in immediate impacts to the way the land is used now and is the most likely criteria to result in impacts on land owners.
Extent and impact of change to future land use (consistency with applicable planning policies).	Desktop assessment of relevant Planning Schemes, SPPF, LPPF, Zones and Overlays. Analysis of GIS maps	0.3 This criterion has been weighted slightly less than existing land use impacts as any future use or development will occur after the roadway has been constructed and therefore, will adapt to the existing physical conditions. The assessment has allowed for consideration against Council's strategic policies and ultimate objectives for the future development of the Great Western township and general land uses within the study corridor.

4.7 Social Impact Assessment

A qualitative assessment of the potential social impacts of the alignment options was undertaken. Key to the assessment of the alignment options was developing a sound understanding of the current conditions and social factors that apply to the existing Western Highway and local roads. To develop this understanding, the following tasks were undertaken:

- Three site visits to the area, including two visits to attend community information sessions and Council meetings, and a third to meet with an affected landowner and to inspect the options around Great Western;
- Review of the community feedback collected informally at the public information displays and provided later through feedback forms and records of VicRoads contacts with affected landowners, as well as feedback provided through stakeholder interviews;
- Review of the information collected on the location of community services and facilities;
- Review of the social policy data collected during for the existing conditions report; and
- Consideration of the number of properties potentially severed by each option and the number houses potentially affected, either by acquisition or amenity impacts.

The following was considered to assess each alignment option against the evaluation criteria.

Extent of impact on access, mobility and severance

- Access benefits can occur when travelling times are reduced; there is easier access to community services and facilities, and when people have more transport choices available to them. Access is assessed in terms of access to private property, community facilities and valued places (environmental features, public open space or cultural or historic sites).
- Mobility impacts can occur when people with specific transport needs, or vulnerable groups within the community, find it more difficult to move around their local area and have their mobility restricted. These impacts can be perceptual or actual.
- Severance effects occur when local roads are cut off; connector roads are changed or suffer increased traffic movements, or when public transport routes are changed. Severance is either a physical or psychological impact. This may be caused by new infrastructure creating a physical barrier or by people's perceptions of changes to existing routes.

Each option was assessed based on whether it would create barriers to access adjacent properties, whether it would increase travel times for landowners and whether any property severance was severe enough to create a negative social impact. This was based on the basic assumptions made with regard to access and intersections. The locations of median breaks were not identified for short-listed options so these were not considered.

Extent of impact of the full or partial acquisition of properties

Full acquisition of properties has social impacts by potentially removing residents and businesses from a community. Partial acquisition of properties has impacts on individual landowners and businesses but these individual impacts multiply to community impacts.

Each option was assessed based on the anticipated community impacts of full or partial acquisition of properties.

Impacts from dislocation effects

Dislocation effects occur primarily at the household and individual level. They include property disruption or acquisition, or people leaving an area due to significant changes to the valued features of their local environment. In addition, they can impact upon accessibility to and between towns and community sites (such as halls or parks). They can also affect business and service catchments. Dislocation can have a flow-on effect on the whole community. The nature and extent of land acquisition for each option was examined to rate options against this criterion.

Each option was assessed based on whether it may lead to a dislocation impact for the landowner. This was a qualitative assessment based on the options maps and data on the number of houses within 50 m and 100 m distances from each option.

Extent of impact from amenity changes

Potential impacts on amenity to individual houses or properties can be direct or indirect, including changes to landscape, introducing noise or altering access. Amenity impacts are specific impacts on the attractiveness of a given area and people's enjoyment of it. The distance between the shortlisted options and residences was used to rate options against this criterion.

Each option was assessed based on its potential to lead to negative effects on the amenity of adjacent properties. However, this criterion was not rated in the options assessment matrix because the components of amenity impacts are covered in individual ratings for air, noise, landscape and transport criteria.

Extent of impacts on community facilities

Community facilities such as public halls, sports grounds and parks are generally valued by local community. Each option was assessed based upon its impact on facilities for the local or broader community.

Community context – the expressed concerns of the local people

- The expressed preferences and concerns of local people need to be considered in planning for infrastructure development. This includes their preferences for transport modes and access arrangements, concerns about amenity and other impacts and concerns about environmental impacts.
- The outcomes of community information sessions and other meetings held with some potentially affected landowners directly affected by the short-listed alignment options, informed the rating of options against this criterion. A summary of the outcomes of this consultation is outlined in Chapter 5.

Each option was assessed based on the community response from the landowner information sessions and the feedback forms. This was a preliminary qualitative assessment which was intended to reflect the community response to each option.

The planning and land use assessment methodology for each criteria and its weighting is outlined in Table 16. Further details of the social impact options assessment is provided in Appendix K.

Table 16 Social Impact Options Assessment Method Summary

Criteria	Basis for Assessment	Criteria Weighting
Impact on Access, mobility and social severance	This criterion assesses the impact of the option on accessibility and mobility. This includes accessibility to and between towns, and to key community sites. Mobility includes consideration of how the option might affect people's ability to get around their property, as well as impacts on individual mobility. Severance considers whether any options disconnect people from places they need or want to go to (not land severance).	0.25 This is a high priority criterion for any social impact assessment
Impact of the full or partial acquisition of properties	This criterion calculates the number of properties affected by land acquisition and the severity of that impact in terms of land severance which affects people's enjoyment of their land or their ability to continue working the land. The criterion also calculates the number of dwellings which may be acquired under each option.	0.25 This is a high priority criterion for any social impact assessment
Experiences of the local environment - Impacts from dislocation effects	Based on the extent of change the option will make in the local environment, including on-property changes and changes to the experience of driving through the area.	0.2 This criterion is also partially considered by other specialist assessments (including planning and land use, economic) and is therefore downgraded compared to the other criteria for the social assessment.
Experiences of the local environment - Impacts on community facilities	Consideration of the location of community facilities such as public halls, sports grounds, parks, etc.	0.05 This project has minimal impact on community facilities and hence this criterion has been downgraded.
Community Context - The expressed preferences and concerns of local people	Based on feedback from community in letters, feedback forms and at community information sessions.	0.25 This is a high priority criterion for any social impact assessment

4.8 Economic Assessment

The economic assessment was informed by existing information, aerial imagery and outcomes from community consultation, discussions with council officers, and some affected landowners.

The following was considered to assess each alignment option against the evaluation criteria. Details of the assessment ratings and reference information are provided in Appendix L.

Number and significance of businesses (including agricultural) affected by full or partial acquisition

To assess this criterion the direct land loss, degree of severance, relationship to allotment and tenement boundaries, and effects on infrastructure was considered. Tourism and commercial sites were assessed on whether land loss would be a disbenefit or benefit to the viability of the business.

Impact on accessibility for industry and tourism opportunities.

To assess the impact of accessibility for industry and tourism opportunities, the following Information was considered:

- The study area boundaries containing the alignment options;
- The ownership patterns of allotments within the Study Area;
- Townships within the study area or that are currently on the Western Highway and would be bypassed as a result of the highway duplication; and
- Proposed location of intersections.

Municipal planning schemes were cross referenced to identify the zone of land in or near the study area near towns and townships. Impacts on land zoned industrial or business were rated with consideration of local economic and tourism development plans and strategies and the importance of the land, site, or tourist destination as identified in these strategies and plans.

With respect to the 'impact on accessibility' assessment criterion, highway visibility was also considered. This is a particularly important aspect for industry and for some tourism businesses that rely on highway trade for a large share of their business. If their highway visibility is reduced through realignment, it is likely to affect the impetus or impulse to access as well as accessibility itself.

Impact on Rail Operations during Construction

Research was undertaken to gather information about the profile of each section in terms of its passenger and freight movements and to gain an understanding of how these movements were important on a local, regional or State level.

For each of the three design zones, the existing highway alignment and the proposed alternative highway duplication alignments were evaluated for their impact on rail operations. This involved identifying the alignment of the rail line and identifying points within the zone where either the rail line was observed to run parallel to the new alignment options or, more importantly, where physical crossings of the rail would occur with one of the new alignment options.

In the event of a new rail crossing, an assessment was made as to the likely impact (where applicable) to the locality, region and the State. In each case, a rating was assigned to the road/rail interaction to describe the type of impact that could occur.

4.9 Visual and Landscape Character Assessment

The visual and landscape options assessment was undertaken by Aspect Studios. The assessment was informed by a site inspection from publicly accessible locations, and a review of aerial photography and topographic information.

The following was considered to assess each alignment option against the evaluation criteria.

To minimise the impact upon the amenity of adjacent residents

Households located within 500 m proximity of an alignment option were considered within the assessment. This proximity is a typical benchmark for VicRoads and other studies to identify households that may receive a visual impact from proposed developments if there is not barrier between the residence and the road. Outside of this 500 m proximity, typical visual impact significantly reduces.

Households within 150 m proximity of the duplication options are assumed to receive a greater visual impact given their increased proximity.

The visual impact upon households has also been considered based upon whether the options propose the duplication of the existing Western Highway alignment or an entirely new alignment for the highway. Households that are affected by the duplication of the existing highway are considered to receive a lower visual impact than those households that are affected by a new highway alignment.

Their visual impact will be based upon an existing infrastructure element, the existing highway becoming larger in scale or width. Those households affected by a new highway alignment receive a higher visual impact because they are impacted upon by a new infrastructure element within their visual outlook.

In order to provide a comparison between the options, points have been assigned to affected houses dependent upon their proximity to the alignment option and whether they are affected by a duplicated alignment or a new alignment. Further details of this approach are provided in Appendix M.

To minimise the impact upon townships and places of cultural and natural value

Within this study, townships and places of cultural and natural value were individually assessed to determine the proposed visual impact of the multiple duplication options. This is based upon the following attributes:

- Level of significance of the place of natural or cultural value;
- Size of township;
- Distance of duplication alignment option from a township or place of natural or cultural value; and
- Estimated visual prominence of the alignment option from a township or place of natural or cultural value.

To minimise detrimental impact upon existing landscape character

The duplication options have been assessed to calculate the proportion that each alignment affects different visually sensitive landscape character types.

In order to provide a comparison between the options, numerical values have been assigned to the landscape character types, based upon their visual sensitivity. The level of sensitivity and their corresponding numerical values are provided in Appendix M.

The visual and landscape character assessment methodology for each criteria and its weighting is outlined in Table 17.

Table 17 Visual and Landscape Character Assessment Method Summary

Criteria	Basis for Assessment	Criteria Weighting
To minimise the impact upon the amenity of adjacent residents - assess the number and level of visual impact of households affected by the project.	Quantify number of households within 500 m proximity to the duplication option, including those within 150 m proximity.	0.33 All criteria weighted equally
To minimise the impact upon townships and places of cultural and natural value - assess the project's impact of visual change to the landscape from townships, vistas and places of cultural and natural value.	Assess proximity and estimated impact of duplication options upon townships, views and natural and cultural values.	0.33 All criteria weighted equally
To minimise detrimental impact upon existing landscape character - assess the capacity of the landscape character types to absorb the visual change from the project.	Quantify percentage of landscape character type that alignment option travels through.	0.33 All criteria weighted equally

4.10 Air Quality Assessment

Road projects generate two types of air quality impacts; these are (i) vehicle emissions dispersing away from the running lanes during operation, both near field and further afield (regional), and (ii) dust, and other minor emissions, due to construction activity. When considering the no project case, traffic emissions can be considered to be always better with the Project proceeding due to smother traffic flow and construction will always provide a worsening impact compared to a no project scenario.

The operational criteria were selected in order to determine compliance with the State Environment Protection Policy (Air Quality Management) (SEPP (AQM)) intervention levels described in Schedule B of the policy and the objectives and goals outlined in the State Environment Protection Policy (Ambient Air Quality) SEPP (AAR) Schedule 2. The construction dust criterion was selected in order to determine the number of sensitive receptors within close proximity to the Project in order to assess the relative dust impacts of each of the different options within each zone.

These three air quality criteria were then weighted equally between construction and operational impacts with the two operational criteria each taking an even share of the overall operational weighting and the single construction criteria utilising the entire construction weighting, as shown in the table below.

The air quality assessment methodology for each criteria and its weighting is outlined in Table 18. Further details of the air quality options assessment methodology are provided in Appendix N.

Table 18 Air Quality Options Assessment Method Summary

Criteria	Basis for Assessment	Criteria Weighting
Predicted impact of vehicle emissions on sensitive receptors within a minimum distance as evaluated by Austroads using expected, indicative traffic emissions and sectional meteorology.	Use Austroads to define distance from road where SEPP (AQM) objectives are not met. Any identified sensitive receptor within this distance is rated 'Very Poorly'. Otherwise, negligible rating as compliant to policy - as is the existing road and traffic conditions.	0.25 Weighting equally split between construction and operation impacts. Operational impacts then equally split between two criteria.
Extent of impact of ***construction*** dust on sensitive receptors within close proximity to the road.	Determine number of sensitive receptors within 0-15 m; 15-80 m, 80-100 m and 100-200 m of the road.	0.5 Weighting equally split between construction and operation impacts. Construction impacts are likely to be the greatest difference between Build and No Build
Extent of impact of emissions into the atmosphere as a measure of potential contribution to regional load of air pollutants.	All options will be an improvement on existing conditions due to better traffic flow with dual carriageways. Vehicle Kilometres Travelled (VKT) is a direct measure of total pollutants released for freely mixing into the regional 'airshed'. Shortest distance scores an improving impact. When all options are same length, all score neutral.	0.25 Weighting equally split between construction and operation impacts. Operational impacts then equally split between two criteria.

4.11 Noise and Vibration Assessment

Road projects generate two types of noise impact. These are; (i) noise due to construction activity, and (ii) noise from vehicles during operation.

The options assessment considered the distances from dwellings and other sensitive receptors (e.g. schools) to the road corridor for each option with regard to operational noise. Construction noise has not been used as a criterion for the options assessment as it is assumed that works will be carried out during the daytime and there is currently no noise policy available for daytime construction works.

Measurements of existing noise levels were collected from dwellings close to the existing highway and at those which could be close to the options that deviate from the existing highway alignment (called amenity sites). Both unattended noise loggers and attended noise measurements were obtained to inform the options assessment. The measurements of existing noise levels were used to measure the base case for comparison with each option.

Only one evaluation criteria was used during this early phase of the Project. It is expected that once a preferred option and detailed grade line design has been carried out an assessment of noise levels using topography as an evaluation criteria will be carried out. The final weighting for the above criteria (without topography) is shown in the table below. Once topography has been added these criteria will be equally weighted.

Each option was assigned a rating using the assessment approach outlined in Table 19. A secondary "rating" was also carried out to acknowledge options where the VicRoads Traffic Noise Reduction Policy 2005 would apply. Where the policy would not apply the rating given was "Negligible" indicating

a minimal disbenefit. However, where the policy would apply the rating given was “Low” as it is expected some form of noise mitigation would be required in these areas. The EES Scoping Requirements focus on amenity impacts. VicRoads Traffic Noise Reduction Policy has therefore not been used in the options assessment as they have been provided for information purposes only. Further details of the noise options assessment methodology and outcomes of the assessment are provided in Appendix O.

The noise assessment methodology for each criteria and its weighting is outlined in Table 19.

Table 19 Noise Options Assessment Method Summary

Criteria	Basis for Assessment	Criteria Weighting
Distances from dwellings and other sensitive receptors (e.g. schools) to road corridor for each option.	Number of sensitive receptors (dwellings) within 0-15 m; 15-50 m, 50-120 m and 120-200 m of the road. Relative ratings of each option were based on a comparison to the existing highway (no build) scenario. Fieldwork to enable measurement of existing noise levels along the relevant section of the highway and at amenity sites where an option results in a new duplicated freeway away from the existing highway.	1

4.12 Surface Water Assessment

All of the alignment options involved the crossing of waterways as they are located in the upstream end of waterway catchments. The key assumptions for this assessment include:

- The highway will include some form of waterway crossing at each identified waterway (i.e. culvert, pipe, bridge). The nature of the crossing is not yet identified but is expected to be similar to existing highway crossings.
- The potential for impact was assessed, not taking into account some likely waterway protection measures that are expected for a project of this nature. Some of the identified impacts could be reduced with appropriate mitigation.
- Due to limited details of flood modelling methodology at this stage, there is still some uncertainty whether water courses not identified as flooding in the 100 year event can be ruled out of having flood impact.
- Detailed assessment of flora and fauna impacts associated with waterways has not been undertaken for the options assessment. However, knowledge of the presence of protected species in waterways, as well as the fauna abundance and diversity, have been taken into account along with information about vegetation extent and diversity of stream form, purely as in indication of the habitat value of waterways. Impacts on waterways with good habitat quality as judged from this information were more likely to be considered significant, compared with impacts on similar waterways with low habitat quality.

A desktop assessment was undertaken using information from the ecological surveys undertaken by Ecology and Heritage Partners and flood mapping prepared by Bonacci Water.

In order to quantify the impacts and compare the relative impact across the alignment zones and options, the following was considered to assess each criterion.

Potential impact to waterway value taking into account the following:
The status of river health was assessed to take into consideration the significance of the waterway within the catchment and condition of its local/in-stream features. Waterways were assessed as falling into one of the following categories;

- Minor Waterway – Refers to undefined tributaries and often without permanent water. Many minor tributaries in this area of works are not evident and expected to only flow in significant rainfall events.
- Moderate Waterway – Refers to waterways with a defined channel, some in-stream vegetation and some section of permanent water. Larger waterways that are heavily degraded with low ecological value were also considered moderate waterways.
- Major Waterway - Well defined channel with permanent water. Moderate to good in-stream vegetation, providing likely (or known) habitat for a range of valued or rare species and some stream protection. The Hopkins River falls into this category.

The scale of the Impact Ratings Table used for the options assessment is defined in terms of Individual property, Locality, Region and State level benefits. In order to draw parallels between these descriptors and the categories defined above relationships were adopted as shown in Table 20.

Table 20 Impact Rating Terminology Relationship

Waterway Categorisation	Impact Rating Table Significance
Minor Waterway	Individual property
Moderate Waterway (less than medium habitat quality)	Locality
Moderate Waterway (medium habitat quality or greater)	Regional
Major Waterway	Regional

From this assessment, the number of waterways and status of crossings was compared, and expected level of impact on the ecological value or waterway condition at the crossing location was rated. The other main impacts to the waterway value that were included in the assessment were:

- Straight crossings with no complications were considered to be of low level disbenefit.
- Skewed crossings or alignments that followed along the course of a waterway were identified. A crossing that is skewed or along the alignment will result in a greater impact than a more direct or perpendicular crossing. Skewed crossings were considered to be of moderate disbenefit.
- Realignment - The potential need for the waterway to be realigned was considered to have a significant disbenefit on the waterway health.

Potential to increase flooding risk taking into account the following:

The interaction between the highway alignment and the existing flood extent as well as the potential for changes to the floodplain or impact on houses due to flooding was assessed using the following:

- Number of waterway crossings;
- Effective width of the 100 year flood extent (Bonacci Water, May 2011);
- Depth, width and cause of flooding and potential for an alignment to significantly change the flood severity and extents;
- Potential impact of waterways with the potential to flood that are not indicated in Bonnaci flood extent, where potential localised flooding impacts cannot be ruled out;
- Potential for increase in flooding where it may impact on houses; and
- Level of complexity in the interaction of the modelled flood extents within the alignment options (e.g. significant length of road alignment within the flood extent associated with stream confluences).

To align with the terminology in the Impacts Rating Table the following classifications were adopted:

- Impacts to three or less houses and outbuildings was considered to be at an individual scale;
- Impacts to greater than three houses and outbuildings was considered to be at a locality scale;
- All flood impacts to buildings was considered to be of significant disbenefit at a local scale; and
- Complex interaction of the flood extents with alignment options where properties may be impacted is considered to be of significant disbenefit at a regional scale.

It is noted that complex interaction of alignment options with the modelled flood extents implies a potential to redistribute flows and impact on flooding. The surface water assessment methodology for each criteria and its weighting is outlined in Table 21. Further details of the surface water options assessment methodology and outcomes of the assessment are provided in Appendix P.

Table 21 Surface Water Options Assessment Method Summary

Criteria	Basis for Assessment	Criteria Weighting
Extent of potential impact to waterway value	Count the number of waterway crossings and measure the existing width of the waterway crossing at the proposed location using ArcGIS aerial image Assess using aerial image from ArcGIS and any available image from Google street view - looking for bank vegetation, pools, other features	0.5
Potential to increase flooding risk.	Measure the existing flood extent where it crosses the proposed alignment from the Bonacci Water modelling results	0.5

4.13 Groundwater Assessment

The groundwater assessment of alignment options focused on areas which were below grade and therefore had potential to interact with the groundwater system. Whilst areas above grade (natural surface level) can result in impacts to groundwater, these can generally be mitigated using a number of engineering design and construction techniques and are therefore considered a lower risk. Areas above grade, or shallow cuts (generally less than 4 m) were considered to have negligible impacts.

From a regional perspective, the groundwater resources are generally considered to be low yielding and of poor quality (saline), and this has resulted in limited development of groundwater, apart from the occasional stock bore. The limited groundwater development means that there is very limited bore information and site specific groundwater information relative to the various alignment options. Some general assumptions have been made based on regional mapping to address the limited information available and these assumptions are explained below.

The following was considered to assess each alignment option against the evaluation criteria.

Extent of potential impacts (decline/deterioration) to groundwater quality and implications for beneficial uses.

A review of regional information suggests that the groundwater falls within beneficial use segments B (TDS 1,001-3,501 mg/L beneficial uses include potable mineral water, irrigation, stock water, industry, ecosystem protection, buildings and structure) and C (3,501 – 13,000 mg/L beneficial uses include stock water, industry, ecosystem protection, buildings and structure) for the entire study area. The most common pathways that lead to the degradation of groundwater quality are those that could arise from construction or operation, e.g. spills, or poor drainage design resulting in water logging (which could exacerbate salinity). These could occur in any part of the alignment and there is no obvious means to differentiate between alignment options. Low lying areas that are potentially a salinity risk have not been mapped and there is insufficient definition of the depth to water to differentiate alignment options. Local groundwater depth information is poorly understood. Site specific groundwater information (e.g. from geotechnical investigations) could shift risk ratings from low to negligible.

Extent of disruption of groundwater flow (recharge, discharge) i.e. flow paths, availability (for users, environment). Potential for alteration of groundwater levels.

The effect on groundwater availability (the alteration of groundwater flow and groundwater levels) would be most likely to occur in those areas where the road has the greatest likelihood of interacting with the groundwater environment (i.e., areas of cut / below existing grade, particularly the deeper, longer cuttings). Owing to an absence of site specific groundwater level information, similarly for groundwater quality, impacts have been conservatively assessed assuming that interaction with groundwater could occur within a deep cut. Areas of cut may not necessarily intersect the water table and therefore impact (if any) may be negligible, however in the absence of information, the conservative approach seems reasonable.

Furthermore, the depth of cut has not resulted in a change in the risk rating between options within a zone, however where greater lengths and deeper cuts have been identified in a specific option, comments have been made in the options assessment spreadsheet.

The groundwater assessment methodology for each criteria and its weighting is outlined in Table 22. Further details of the groundwater options assessment methodology and outcomes of the assessment are provided in Appendix Q.

Table 22 Groundwater Options Assessment Method Summary

Criteria	Basis for Assessment	Criteria Weighting
Extent of potential impacts (decline/deterioration) to groundwater quality and implications for beneficial uses.	Review option gradelines. Review of data collected and collated as part of the existing conditions report. Inspection of geology, aerial photography. Local groundwater depth information (where available)	0.3 Groundwater quality is marginal in the region, low yielding, low value resource.
Extent of disruption of groundwater flow (recharge, discharge) i.e. flow paths, availability (for users, environment). Potential for alteration of groundwater levels.		0.7 In the assessment of impacts, most pathways relate to the change in water availability (e.g. flows for resource users, supplies to the environment), of change in hydraulic gradient (subsidence, Acid Sulphate Soils sulphate activation, waterlogging and salinity development). Accordingly this should be assigned a marginally higher weighting.

4.14 Soils and Geology

A desktop review was undertaken to assess the existing soil and geological conditions within the study area. The scope of work for the assessment of the existing conditions in relation to soils and geology included a review of available information to satisfy the EES Scoping Requirements, which comprised the following tasks:

- A review of historical aerial photographs of the study area, where available, to assist in establishing the physical patterns of development over time;
- A review of publicly available literature and geotechnical information relevant to the study area;
- Sourcing and collating relevant available borehole, test pit and other geotechnical data;
- Interpretation of the available information;
- Development of a preliminary geological and geotechnical model of the study area; and
- A preliminary acid sulphate soil (ASS) hazard assessment.

Due to the lack of potential areas of concern identified in the historical aerial photograph review, a review of historic title deeds was not undertaken.

The following was considered to assess each alignment options against the evaluation criteria. Note that none of the criteria have been rated above 'moderately poor' because common engineering solutions and environmental management measures have been assumed to mitigate impacts.

Extent of impact of gross contamination from historic land use (including historic landfills), and potential cost of works

The historic land uses identified along the alignment are the key 'drivers' for assigning ratings as they pose the main human health and environmental risks. Some of the land uses that pose the greatest risks to creating contamination include:

- Agriculture: Pasture and Grazing including sheep shearing sheds with sheep dips and farm sheds containing above ground storage tanks: The potential risks to human health and the environment associated with this land use would be relatively low across the alignment options, as contaminant concentrations due to the application of fertilizers and other pastoral improvement substances, where present are unlikely to be high (orders of magnitude greater than criteria). The exception to this generalisation would be sheep dip sites, which would represent localised high contaminant concentrations as they tend to be confined to a discrete location. As such, alignment options encountering potential sheep dip sites have assigned a rating of 'Low' instead of 'Negligible';
- Commercial and Industrial Activity including services stations, heavy industry and utilities, such as railway lines and electricity supply infrastructure: There were no identifiable significant commercial or industrial areas along the alignment options; however potential for contamination exists where the highway alignment crosses or is parallel to the railway lines given the potential for the use of pesticides containing arsenic by the rail authority for the management of weeds along the corridor. Thus, alignment options intersecting or parallel in close proximity to the railway line have been assigned a rating of 'Low' instead of 'Negligible'; and
- Waste Disposal: These types of areas, such as the landfills, infilling of dams with contaminated soils or other wastes and disturbed soils, could represent a moderate to high risk due to the potential for high contaminant concentrations to occur. Therefore, alignment options intersecting disturbed soils have been assigned rating from 'Low' to 'Moderately Poor'. The section of alignment that comes close to the old landfill at Greater Western is assigned a rating of 'Moderately Poor'.

Extent of exposure to watercourse embankments and river beds (potential triggers for erosion/instability criteria)

Construction of the Project will result in the removal of some vegetation. It is generally expected that the soils encountered along the alignment will exhibit a degree of dispersive behaviour. The rate of erosion depends on factors, such as surface incline and the amount of and type of ground cover. Failure to reinstate exposed areas properly after construction may result in continuing soil erosion.

A small degree of rill-type erosion was observed along some sections of the alignment and it is therefore recognised that erosion may be a key geotechnical issue to address during the project phase and long-term operation of the asset. Consequently the alignment options have been assessed as 'Negligible' to 'Moderately Poor' in terms of risk associated with soil erosion.

Extent of potential impact of poor soils and / or topographic location on road construction or operation activities (unstable, low strength subgrades, wet or poor draining areas)

Topographic, geotechnical and geological characteristics along the alignment form the key 'drivers' for assigning ratings to the geological criteria previously established:

- Unstable and Compressible Geological Units: No known areas of significant instability have been identified within the alignment corridor. However, the removal of toe support, surcharging of slope crests or the interception of planes of weakness (unfavourable bedding or jointing planes) may

result in significant slope instabilities. Erodible soils present an additional risk to soil stability, as the loss of material from the slope, and in particular about the toe, may initiate a destabilising effect on the overall slope. Construction within areas that require large volumes of cut or fill placements, particularly adjacent watercourses or weak soils, will present an increased risk of slope instability and require careful consideration of batter angles or benching to mitigate this risk. Alignment options which are likely to attract a higher degree of surcharging or removal of earth to achieve design gradients have typically attracted a higher risk rating. Risk ratings for alignment options have been assigned as 'Negligible' to 'Moderately Poor' in terms of unstable and compressible geological units.

- Extensive Earthworks: There is a potential for large quantities of fill material required during the construction of the highway duplication. A risk exists that that excess material is cut from site resulting in unplanned offsite disposal or temporary stockpile. Alternatively, unplanned requirements to source fill material from offsite, including local quarries, may be necessitated to achieve grade separation or to overcome poor subgrade conditions. Areas adjacent creeks may require the construction of fill embankments to assist with flood control. Railway crossing in relatively flat terrain is likely to require longer and or higher fill embankments to achieve grade separation. Considering the above, the alignment options have been assigned a risk rating of 'Negligible' to 'Moderately Poor' in response to risk associated with excessive earthworks.

The soils and geology assessment methodology for each criteria and its weighting is outlined in Table 23. Further details of the soils and geology options assessment methodology and outcomes of the assessment are provided in Appendix R.

Table 23 Soils and Geology Assessment Method Summary

Criteria	Basis for Assessment	Criteria Weighting
Impact of gross contamination from historic land use, and potential cost of works.	Review of historical aerial photos (seven decades)	0.33 All criteria are equally important
Avoid or minimise exposure to watercourse embankments and river beds (potential triggers for erosion/instability criteria).	Review of regional and site-specific geology and aerial photography	0.33 All criteria are equally important
Potential impact of poor soils and / or topographic location on road construction or operation activities (unstable, low strength subgrades, wet or poor draining areas).	Review of regional and site-specific geology and aerial photography, complimented with drive through field mapping	0.33 All criteria are equally important

4.15 Community and TRG feedback on short listed options

The shortlisted options developed were presented to the community and submitted to the Technical Reference Group (TRG) for comment in July 2011.

There were two public consultation sessions held for in Section 3 residents and the community living within the project area, and wider vicinity. The sessions were held on:

- 14 July 2011 at Great Western; and
- 19 July 2011 at Ararat.

The outcomes of the public consultation sessions were documented in a Consultation Report and are outlined in Chapter 5.

On 12 July 2011, the shortlisted options were presented to the TRG for feedback and commentary. As a result of the TRG feedback, an additional alignment was included at the end of Zone 3 (Option 3DC), providing an alternative entry to Stawell.

The outcomes of the public consultation sessions were considered in the assessment of shortlisted options for the Social Impact Assessment.

The outcomes of the options assessment were presented to TRG for comment in November 2011. The TRG comments were then discussed in December 2011 to confirm they were understood and the report was then finalised. The TRG comments and how they were addressed are provided in Appendix S.

Community consultation sessions were also held in November 2011 to seek comment on the assessments and about the options that had been recommend within each zone which make up the three complete options being further assessed in the EES. The comments provided have been incorporated into the assessment documented in this report. The Stakeholder and Community consultation Report for the project is provided on the DPCD website.

5. Phase 2: Community Consultation

5.1 Consultation Prior to the EES

Community and stakeholder feedback is important to help guide the alignment assessment process to ensure the various alignment options represent a fair balance between meeting the Project's objectives and minimising the impact to the local community.

A community meeting was held in Great Western on 11 November 2009 to raise the proposal for a duplication of the Western Highway from Ararat to Stawell, and seek the views and input from the community. No specific alignment options were presented at this meeting.

The feedback received was utilised to help inform a long list of draft options. These options were presented at a second community meeting held in Great Western on 10 February 2010 to seek feedback on the initial draft alignment options.

Information Bulletins have also been sent out to the community to keep them informed of developments, including the selection of options for further investigation in December 2010.

5.2 Approach to Consultation on the Shortlisted Options

5.2.1 Community

As part of the first stage of the EES process, alignment options were reviewed and revised options were presented at community meetings. These meetings were held in Great Western on 14 July, and Ararat 19 July 2011. These public displays were held to provide information on the route options and provide the community with an opportunity to ask questions and provide feedback.

The displays were advertised in an Information Bulletin which was posted to addresses in the project area, as well as in local newspapers across the two municipalities affected. Visitors to the displays could view posters, fact sheets, photos and large colour aerial maps of each section of the upgrade. The project team and VicRoads property team were in attendance to discuss any issues and answer questions.

Attendees at the community information sessions were invited to complete a detailed feedback form. Following the community consultation sessions, VicRoads had received approximately 100 completed forms by directly, and indirectly affected parties.

In addition to the displays, maps and other information is available at the VicRoads project office and several locations including VicRoads Customer Service Centres, and Council offices, Australia Post Offices, Public Libraries and Service stations along the Western Highway.

5.2.2 Statutory Authorities and Service Groups

Consultation with statutory authorities is achieved through a ***Technical Reference Group*** (TRG), which was established in April 2011 and held its first meeting in May 2011. The TRG comprises the statutory authorities who will be responsible for project approvals, including representatives from, Ararat Rural City and Northern Grampians Shire Councils, Department of Planning and Community Development, Aboriginal Affairs Victoria, Parks Victoria, Heritage Victoria, Department of Sustainability and Environment, Environment Protection Authority and Glenelg Hopkins and Wimmera Catchment Management Authorities. The group meets regularly throughout the preparation of the EES to

contribute feedback on the scope, options assessment and technical aspects of the preparation of the EES.

A ***Professional and Local Services Group*** (PLSG) has also been convened and consulted about the Project. Members include emergency services, private infrastructure operators, other local service providers and community representatives including members of parliament, council representatives, and tourism and progress associations.

The first PLSG meeting was held on 14 July 2011 in Great Western. The group was given a presentation covering project planning, EES requirements, the shortlisted options and the consultation and communication objectives, activities and timelines, followed by an open session discussing issues affecting the members present. The next meeting will be held to discuss VicRoads' preferred option when it is selected.

5.3 Outcomes of Community Consultation

5.3.1 Overview

Approximately 250 people attended the four public displays which were held for Sections 2 and 3 combined, and were invited to register their addresses in order to evaluate whether the groups were spatially representative of the whole project area. Of those who registered, more than 80 per cent were people directly potentially affected by proposed alignment options.

Most of the other people who registered were from the towns of Beaufort and Ararat (many of whom had enquiries outside the scope of the project), and a few came from areas not directly affected by the project. To help inform the community, aerial maps with alignments were laid on tables to assist in locating the potential footprint of the option and how it may impact upon their property and / or access.

The queries raised by the community generally related to the timeframe for planning and construction, how land acquisition is undertaken and the way traffic levels and travel may be affected during construction and operation.

For those who may be directly impacted, queries extended to concerns that the highway would be too close, their property value might be impacted, and that property access might be impacted.

Some people had questions which could not be answered because they were subject further design considerations which would be undertaken once a preferred alignment had been determined. These queries included the specific position of median breaks, turning lanes and design of intersections.

All feedback and information received through the consultation is taken into consideration and informs the EES and assessment of options.

The most frequent comment resulting from the community information sessions was that the highway duplication would have positive effects for driving safety and comfort. Keeping long-haul heavy vehicle traffic out of the townships was also welcomed.

There was a general preference for the road to be as close as possible to the existing highway where feasible. It was felt that this would generally reduce impact and costs.

A number of comments covered aspects of design that people felt would improve the project. The most common of these included:

- turning lanes or service roads;

- acceleration or slip lanes;
- rest stops and emergency stopping lanes; and
- access to side roads and properties for regular and emergency vehicles.

Several people expressed concern about:

- maintaining safety and accessibility on local roads;
- protecting wildlife along the road corridor;
- design or management of rail crossings; and
- potential increased noise and littering.

Other issues mentioned included provision of walking and cycling options, and designing landscaping that does not cause distraction or impact on visibility and therefore safety.

There was an overall theme of community cohesion. For example, people who weren't personally likely to be affected expressed concern about impacts on their neighbours and friends. Other community considerations included:

- Design of any town bypass should ensure access is maintained or improved for tourist and local business activities;
- Future expansion of the towns along the highway should not be compromised by the alignment; and
- Cultural and natural heritage sites (large and small) that are valued by local communities.

Some people wanted the work to begin as soon as possible and asked why options were still being assessed and why a decision was yet to be made.

5.3.2 Section 3 Specific

An overview of the main comments received specifically in relation to Section 3 includes:

Zone 1:

- Keep overall impact on residential areas and township to a minimum;
- Provide access to Grampians and Seppelt's wineries without coming into town;
- Reduce visual impact; and
- Minimise creek crossings.

Zone 2:

- Protect bushland;
- Allow for future growth;
- Keep overall impact on houses to a minimum; and
- Minimise noise and visual impact.

Zone 3:

- Keep overall impact on houses to a minimum;
- Protect environmental and heritage values; and
- Keep overall land acquisition to a minimum.

6. Phase 2: Assessment of Zone 1 Alignment Options

6.1 Zone Description

Zone 1: Pollard Lane to Allanvale Road

Zone 1 extends from Pollards Lane west of Ararat to Allanvale Road before Great Western and contains three options for assessment. The existing highway comprises of single traffic lanes in both directions for traffic travelling between Ararat and Great Western. This section of the highway includes the Armstrong Deviation, which crosses the railway line and is a section of the highway that was upgraded in 2003. The existing highway intersects ten local roads and an access point to tracks in the Ararat Regional Park. The characteristics and key constraints in Zone 1 include:

- At the start of the zone the Ararat Regional Park constrains the Western Highway to the east and west for approximately 3.5 km of the highway;
- The Australian Rail Track Corporation's (ARTC) interstate rail line is located to the east of the existing highway and is crossed by the existing highway at the Armstrong Deviation;
- The locality of Armstrong is located within this zone, largely between the existing highway and railway line;
- The area is predominantly privately owned land used for agricultural or rural living purposes with a number of established dwellings in Armstrong;
- Historical ruins are located near the existing highway in the Armstrong area; and
- Crossing of a number of waterway tributaries.

Appendix C comprises mapbooks illustrating the alignments in Zone 1. Table 24 provides a summary of the key aspects for Zone 1.

In the following figures, the purple outline represents the maximum construction foot print while the coloured lines represent the proposed alignment that is further described in the text.

Table 24 Summary of Potential Impacts for Zone 1

		Option 1A	Option 1C	Option 1E	Option 1A/1E
Approximate Land Acquisition (ha)		45	96	60	36
Native Vegetation					
EVC (bioregion)	***Conservation Status***	***Area Impacted (ha)***			
CGW (Goldfields)	Endangered	5.8	8.2	4.2	4.0
GDF (Goldfields)	Depleted	3.8	3.1	3.9	3.8
GW (Goldfields)	Endangered	41.1	14.0	45.2	35.7
PGW (Goldfields)	Endangered	3.2	3.3	0.0	3.2
Total Potential Native Vegetation Loss (ha)		54.1	28.6	53.3	46.8

	Option 1A	Option 1C	Option 1E	Option 1A/1E
Large old (LOT) and Very Large Trees (VLOT)	LOT: 8 VLOT: 6	LOT: 22 VLOT: 15	LOT: 10 VLOT: 9	LOT: 3 VLOT: 7
Heritage Values	Known heritage sites at Armstrong although not registered*	Heritage Overlay – Fountain Head Brewery HO112	Known heritage sites at Armstrong although not registered*	Known heritage sites at Armstrong although not registered*
Number of Waterway Crossings	3 significant waterway crossings 29 minor drainage line crossings	3 significant waterway crossings 26 minor drainage line crossings	2 significant waterway crossings 33 minor drainage line crossings	3 significant waterway crossings 27 minor drainage line crossings
* At the time of the Options Assessment sites were not registered, however they have been registered through the impact assessment				

6.2 Options Description

6.2.1 Option 1A

This option involves a new eastbound carriageway north east of the existing highway. Option 1A has minimal encroachment on farming and residential properties, therefore requires a smaller area of land acquisition.

Two half-diamond interchanges are proposed for the ultimate AMP1 access control. The locations for these interchanges are at Garden Gully Road, which services the Western Highway to the east, and Military Bypass Road, which services the Western Highway to the west.

Figure 8 Option 1A Alignment

6.2.2 Option 1C

This option deviates from the current highway alignment at Pollard Lane and heads in a northerly direction across paddocks to cross the railway line near Majors Road. The alignment will then head in a north-westerly direction alongside Railway Loop Road and then through agricultural properties to re-join the existing highway near Kimbarra Road.

Figure 9 Option 1C Alignment

6.2.3 Option 1E

This option follows a similar route to Option 1A, however it deviates slightly west of the existing highway approximately one kilometre along to avoid the section of the Ararat Regional Park located on the eastern side of the existing highway. At the northern end, 1E then deviates again from the 1A alignment and heads slightly south of the existing highway to follow the alignment of the railway line as opposed to crossing the railway line. The northern end of Option 1E connects into Options 2D and 2E with a new dual carriageway south of the existing highway.

As for Option 1A, two half diamond interchanges are proposed for the ultimate AMP1 access control. The locations for these interchanges are at Garden Gully Road, and Military Bypass Road, which services Armstrong to the east and west respectively.

Figure 10 Option 1E Alignment

6.3 Outcomes of Specialists Assessments

6.3.1 Flora and Fauna Assessment

The existing Western Highway road reserve contains areas of remnant native vegetation interspersed with cleared land. The native vegetation within and adjacent to the road reserve comprises variously Grassy Woodland EVC of high to very high conservation significance (the most common EVC in the zone), Grassy Dry Forest of medium to very high conservation significance, Creekline Grassy Woodland of high to very high conservation significance and Plains Grassy Woodland of high conservation significance.. Ararat Regional Park exists adjacent to the current Western Highway near the southern (Ararat) end of the zone and land within the balance of the zone comprises variously cleared farmland or small areas of remnant native vegetation. The Ararat Regional Park is located on either side of the existing highway north of Ararat. The largest area of the park is located to the north-east of the existing highway and of the railway line

The area comprising the segments of the Ararat Regional Park either side of the existing highway forms a significant wildlife corridor to the north-east. This corridor is potentially impacted by all alignment options in Zone 1 to varying degrees. It would especially be impacted by Option 1C which would create a new highway alignment which bisects a significant wildlife corridor between the two largest blocks of the Ararat Regional Park (the 2,670 ha Dunneworthy Block that commences immediately north-east of Option 1C, and the 820 ha Ararat Hills Block that commences immediately south-west of Option 1C). Option 1C would therefore result in additional points of conflict with road traffic instead of using the existing highway alignment.

A summary of the flora and fauna values of Options 1A, 1C and 1E is shown in Table 24. Options 1A and 1E run along the existing Western Highway, Option 1A for its entire length and Option 1B up until the Armstrong Deviation railway bridge, from where it continues along the western side of the highway rather than following the existing highway alignment across the railway. Option 1A has a greater impact on native vegetation and habitat than Option 1E from Ararat to the Armstrong Deviation because it runs further into cleared land adjacent to the highway to lessen impacts on native vegetation and habitat, including on the Ararat Regional Park. However, to the north of the Armstrong Deviation rail bridge, Option 1A has a lower impact than Option 1E because it avoids impacts on the very high conservation significance Grassy Woodland on the western side of the railway line. Option 1C has lower overall impacts on flora and fauna than Options 1A and 1E because it involves a significant deviation from the existing highway to run predominantly through cleared farmland to the east of the railway line. However, Option 1C has higher impacts on wildlife corridors than the other options, as described above, and does impact on areas of native vegetation (predominantly Grassy Woodland of high to very high conservation significance) as well as a large number of scattered large old trees within paddocks at the southern end of the zone.

Many individuals of the following plant species are located next to the existing highway in the vicinity of The Majors Road, thereby potentially affected to some extent by all options:

- Emerald-lip Greenhood (FFG Act listed); and
- Rosemary Grevillea (FFG Act listed).

However, most of these plants can be retained with minor modifications to the alignments of the options in this vicinity.

Many individuals of the Golden Sun Moth (listed as critically endangered under the EPBC Act) were recorded during targeted surveys both within and adjacent to Option 1E near Old Brewery Road and Petticoat Road and adjacent to Options 1A and 1C near the Armstrong Deviation Rail Bridge.

Overall, from a flora and fauna perspective, Option 1E is preferred in relation to EPBC and FFG considerations; however Option 1C is preferred in relation to Victoria's Native Vegetation Management – A Framework for Action.

6.3.2 Traffic and Transport

Options 1A and 1E would utilise the existing highway as one of the carriageways. Option 1C however introduces a new dual carriage highway into an area with small local unsealed roads.

Option 1A would require duplication of the existing railway crossing at the Armstrong Deviation and would utilise the existing railway crossing. Option 1C would require a new railway crossing. Option 1E does not require additional railway crossings.

All options appropriately address the traffic and transport evaluation criteria and would improve traffic flows and safety. Overall, Options 1A and 1E are considered more favourable as they utilise the existing highway and do not require new railway crossings.

6.3.3 Heritage Assessment

All options intersect registered scarred trees, and have potential to encounter other unknown sites of Aboriginal heritage significance, particularly near creek crossings. However, Option 1C has the highest risk of potential impacts on Aboriginal heritage sites because of the large number of scattered large old trees with hollows (potential Aboriginal mortuary trees) and a registered Aboriginal scarred tree and an artefact scatter within this alignment.

Options 1A and 1E intersect the former Armstrong Hotel, an old school site, and potential graves. These are sites of non-Aboriginal Victorian heritage. A site inspection was undertaken with Heritage Victoria following the option assessment and review of the first version of this report to determine if the potential grave sites would be impacted. It was considered by Heritage Victoria that the sites are unlikely to be graves, however excavation would be required to confirm this.

Option 1C has potential for impacting on the aesthetic value of the heritage listed Fountain Brewery. Heritage Victoria did not foresee that there are any potential 'show stoppers' relating to non-Aboriginal heritage for Alignments 1A, 1E or 1C that could not be managed. With Option 1C having the highest potential impact on Aboriginal heritage, Options 1A and 1E are preferred from an historic and cultural heritage perspective.

6.3.4 Planning and Land Use Assessment

All options sever a number of rural properties, however Option 1C has the greatest impact as it does not generally follow property boundaries, particularly at the southern end. Options 1A and 1E follow the existing highway and therefore intersect properties along their boundaries.

Option 1C traverses and divides rural landholdings potentially creating insufficient lot sizes, which is inconsistent with planning controls and policies. Options 1A and 1E are preferred as they have the least potential impact for existing and future farming land uses by following the existing highway alignment. Option 1C could also impact on an organic vineyard and its water supply.

6.3.5 Air Assessment

Option 1C was rated 'negligible' for all criteria as no sensitive receivers are located near enough to be impacted. Options 1A and 1E have approximately seven residences within 80 m of the construction corridor which have the potential to be impacted by construction dust. Option 1E is slightly more beneficial to the regional air pollutant load than the other options, as it is the shortest and exhibits better traffic flows than the existing highway. Overall, Option 1C is preferred from an air quality perspective, followed closely by Option 1E.

6.3.6 Noise Assessment

Option 1C will provide a minor noise benefit by moving the carriageway traffic further east, away from nearby dwellings. The other options move the carriageway closer to dwellings and therefore have minor potential impacts. Option 1C is preferred from a noise assessment perspective based on the number of nearby dwellings, however it does bring the freeway near properties that currently do not experience highway traffic noise.

6.3.7 Surface Water Assessment

Concongella Creek is the most significant watercourse in Zone 1, and is of low to medium habitat quality. Options 1A and 1E cross the creek three times, all at near perpendicular angles, which minimises impact. Option 1C has greater waterway health impacts because, although it also crosses the creek three times, one of these crossings is at an acute angle, and it also crosses the confluence of three minor waterways. Overall, Options 1A and 1E are equally preferred in relation to potential impacts on surface water.

6.3.8 Groundwater Assessment

All options have small areas of cut with the potential to interact with groundwater and could not be differentiated. Option 1E has the deepest cut, estimated to be 6 to 10 m, at the northern end adjacent to the railway line.

6.3.9 Landscape and Visual Assessment

Options 1A and 1E widen the road reserve, with Option 1E cutting into the Ararat Regional Park to a small extent, resulting in an impact upon this landscape of significant natural and cultural value. However, Option 1C proposes a totally new highway alignment, resulting in a more significant impact upon sensitive landscape character types and views from households. Overall, Options 1A and 1E rank equally as the preferred options.

6.3.10 Soils and Geology

All options have a minor potential for encountering gross contamination due to the proximity of the rail line. Options 1A and 1C cross a number of drainage lines, and in the case of Option 1C, it crosses two farm dams, which have potential for erosion and instability impacts. Overall, Option 1E is preferred with regard to potential or impacts relating to soils and geology.

6.3.11 Social Impact Assessment

The options generally follow two corridors; one that extends along the existing highway and the other that provides for a duplication across farmland to the north east of Armstrong. Options 1A and 1E stay the closest to the current highway alignment and hence, would have the least impact on access and land severance. Whilst Options 1A and 1E may have effects on access for adjacent landowners, this could also be a benefit if the opportunity is taken to make safer property entrances.

Option 1C extends across rural properties to the north east of Armstrong. This would have land severance impacts that could result in the gradual change of land from rural to rural residential/ rural lifestyle land uses.

In relation to community feedback, the options extending along the existing highway are favoured. Option 1A utilises the Armstrong Deviation and therefore is preferred due to its reduced land severance impacts and reduced impacts on community dislocation.

6.3.12 Economic Impact Assessment

Options 1A and 1E are considered to have the least impact on agricultural land as they extend along the existing highway, rather than dividing existing lots. Option 1C will result in significant severance of farm properties throughout the route, being particularly severe at the eastern end because of its diagonal orientation. Although no commercial or tourism businesses need to be acquired in any option, Option 1C, with the deviation north of Armstrong, will make travelling to Westgate Country House (in Westgate Road near Armstrong) more complicated for tourists and was therefore considered to potentially have a more significant impact for this criteria. Options 1A and 1C will require new rail crossings. Overall, Option 1E is most preferred as the alignment does not impact agricultural land, and does not impact rail traffic during construction.

7. Phase 2: Assessment of Zone 2 Alignment Options

7.1 Zone Description

Zone 2: Allanvale Road to Briggs Lane

Zone 2 includes four shortlisted alignment options that bypass the township of Great Western to the east and west. The existing highway comprises of single traffic lanes in both directions and extends through the centre of the Great Western township. The existing highway intersects a number of local roads, including Great Western – Moyston Road, which provides access to the Grampians National Park. The alignment options in Zone 2 provide a bypass for Great Western and do not follow the existing highway through the town. The characteristics and key constraints in Zone 2 include:

- On the south eastern side of Great Western adjacent to the existing highway (near Concongella Creek) is the Grampians Estate Vineyard, which is over 100 years old, and a historic homestead (not yet listed on the Heritage Register);
- An existing quarry and old landfill to the north east of Great Western off Sandy Creek Road;
- A bushland reserve north east of Great Western;
- Bests Winery, located north of Great Western off Bests Road, which is listed on the Heritage Register;
- The Australian Rail Track Corporation's (ARTC) interstate railway line is located to the south west of the existing highway;
- The confluence of Concongella Creek, Robinsons Creek and Donalds Creek on the north west side of Great Western;
- Rural Living Zone in areas to the south west of Great Western, suggesting future growth could occur to the south west;
- Primarily Farming Zone in the area to the east of Great Western;
- Historical heritage relating to former mining activities around Great Western; and
- The immediate area surrounding the Western Highway is predominantly low density residential, with agricultural land and bush reserves in the surrounding area.

Appendix C comprises mapbooks illustrating the alignments in Zone 2.

Table 25 provides a summary of the key aspects for Zone 2.

In the following figures, the purple outline represents the maximum construction foot print while the coloured lines represent the proposed alignment that is further described in the text.

Table 25 Summary of Potential Impacts for Zone 2

		Option 2B	Option 2C	Option 2D	Option 2E
Approximate Land Acquisition (ha)		113	128	94	100
Native Vegetation					
EVC (Bioregion)	***Conservation Status***	***Area Impacted (ha)***			
CGW (Central Victorian Uplands)	Endangered	4.6	3.8	2.5	0.8
CGW (Goldfields)	Endangered	0.7	0.7	0.5	0.5
GW (Goldfields)	Endangered	1.2	1.2	0.3	1.9
GW (Central Victorian Uplands)	Endangered	-	-	3.9	1.9
HW (Central Victorian Uplands)	Depleted	13.6	15.6	-	-
PGW (Central Victorian Uplands)	Endangered	16.4	14.5	9.7	5.0
PGW (Goldfields)	Endangered	8.0	5.8	6.9	6.9
Total Potential Native Vegetation Loss **(ha)**		44.5	41.7	23.9	15.4
Large old (LOT) and Very Large Trees (VLOT)		LOT: 6 VLOT: 1	LOT: 4 VLOT: 0	LOT: 6 VLOT: 4	LOT: 7 VLOT: 6
Heritage Values		DSE registry - Great Western Lead	DSE registry - Great Western Lead	Potential Mortuary Trees and area of Aboriginal value	Potential Mortuary Trees and area of Aboriginal value
Number of Waterway Crossings		8 significant waterway crossings 1 minor drainage line crossings	7 significant waterway crossings 5 minor drainage line crossings	8 significant waterway crossings 13 minor drainage line crossings	6 significant waterway crossings 14 minor drainage line crossings

7.2 Options Description

Following the Phase 1 assessment, Option 2E (as a variation of Option 2D) was added in Zone 2 to provide connection with options in Zone 1 and 3 located on the western side of the existing highway and railway.

7.2.1 Option 2B

This option involves a north-eastern bypass of Great Western and requires a new dual carriageway. The proposed bypass begins slightly north-west of Delahoy Road, with the alignment running north-west of an existing bushland reserve, and intersecting with Sandy Creek Road and Metcalfe Road. Option 2B runs directly through an existing quarry and gravel pit located adjacent to Metcalfe Road and Sandy Creek Roads. The alignment then crosses Hurleys Lane and Bests Road, to re-join the

existing highway at Briggs Lane. On and off ramps connecting to the existing highway either side of Great Western is proposed.

Figure 11 Option 2B Alignment

7.2.2 Option 2C

Similar to Option 2B, Option 2C provides a north-eastern bypass of Great Western. It involves a new dual carriageway and begins just south-west of Delahoy Road. It extends around the bushland reserve and the quarry located adjacent to Sandy Creek Road. Option 2C then crosses Hurleys Lane and Bests Road to re-join the existing highway near Briggs Lane.

On and off ramps connecting to the existing highway either side of Great Western are also proposed for this option.

Figure 12 Option 2C Alignment

7.2.3 Option 2D

This option bypasses the township of Great Western to the south-west, with divided east and west bound carriageways. The bypass is a continuation of Option 1E, which stays west of the railway line before deviating further south-west dissecting many local roads, including: St Ethels Road, Garden Gully Road, Moyston-Great Western Road and Roxborough Road. The option then follows St George Road in a northerly direction, crossing the railway line just before the alignment re-joins the existing highway near Briggs Lane. A full diamond intersection is proposed at Moyston-Great Western Road near Grellet Road.

Figure 13 Option 2D Alignment

7.2.4 Option 2E

This option generally follows the same alignment as Option 2D. However, rather than cross the railway line, Option 2E remains south-west of the railway and connects with Option 3C.

Figure 14 Option 2E Alignment

7.3 Outcomes of Specialists Assessments

7.3.1 Flora and Fauna Assessment

Zone 2 has the township of Great Western located in the centre and surrounding the town the land is either used for agriculture and/or contains areas of remnant woodland. The largest area of remnant woodland is to the north and north-east of the town. To the south-west of the town are patches of remnant vegetation and scattered large and very large old trees. The native vegetation is of very high and high conservation significance on both sides of Great Western.

The large area of vegetation to the north and north-east (adjacent to St George Road) of the town forms part of a wildlife corridor which is connected to vegetated land along Concongella and Allenvale Creeks to the south-west and south-east respectively. This wildlife corridor is potentially impacted by all alignment options in Zone 2.

A summary of the flora and fauna values of Options 2B, 2C, 2D and 2E is shown in Table 25. Options 2D and 2E each involve southern bypasses of the town and traverse land which is productive agriculture land with patches of of remnant native vegetation (predominantly relatively small areas of Plains Grassy Woodland of high to very high conservation significance) and scattered large and very large old trees. Options 2D and 2E are likely to involve lower impacts on flora and fauna than Options 2B and 2C, which each involve northern bypasses of the town and consequently, have potential to impact on the remnant woodland in this locality. Of the two northern bypass options, Option 2C has higher total estimated losses of vegetation, in particular on the Heathy Woodland of high to very high conservation significance. Further, the table presents a conservative estimate for the potential loss of Heathy Woodland for Option 2B because some of this vegetation is within extractive industry tenements which would be removed through current activities and quarry expansion. Option 2B has been located in areas already highly disturbed and where vegetation is proposed to be removed by extractive industry activities.

Many individuals of the Golden Sun Moth (listed as critically endangered under the EPBC Act) were recorded during targeted surveys both within and adjacent to Options 2D and 2E between the eastern end of Zone 2 and St Ethels Road. There are also large areas of potential Golden Sun Moth habitat to the south-west of Great Western.

The Brown Toadlet, which is state listed, was recorded north-east and north-west of Great Western during targeted surveys. The Brown Toadlet was also found to be widespread through the study area.

Options 2D and 2E would impact on less area of native vegetation than Option 2B, and particularly 2C. However Options 2D and 2E would have more potential impact on Golden Sun Moth habitat and scattered large and very large old trees.

Whilst Option 2B has more impact on significant native vegetation than Options 2D or 2E, the area of impact would be further reduced during detailed design through adopting minimum medium widths between carriageways. A conservative footprint was adopted for the alignment options assessment.

Overall, from a flora and fauna perspective, Options 2B and 2C are equally preferred in relation to EPBC and FFG considerations; however Option 2D is preferred in relation to Victoria's Native Vegetation Management – A Framework for Action.

7.3.2 Traffic and Transport Assessment

The alignment options bypass the town of Great Western, either to the north-east (Options 2B and 2C) or the south-west (Options 2D and 2E). All options appropriately address the traffic and transport evaluation criteria. A differentiator is the requirement for a rail crossing in Option 2D, which has the potential to impact rail travel times during construction. Options 2B, 2C and 2E therefore rank equal in relation to traffic and transport impacts.

The interchanges associated with Options 2B and 2C were considered to be more conducive to traffic flow through the town. This is because vehicles could exit the highway from one side of the town and then continue in the overall direction of travel to re-enter the highway. Whereas a single interchange, as proposed for Option 2D and 2E, would require travel into and out of Great Western by the same road, which would not flow with the overall direction of travel. The interchanges for Options 2D and 2E would, however allow direct connection to Great Western – Moyston Road which provides access to the Grampians.

It is noted that a differentiator between the south-western and north-eastern options is that two freeway interchanges are required for the latter at either end of Great Western, whereas only one freeway interchange is required for the southern options at Moyston-Great Western Road. It was assumed that the alignments will be designed to the appropriate Austroads and VicRoads standards, and as such, the provision of an additional interchange is not expected to materially impact upon road safety.

Option 2B utilises more of the existing highway than the other options. Options 2D and 2E have limited use of the existing highway.

Options 2B and 2C were considered to be more favourable as they are likely to enable better traffic flow through Great Western. Option 2B was preferred over 2C as it utilises more of the existing highway.

7.3.3 Heritage Assessment

All options were considered to have a low potential impact on historical heritage values. However Options 2B and 2C are equally preferred from a historic and cultural heritage perspective.

Options 2B and 2C follow the existing highway for some of their alignment which minimises impact, whereas Options 2D and 2E are greenfield alignments and therefore have greater risk of impact on Aboriginal heritage sites due to many scattered large old trees with hollows (potential Aboriginal mortuary trees) and large areas of Aboriginal heritage sensitivity being located within the alignments of these options.

Also Options 2D and 2E cross more waterways and tributaries which have potential areas of Aboriginal heritage values. Additionally, Options 2D and 2E were considered to transverse an area of Aboriginal cultural heritage sensitivity, as indicated by the predictive modelling and confirmed through consultation with the local Aboriginal community.

Options 2B and 2C are located on either side of the Great Western lead alluvial diggings that are listed on the heritage register but do not cross into the registered area.

7.3.4 Planning and Land Use Assessment

All options extend across farming land and would result in land severance impacts. However Option 2D and 2E result in the severance of a larger number of rural properties than Option 2B and 2C. They also impact on productive agricultural land to the west of Great Western.

The south-western options (2D and 2E) could also restrict future Great Western township growth. The Northern Grampians Municipal Strategic Statement acknowledges that Great Western's growth is restricted by its physical features and growth of the potential growth area connected to the existing township would be towards the west. Therefore, aligning the new road to the east will assist in minimising potential impacts due to the separation of the highway from the town and the growth of the town.

Option 2B is considered to have the least impact, as the alignment extends closer to property boundaries and does not sever large agricultural properties compared to the other options.

7.3.5 Air Assessment

Options 2B, 2C and 2E are equally favoured as no sensitive receivers are located near enough to be impacted by construction and operation emissions, and all provide some partial benefit to the regional air pollutant load by exhibiting better traffic flows than the existing highway. Option 2D would potentially impact nearby dwellings through temporary construction dust emissions, however it would also have a small long-term benefit to the regional air pollutant load by being the shortest option, combined with by-passing Great Western township.

7.3.6 Noise Assessment

All options would provide minor noise benefits by increasing the distance to dwellings overall. All alignment options require new dual carriageways in areas where there is currently no major road. Option 2B is closer to more dwellings than the other options, however some of the alignment length is proposed to be located within a large section of cut which provides some mitigation for noise and visual amenity impacts.

All options move the highway away from more dwellings than moving the highway closer, providing some noise benefits.

7.3.7 Surface Water Assessment

Some significant waterways flow into Concongella Creek on both sides of Great Western township. Option 2E does not involve an interchange impacting the health of these waterways, however selecting this alignment necessitates a connection with Option 3C in Zone 3 and this has potential significant impacts on Donald Creek.

Options 2B and 2C cross relatively long sections of flood extent, including substantial areas where interchanges are proposed. Options 2D and 2E cross less floodplain but potentially exacerbate local flooding at the northern end of the zone near the confluence of Robinsons and Cobeys Creek.

Great Western is known to have flooding issues and the existing highway is also flood affected. Alignment options that utilise the existing highway provide an opportunity to address flooding issues for the highway which may provide benefits for Great Western. On this basis, Options 2B was preferred and then Option 2C.

Overall, the preferred Option is 2E, however it is noted that this limits alignment options in Zone 3. Options 2C and 2D are equally the next preferred from the perspective of potential impacts on surface water. Option 2B was preferred in terms of providing opportunities to address flooding issues in Great Western associated with the existing waterway crossings.

7.3.8 Groundwater Assessment

Options 2B and 2C involve the greatest lengths of cut which may interact with groundwater, and therefore potentially have higher impacts than Options 2D and 2E, which have areas of cut that are shallow and limited in extent.

7.3.9 Landscape and Visual Assessment

Option 2B bypasses Great Western town centre (the intersection of Main Street and Paxton Street) by approximately 1 km. Impact upon the town and adjacent residents will be reduced to some extent by cutting the alignment into the existing topography north of Western View Road.

Option 2C also bypasses the township to the north upon elevated land, however it maintains further distance and is located behind a ridgeline over some of its length, reducing the anticipated visual impact.

The options that bypass Great Western to the south-west (2D and 2E) share the same alignment, however both differ as they meet the adjacent Zone 3. Option 2D matches with the existing Western Highway, north of rail line, while Option 2E stays on the southern side of the rail line. Both options bypass Great Western on relatively lower land and maintain a minimum proximity of 1.5 km from the town centre.

While parts of Option 2B may be more visible than 2C, 2D and 2E from the township, community consultation with local businesses suggested this could be beneficial by being able to see the town from the bypass and increasing the likelihood of passing traffic stopping to support the town businesses. Community consultation revealed more support for an eastern bypass of Great Western.

Option 2B would also be in a large area of cut for a portion of its length, thereby reducing visual impacts.

Options 2C, 2D and 2E rank equally with the least visual impacts, with Option 2B ranking lower due to being visual from the town. However, this visual impact could also be seen as positive through making the town visible to passing traffic.

7.3.10 Soils and Geology

Option 2B passes close to the former Great Western Landfill site adjacent to Metcalfe Road and has the potential to disturb the landfill causing contamination to the surrounding environment. The former landfill is in two sections, an older and deeper section to the south and a newer and shallower section to the north.

Option 2B passes through the northern edge of the shallower northern section of the former landfill. Golder Associates has conducted an investigation of the former landfill for VicRoads and has estimated that northern section of the landfill contains approximately 4,300 m^3 of compacted mixed solid inert and putrescible municipal waste with an average thickness of 1.6 m. This waste is overlain

by approximately 7,000 m^3 of compacted and loosely consolidated soil fill with an average thickness of approximately 1.4 m (Golder Associates, February 2011).

The landfill is located at the base of a former quarry and the surface of the landfilled area is approximately 6 m below the natural surrounding land elevation. It is anticipated that the road construction would require the excavation and re-burial of the waste material in a new landfill area engineered to EPA requirements. This will avoid the need for considerable new excavation for siting of the road in this locality, avoid the need to remove native vegetation and habitat on adjacent land and improve the environmental management of the waste which is within this old landfill area.

All options could be potentially impacted by localised gross contamination as they intersect areas occupied by sheep shearing sheds and all options apart from Option 2C would also have potential adverse impacts associated with erosion and instability.

Option 2C is therefore preferred. Options 2D and 2E could not be differentiated, and Option 2B ranked as having the largest potential impact in the Zone due to its alignment relative to the former Great Western Landfill. However it should also be noted that Option 2B travels through areas already substantially disturbed by quarrying activities.

Existing Quarry, north-east of Great Western

7.3.11 Social Impact Assessment

In relation to access considerations, Options 2B and 2C take the heavy vehicle traffic out of the township, and provide for direct access into Great Western via interchanges at either end of the town. The design of these options will make the township visible from the upgraded highway and easily maintain efficient public transport connectivity.

The options to the south west of the Great Western (Option 2D and 2E) would also assist in removing most of the heavy vehicle traffic out of Great Western, however it takes the single interchange further away from the town and would potentially increase travel times to other locations from Great Western.

In relation to land acquisition considerations, Option 2B is considered to have the least impact, as the alignment extends closer to property boundaries, does not sever large rural properties (compared to the other options) and only results in the potential acquisition of one dwelling. Option 2C will have slightly more impact than 2B, given it will impact on more rural properties and result in greater land

severance. Options 2D and 2E will have the greatest impact on land severance and are therefore least preferred as they are likely to have a more significant impact on change in the community.

7.3.12 Economic Impact Assessment

All options will have a moderately poor impact on existing businesses and tourism opportunities, including those in the town centre and the Grampians Estate Winery.

Option 2C will impose significant severance and direct land loss to the north-east of Great Western, while the area to the north-west of the town is less significant because of poorer quality land. A large area occupied by Bests Winery interests, but not containing the vineyard, will be acquired; however the owner has advised that this is not likely to be to the detriment of the business.

Options 2D and 2E will involve significant severance of agricultural land of relatively high quality, including an area of the Beringer Blass Wine Estate (Seppelts). Option 2D is also the only option which would be likely to result in a short closure of the rail line during construction.

Option 2B is preferred in relation to economic impacts although it will result in severance of small lots to north-east of the township, in the eastern-most section of the option the agricultural quality of the land is only fair.

Extractive Industry Tenements

Option 2B passes through three extractive industry tenements to the north of Great Western. Two of the sites (with Extractive Industry Work Authorities (WAs) 606 and 894), to the east of Sandy Creek and Metcalfe Roads, contain small adjoining pits and appear to be inactive. The third site (WA1149), to the west of Sandy Creek Road, is active. There are advantages, relating to obtaining construction material and obtaining appropriate vertical alignment of the new highway, in utilising these sites for the highway alignment. However, a potential negative impact relates to loss of raw materials for future construction materials in the locality. This negative impact is not considered significant as there is a large area with the same geology as the affected sites (Igneous Intrusives at surface) and two other sites with current Extractive Industry Work Authorities (WA 846 & 1335) within 4 km of the affected sites (Department of Primary Industries, GeoVic online, January 2012).

8. Phase 2: Assessment of Zone 3 Alignment Options

8.1 Zone Description

Zone 3: Briggs Lane to Gilchrist Road

Zone 3 includes five alignment options that extend from Briggs Lane north of Great Western to Gilchrist Road, south east of Stawell. The existing highway comprises of single traffic lanes in both directions and crossing of the railway at Harvey Lane (known as Oddfellows Bridge). The existing highway intersects with four local roads including London Road which is the busiest intersection along the entire Western Highway through Sections 2 and 3 of the Project.

The characteristics and key constraints in Zone 3 include:

- Substantial roadside vegetation including a patch near the interjection of Church Hill Crossing Road which has been found to contain significant flora and fauna species, and a flora and fauna reserve alongside the existing highway near Robson Road;
- Sisters Rocks council open space reserve, located on the north eastern side of the existing highway;
- Sisters Rocks Aboriginal Heritage site (listed on the Heritage Inventory) is located within the bushland reserve less than 100 m from the existing highway;
- Stawell Park Caravan Park is located south west of the Western Highway alongside Monaghan Road on the outskirts of Stawell, which has a high proportion of permanent residents;
- An 18-hole course is located next to the caravan park also on the south west side of the existing highway alongside Monaghan Road;
- Crossing of the ARTC railway line at Harvey Lane;
- Crossing of a number of waterway tributaries; and
- The area is predominantly agricultural land with a number of established dwellings located either side of the existing highway.

Appendix C contains mapbooks illustrating the alignments in Zone 3. Table 26 provides a summary of the key aspects for Zone 3.

In the following figures, the purple outline represents the maximum construction foot print while the coloured lines represent the proposed alignment that is further described in the text.

Table 26 Summary of Potential Impacts for Zone 3

		Option 3A	Option 3AD	Option 3B	Option 3C	Option 3DC
Approximate Land Acquisition (ha)		**68.7**	**171.7**	**57.2**	**76.9**	**109**
Native Vegetation						
EVC (Bioregion)	***Conservation Status***	***Area Impacted (ha)***				
CGW (Central Victorian Uplands)	Endangered	**1.2**	**2.8**	**0.4**	**2.8**	**2.8**
CGW (Wimmera)	Endangered		**0.4**			**0.4**
GW (Central Victorian Uplands)	Endangered		**4.1**		**7.7**	**3.6**
GW (Wimmera)	Endangered		**5.0**		**0.2**	**4.2**
HW (Central Victorian Uplands)	Depleted	**32.1**	**25.5**	**30.8**	**21.9**	**4.5**
HW (Wimmera)	Depleted		**0.4**			
PGW (Central Victorian Uplands)	Endangered	**10.3**	**4.0**	**7.6**	**3.3**	**0.9**
PGW (Wimmera)	Endangered	**1.6**	**3.3**	**1.6**	**1.6**	**3.3**
RS (Central Victorian Uplands)	Endangered		**0.2**			**0.2**
Total Potential Native Vegetation Loss (ha)		**45.5**	**45.7**	**40.5**	**37.5**	**20.0**
Large old (LOT) and Very Large Trees (VLOT)		LOT: 5 VLOT: 8	LOT: 11 VLOT: 11	LOT: 11 VLOT: 11	LOT: 11 VLOT: 4	LOT: 6 VLOT: 3
Heritage Values		Sisters Rocks – Historical and Aboriginal significance	View between Sisters Rocks and Black Range has high Aboriginal cultural heritage significance	Sisters Rocks – Historical and Aboriginal significance	Sisters Rocks – Historical and Aboriginal significance	View between Sisters Rocks and Black Range has high Aboriginal cultural heritage significance
Number of Waterway Crossings		7 significant waterway crossings 6 minor crossings	5 significant waterway crossing 29 minor crossings	5 significant waterway crossings 7 minor crossings.	4 significant waterway crossings 15 minor crossings,	4 significant waterway crossings 19 minor crossings,

8.2 Options Description

Following the Phase 1 assessment and through discussion with the TRG, alignment Option 3DC were was added to Zone 3 to provide an alternative to following the existing highway past Sisters Rocks and the Stawell Park Caravan Park. Option 3AD was a new option added to provide connection to a north-eastern bypass of Great Western in Zone 2 and Option 3DC in Zone 3.

8.2.1 Option 3A

This option involves duplication on the south-west side of the existing highway for north-bound traffic and the use of the existing highway for south-bound traffic from Briggs Lane to Stawell. This option has two separate railway crossings: 1) a new bridge for a single carriageway across the railway line and 2) the existing railway crossing at Odd Fellows Bridge (Harvey Lane) will be upgraded.

This option will require the realignment of Panrock Reservoir Road and an upgraded intersection with London Road. The roadside vegetation along the existing highway south of the railway crossing will be largely avoided and be incorporated into a wide median.

Figure 15 Option 3A Alignment

8.2.2 Option 3B

Option 3B comprises of a new dual carriageway on the north eastern side the existing highway (opposite side to O ption 3A). The existing highway will be used for north-bound traffic and south-bound traffic will use the new carriage way. This option has single railway crossing at the Oddfellows Bridge, which will be upgraded for a duplicated dual carriageway.

As for Option 3A, this option will require the realignment of Panrock Reservoir Road and an upgraded intersection with London Road. The roadside vegetation along the existing highway south of the railway crossing will be avoided and incorporated into a wide median.

Figure 16 Option 3B Alignment

8.2.3 Option 3C

This option comprises of a new dual carriageway extending from Option 2D along the south-west side of the railway line. It re-joins the existing highway near Harvey Lane and continues north-west following the existing highway to Stawell. Option 3C will require the realignment of Panrock Reservoir Road and an upgraded intersection with London Road.

Figure 17 Figure 3C Alignment

8.2.4 Option 3DC

This option comprises of a new dual carriageway extending from Option 2D along the south-west side of the railway line and then heading north through farming properties towards Stawell. The alignment is located about 1 km south-west of the existing highway. It crosses Panrock Reservoir Road and to the south-western side of the golf course and caravan park. Option 3DC re-joins the existing highway 1.6 km to the north of the London Road intersection with the existing highway, near Gilchrist Road.

A three quarter diamond interchange is proposed to connect to the existing highway near Gilchrist Road. This is the new option to provide an alternative entry into Stawell.

Figure 18 Figure 3DC Alignment

8.2.5 Option 3AD

This option begins following the same alignment as Option 3A, with a new duplication on the south west side of the existing highway for north bound traffic and using the existing highway for south bound traffic. Option 3AD deviates from the alignment of Option 3A before Odd Fellows Bridge, heading approximately 1 km to the south west. It crosses the railway line and Panrock Reservoir Road to then join with the alignment for Option 3DC for the connection to Stawell.

This option involves a new dual carriageway railway crossing. It also includes the same three quarter diamond interchange as proposed for Option 3DC that is 1.6 km north of London Road where it re-joins the existing highway.

Figure 19 Option 3AD Alignment

8.3 Outcomes of Specialists Assessments

8.3.1 Biodiversity and Habitat Assessment

Zone 3 has remnant native vegetation within the Western Highway and other road reserves, alongside Pleasant Creek and on a large area to the east and south-east of London Road in the vicinity of Sisters Rocks. The balance of the land within Zone 3 is predominantly cleared farmland.

Adjacent to the railway is Heathy Woodland, Grassy Woodland and Golden Sun Moth habitat. At the western end of the alignment, Trailing Hop-Bush (listed as Vulnerable under the EPBC Act) and Emerald-lip Greenhood (listed as vulnerable under the FFG Act) have been identified within and adjacent to the road reserve (managed by DSE). From the outset of the options assessment, the alignments between Great Western and Stawell that followed the existing highway were assumed to avoid the significant roadside vegetation near Churchill Crossing Road and in the Crown land reserve near London Road.

Pleasant Creek runs to the west of the existing highway (not crossed by the highway) which has riparian vegetation consisting of Grassy Woodland and Creekline Grassy Woodland. The remaining area is predominantly cleared farmland with scattered indigenous trees and native vegetation in road reserves. The road reserves contain Heathy Woodland with patches of Plains Grassy Woodland and Grassy Woodland.

A summary of the flora and fauna values of Options 3A, 3AD, 3B, 3C and 3DC is shown in Table 26 . Options 3A and 3B, which each run along the existing highway throughout the zone, potentially have

the impacts on Heathy Woodland of very high conservation significance adjacent to the existing highway south-east of London Road and Plains Grassy Woodland of very high conservation significance adjacent to the highway north-west of London Road. However, the estimated total losses of vegetation for each of these options presented in Table 26 is conservative because the losses can be significantly reduced by a combination of:

- moving the alignment of the new carriageway further into the adjacent farmland to the south-east of the railway crossing (Harvey Lane); and
- moving the new carriageway between London Road and the outskirts of Stawell into paddocks on the north-east side of the current highway in order to avoid any impacts on significant roadside vegetation in this locality including the vegetation community Grassy Eucalypt Woodland of the Victorian Volcanic Plain (listed as critically endangered under the EPBC Act), many Trailing Hop Bush plants (listed as vulnerable under the EPBC Act) and many Emerald-lip Greenhood plants (listed as vulnerable under the FFG Act).

Many individuals of the following species of plant exist adjacent to the existing highway near its intersection with London Road:

- Trailing Hop-bush (EPBC Act listed);
- Emerald-lip Greenhood (FFG Act listed); and
- Rising Star Guinea-flower (FFG Act listed).

However, impact on most of these plants can be avoided with minor modifications to the alignment of the new highway.

The large area of native vegetation either side of the existing highway between London Road and Harvey Lane forms part of a significant wildlife corridor which continues to the south and west through vegetated areas along Panrock Reservoir Road and Pleasant Creek respectively. This wildlife corridor is potentially impacted to varying degrees by all alignment options in Zone 3.

Option 3AD has the same alignment and consequent impacts as Option 3A at the south-eastern end of the zone but then diverts from the existing road reserve through cleared farmland and across Pleasant Creek to rejoin the highway near Gilchrist Road at the north-western end of the zone. Option 3DC, which joins either of the southern bypasses of Great Western (Options 2D or 2E) at the south-eastern end of Zone 6 to run along the southern side of the railway line before following the same alignment as Option AD into Stawell, has higher potential flora and fauna impacts than Option 3AD. This is due to its potential impacts on Heathy Woodland, Grassy Woodland and Creekline Grassy Woodland (each of very high conservation significance) along the southern side of the railway line at the south-eastern end of the zone. Further, Options 3AD and 3DC each involve a new crossing of Pleasant Creek through an area of Grassy Woodland and Creekline Grassy Woodland of very high conservation significance.

Option 3C has the same alignment as Option 3DC at the eastern end of the zone but stays alongside the railway line to rejoin the highway at Harvey Lane. It therefore has similar potential impacts to Option 3DC at the south-eastern end of the zone and similar potential impacts to Options 3A and 3B at the north-western end of the zone, including through the locality of Sisters Rocks.

Overall, all the options have impacts to flora and fauna values as they are located either in or adjacent to the road or railway reserves, or involve a new waterway crossing.

Options 3A, 3B and 3C have higher potential impacts to the nationally listed Trailing Hop-bush, whereas Options 3AD and 3DC would have more impact to scattered Large and Very Large Old Trees and require a new crossing of Pleasant Creek.

8.3.2 Traffic and Transport Assessment

Options 3A and 3B follow the existing highway alignment and require duplication of the Oddfellows Bridge. Option 3C follows the rail alignment on the west side and Options 3AD and 3DC are new alignments to the west of the golf course. All alignment options perform equally well in terms of road safety. There is however, differentiation in the following criteria:

- Travel times during construction – Options 3C and 3DC do not require new rail crossings and therefore have negligible impacts in this regard. Other options require a new rail crossing and may cause interruption to rail services during construction;
- Travel times during operation – Options 3AD and 3DC are longer alignments relative to the other options. Due to this, they offer no improvement in travel time (despite the increase in operating speed) in comparison to the existing highway operating at 100 km/h; and
- Meeting AMP3 requirements – Options 3AD and 3DC are new alignment options and will introduce new intersections with the highway.

Option 3C ranks marginally higher than Options 3A and 3B (equal second). Options 3AD and 3DC rank fifth and fourth, respectively in relation to traffic and transport impacts.

8.3.3 Cultural Heritage Assessment

A key consideration in the selection of a proposed alignment was cultural heritage values. Sisters Rocks is a ceremonial Aboriginal heritage site (although not listed on the Aboriginal Heritage Register) located adjacent to the intersection of the existing highway and London Road. Sisters Rocks also have historical cultural significance and it is listed on the DSE heritage register. There is a visual connection between Sisters Rocks and the Black Range located to the south-west and outside the Project area. This view has high Aboriginal cultural significance.

Pleasant Creek also has significant Aboriginal cultural value and there is potential for other significant sites, such as mortuary trees and burnt mounds, to be located in the area west and south-west of the alignment.

Options 3C, 3AD and 3DC are predominately greenfield alignments and all have significant risk for potential Aboriginal heritage impacts and in particular potential mortuary trees and burnt mounds which have previously been located in the area. Options 3AD and 3DC involve a new crossing of the Pleasant Creek where know sites of Aboriginal Cultural Heritage value are located. These options also travel through an area of cultural value and would impact on the visual connection between the Black Rock Range and Sisters Rocks, which is a view that is highly valued to the Aboriginal community. For this reason, the rating for these three options is unlikely to change following further consultation and field work. Based on the available information Option 3DC was rated ‘very poor’ for risk of impacts on mortuary trees and burnt mounds, and this is the least favoured of the options in this Zone.

Options 3A and 3B are immediately adjacent to Sisters Rocks. However it was assumed that the footprint would be constrained through this area with a narrow median to reduce impacts to the

vegetation on either side of the alignment which would also reduce the potential impact on Sisters Rocks.

Overall, whilst Options 3A and 3B are located close to Sisters Rocks they are considered to have lower potential negative impacts on Aboriginal Cultural Heritage by following the existing Western Highway alignment.

8.3.4 Planning and Land Use Assessment

The options that extend along the existing highway (3A, 3B, and 3C) were considered to have less impact on existing farming land, land access and property severance because 3A and 3B use the existing road reserve and 3C follows the railway line and then the road reserve. Option 3C however, would require more acquisition of private land for two new carriageways, whereas Options 3A and 3B utilise the existing highway.

The other options (3AD and 3DC) extend through farm properties over a distance of approximately 6 km and would result in inappropriate subdivision in this rural zone. This could potentially result in land ownership changes and transition from rural land uses due to the reduced lot sizes.

8.3.5 Air Quality Assessment

Options 3C, 3AD and 3DC are equally favoured as no sensitive receivers are located near enough to be impacted by construction and operation emissions, and neither option adversely impacts the regional pollutant load. Options 3A and 3B would potentially impact nearby dwellings through construction dust emissions.

8.3.6 Noise and Vibration Assessment

Options 3AD and 3DC are preferred as the carriageway will be further west than the existing highway, decreasing potential noise impacts for the majority of dwellings.

8.3.7 Surface Water Assessment

All Options have minor potential impacts on waterway health by crossing watercourses with low habitat quality. Option 3C also potentially exacerbates flooding and is therefore least preferred. The other options could not be differentiated in relation to potential impacts on surface water.

8.3.8 Groundwater Assessment

All options have shallow cuts along their length. Option 3AD involves the deepest cut of 6 to 8 m, and a long cut of 4 to 6 m depth at its northern end. This is potentially the least favourable of all of the options within this zone for potential impacts on groundwater, however is still rated as ‘low’.

Option 3DC is preferred due to the greater extent of shallow cut, compared to other options.

8.3.9 Visual and Landscape Assessment

Options 3A and 3B retain the existing Western Highway alignment, duplicating the road either to the south-east (Option 3B) or north-west (Option 3A). Both of these options were ranked equally as the preferred duplication option from a landscape and visual perspective. The other options 3C, 3AD and 3DC propose a new alignment for the highway where no major road currently exists, resulting in a

greater impact upon local households, particularly for 3AD and 3DC on the group of houses located off Robson Road in the north.

8.3.10 Soils and Geology

The differentiating criteria were exposure to watercourse embankments, and instability. Option 3B was rated as having 'negligible' risk of watercourse and stability impacts, whereas Option 3A rated as slightly more significant due to the presence of a minor farm dam. Options 3A, 3B and 3C are preferred, while Options 3AD and 3DC were equally rated as having more impacts as they require a to new crossings of Pleasant Creek. Options 3Ad and DC have higher erosion potential, likely wet subgrade conditions and alluvial deposits with the potential for stability and construction issues.

8.3.11 Social Impact Assessment

The alignment options in Zone 3 either extend along the existing highway or extend across rural properties to the south west of the existing highway. It is considered the options extending along the existing highway will have less impact on land access and property severance, given the use of the existing road reservation compared to options extending across rural properties.

Option 3A will have the least impact on land severance and is considered to have a potential benefit in relation to improved safety and access to community facilities. Options 3C, 3AD and 3DC will result in higher land severance impacts and increased potential for land ownership changes and transition from rural land uses to rural lifestyle closer to Stawell due to the reduced lot sizes.

Option 3A is preferred (followed by 3B) due to its use of the existing highway, ability to limit changes to land use patterns and maintain access to community facilities. Options extending across farming properties, resulting in land severance and inappropriate lot sizes are least preferred due to the high potential for changes.

8.3.12 Economic Assessment

Options 3A, 3B and 3C have low impact on agricultural land as they follow the existing highway alignment. Impacts from Options 3AD and 3DC would be more significant because they extend through farming properties over a distance of approximately 6 km. However, Options 3A, 3B and 3C would change the direct access to the golf course and caravan park, and therefore possibly adversely impact these businesses. Access would be provided to the caravan park and gold course, and it is assumed that an appropriate signage strategies would reduce potential impacts.

Options 3A, 3B and 3AD will require construction activities to be scheduled with rail operations.

Although little separates all the options in relation to overall economic impacts, Options 3A, 3B and 3C were considered to have lower economic impacts by impacting less agricultural land.

9. Phase 2: Options Assessment Outcomes

9.1 Options Assessment Matrix

The objective of the alignment options assessment for the EES is to select alignments that minimise potential adverse environmental, social and economic impacts whilst maximising the benefit to be gained as a result of the project proceeding.

To allow for a balanced consideration of the outcomes of each assessment an Options Assessment Matrix was created, as described in Section 2.5.1. The Options Assessment Matrix compiles the outcomes of the specialists' assessments and provides a ranking of alignment options in each zone based on the total weighted score, as shown in Table 27. Further details of the specialists' assessment that informed the matrix are provided in Chapters 4 to 8, and Appendix G to Appendix R.

The following sections discuss the outcomes to date and the options that are proposed to be further assessed in the EES process. The higher ranked options have been reviewed to determine what option will be further considered in the EES process. In addition to the rankings, the connection between zones has been considered to determine the proposed alignment further assessed in the EES.

9.2 Zone 1

A combination of Option 1E (duplication along the existing highway alignment with some new carriageway on the east side and some on the west side of the existing highway) and Option 1A (duplication with new carriageway along the east side of the existing highway) has been recommended for Zone 1 for further assessment in the EES process. The recommended alignment involves Option 1E for most of the zone and then adopts the Option 1A alignment to utilise the Armstrong Deviation at the northern end of Option 1A. This alignment has been assessed as having the lowest overall negative impacts of the three shortlisted options which were assessed for Zone 1. Option 1A and 1E ranked very closely overall in Zone 1, as shown in Table 27.

As described in Section 6.3.1, Option 1E has less overall impact on native vegetation and habitat than Option 1A from Ararat to the Armstrong Deviation because it runs further into cleared land adjacent to the highway to lessen impacts on native vegetation and habitat, both within the road reserve and within the Ararat Regional Park. However, to the north of the Armstrong Deviation rail bridge, Option 1A has a lower impact than Option 1E because it avoids impacts on the very high conservation significance Grassy Woodland and on scattered large old trees on the western side of the railway line.

Option 1C has lower impacts on roadside native vegetation than Options 1A and 1E because it involves a significant deviation from the existing highway to run predominantly through cleared farmland to the east of the railway line. However, Option 1C does impact on patches of native vegetation (predominantly Grassy Woodland and Creekline Grassy Woodland of high to very high conservation significance) as well as a scatter large and very large old trees within paddocks at the southern end of the zone.

Further, Option 1C creates a new highway alignment which bisects a significant wildlife corridor between the two largest blocks of the Ararat Regional Park (the 2,670 ha Dunneworthy Block, which commences immediately north-east of Option 1C, and the 820 ha Ararat Hills Block, which

commences immediately south-west of Option 1C). Option 1C would therefore result in additional points of conflict with road traffic compared to using the existing highway alignment.

All options in Zone 1 potentially impact on the Golden Sun Moth (listed as critically endangered under the EPBC Act) because this moth has recently been found in grassland scattered throughout the zone.

Option 1C is rated as 'poor' for risk of impacts on Aboriginal heritage sites because of the large number of scattered large old trees (potential Aboriginal mortuary trees) and a registered Aboriginal scarred tree and an artefact scatter within this alignment.

Option 1C would have higher negative impacts on land use, social and economic values than Options 1A and 1E because it involves a new highway alignment which severs many rural properties to the east of the Armstrong village and would therefore have greater impacts on land use, households and farm businesses than Options 1A and 1E. Option 1C would also have greater negative impacts on landscape and visual values than Options 1A and 1E because it involves construction of a new highway through a rural landscape where no major road exists at present, whereas Options 1A and 1E involve duplication of the existing highway. In addition, Option 1C has higher potential impacts relating to land stability because it crosses two farm dams as well as a number of drainage lines. A combination of Options 1A and 1E has therefore been recommended because it has lower potential impacts on land use, social and economic values. Components of Options 1A and 1E with the lower impacts on flora and fauna values was recommended for Zone 1.

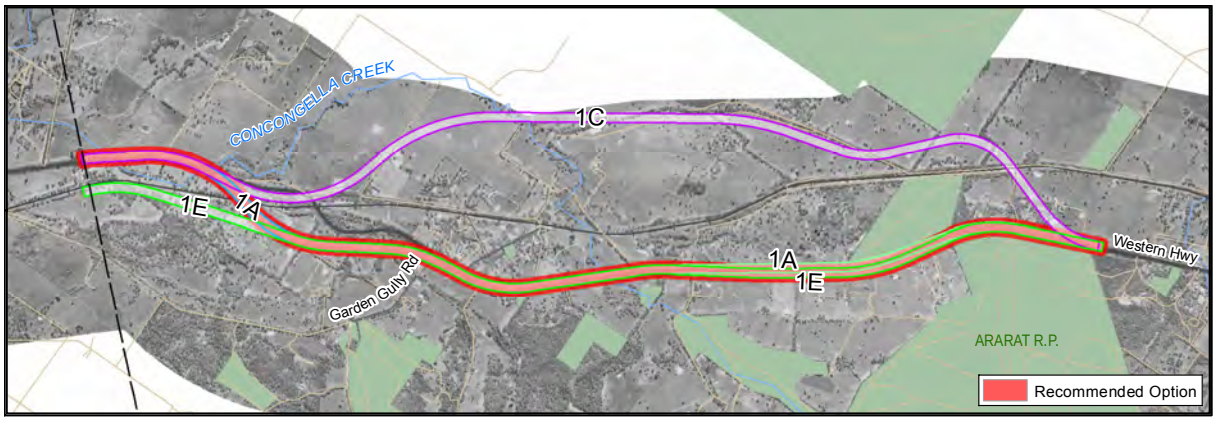


Figure 20 Zone 1 shortlisted and recommended option

9.3 Zone 2

Option 2B (new highway by-passing the township of Great Western to the east but closer to the town than Option 2C) was selected as the recommended option for Zone 2 and was further assessed in the EES. This option was assessed as having, on balance, the lower overall impacts of the four shortlisted options which were assessed for Zone 2, as shown in Table 27.

A bypass of Great Western to the east has been recommended because it:

- Results in lower potential social and economic impacts through less land severance of productive agricultural land;

- Has less potential impact to areas of Aboriginal cultural sensitivity as indicated by the predictive modelling and confirmed through consultation with the local Aboriginal community;
- Provides better connectivity to Great Western with interchanges on either side of the town that would be more conducive to flow through traffic than a single interchange to the west of the town;
- Would not restrict the future growth of Great Western, or place additional pressure upon services proposed by Council due to land severance; and
- Has less potential impact to confirmed and potential Golden Sun Moth habitat, and large and very large old trees.

A bypass to the north-east would also enable the existing area of cut created by the operating quarry to be utilised. It also located in an area identified for potential expansion of the quarry.

As described in Section 7.3.1, the potential impacts of Options 2D and 2E are likely to involve lower impacts on significant EVCs than Options 2B and 2C, which each involve northern bypasses of the town and consequently, have potential to impact on the remnant woodland in this locality. Options 2D and 2E have higher potential impact to large and very large old trees, and Golden Sun Moth.

Of the two northern bypass options, Table 25 shows that Option 2C has higher total estimated losses of vegetation, in particular on the Heathy Woodland of high to very high conservation significance. Further, the table presents a conservative estimate for the potential loss of Heathy Woodland EVC for Option 2B (the recommended option) because some of this vegetation is within extractive industry tenements which would be removed through current activities and quarry expansion. Option 2B has been located in areas already highly disturbed and where vegetation is proposed to be removed by extractive industry activities.

Option 2B has been selected as the recommended option rather than Option 2C because it severs fewer properties and requires removal of less native vegetation. Option 2B severs fewer properties and has less negative impacts on social and economic values than Option 2C. The potential visual impact of Option 2B will be mitigated in part, however the ability to be able to see the township from the bypass has been noted as a positive by business owners in the town with the visibility to passing traffic increasing the potential that travellers may stop and support the town businesses.

Option 2B passes close to the shallower northern section of former Great Western Landfill site adjacent to Metcalfe Road and has the potential to disturb this part of the landfill causing contamination to the surrounding environment. It is anticipated that the road construction would require the excavation and re-burial of the waste material (approximately 4,300 m^3 as outlined in Section 7.3.10) in a new landfill area engineered to EPA requirements. This will avoid the need for considerable new excavation for siting of the road in this locality, avoid the need to remove native vegetation and habitat on adjacent land and improve the environmental management of the waste which is within this old landfill area.

The two shortlisted options which involve a by-pass of the town of Great Western to the west (Options 2D and 2E) have lower impacts on native vegetation than both Options 2B and 2C, however they involve the severance of many more properties than Options 2B and 2C and consequently, have higher social and land use impacts. Options 2C and 2D also have a higher risk of impacts on Aboriginal heritage values, with a rating of 'poor' in this context due to many scattered large old trees (potential Aboriginal mortuary trees) and large areas of Aboriginal heritage sensitivity being located within the alignments of these options. Option 2B has been recommended because it has lower

potential impacts on social, economic and cultural heritage values. Option 2B also has less flora and fauna impacts than Option 2C.

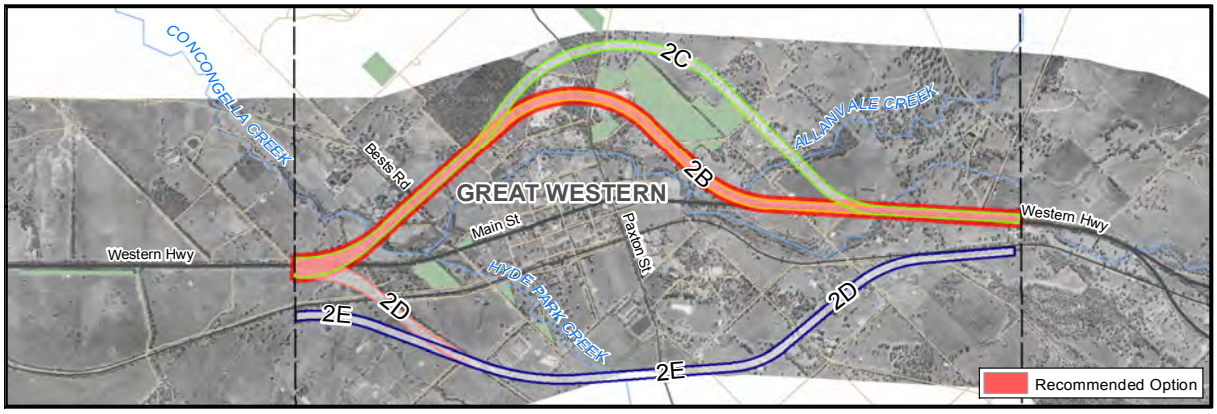


Figure 21 Zone 2 shortlisted and recommended option

9.4 Zone 3

Option 3A (duplicated carriageway on the western side of the existing highway) and Option 3B (duplicated carriageway on the eastern side of the existing highway) were closely ranked in Zone 3.

Option 3B was considered to have the lowest overall negative impacts of the five shortlisted options which were assessed for Zone 3 (Table 27). Option 3B has slightly lower overall impacts than Option 3A (the other option involving duplication of the existing highway), has better connection to the recommended option for Zone 2 (Option 2B) and involves less removal of roadside vegetation.

As described in Section 8.3.1, Options 3A and 3B, which each run along the existing highway throughout the zone, potentially have the highest impacts on flora and fauna, principally on Heathy Woodland of very high conservation significance adjacent to the existing highway south-east of London Road and Plains Grassy Woodland of very high conservation significance adjacent to the highway north-west of London Road. However, the estimated total losses of vegetation for each of these options, as presented in Table 26, are conservative for the options assessment and are expected to be reduced through detailed design.

At the south-eastern end of the zone Option 3AD has the same alignment and consequent impacts as Option 3A but then 3AD diverts from the existing road reserve through cleared farmland and across Pleasant Creek to re-join the highway near Gilchrist Road at the north-western end of the zone. Option 3DC joins either of the southern bypasses of Great Western (Options 2D or 2E) at the south-eastern end of Zone 3 and runs along the southern side of the railway line before following the same alignment as Option AD into Stawell. Option 3DC has higher potential flora and fauna impacts than Option 3AD. This is due to its potential impacts on Heathy Woodland, Grassy Woodland and Creekline Grassy Woodland (each of very high conservation significance) along the southern side of the railway line at the south-eastern end of the zone. Further, Options 3AD and 3DC each involve a new crossing of Pleasant Creek through an area of Grassy Woodland and Creekline Grassy Woodland of very high conservation significance.

Option 3C has the same alignment as Option 3DC at the eastern end of the zone but stays alongside the railway line to rejoin the highway at Harvey Lane. It therefore has similar potential impacts to

Option 3DC at the south-eastern end of the zone and similar potential impacts to Options 3A and 3B at the north-western end of the zone, including through the locality of Sisters Rocks.

Options 3B and 3A have considerably lower overall negative impacts than the three options which involve large sections of new dual carriageway highway alignment (Options 3C, 3AD and 3DC). The latter options have much higher risk of impact on Aboriginal heritage sites and values, in particular Option 3DC, which has a 'very poor' rating for the risk of encountering Aboriginal mortuary trees and burnt mounds. Option 3DC also has a 'poor' rating for potential impact on Aboriginal cultural heritage, as it involves a major new road through a landscape which is of significant value to the Aboriginal community. Option 3DC would impact on the views between Sisters Rocks and Black Rock Range which is of high cultural value to the local Aboriginal community. Options 3C, 3AD and 3DC also have higher visual impacts (due to the new highway alignments through a landscape that currently has no major road) and higher impacts on soils and geology (in particular due to the need for a totally new crossings of Pleasant Creek and several of its tributaries for these options). In addition, Options 3AD and 3DC have higher impacts on land use and social values because they each involve considerable severance of farming properties over a distance of approximately 6 km.

Options 3A and 3B have lower potential impacts on cultural heritage, social, visual and land use values, however Option 3B was recommended because had lower potential impacts to flora and fauna values than Option 3A. During Phase 3 however, the recommend option was changed to follow Option 3A. Subsequent consultation with the landowners affected by Option 3B and 3A revealed that there were significant concerns with 3B on the viability of remaining land and water supplies for the properties. The landowner affected by Option 3A however was accepting of the project so the alignment was altered to be on the western side and a wide median to protect significant vegetation adjacent to Churchill Crossing Road. DSE were consulted about this change in alignment through Phase 3 of the assessment.

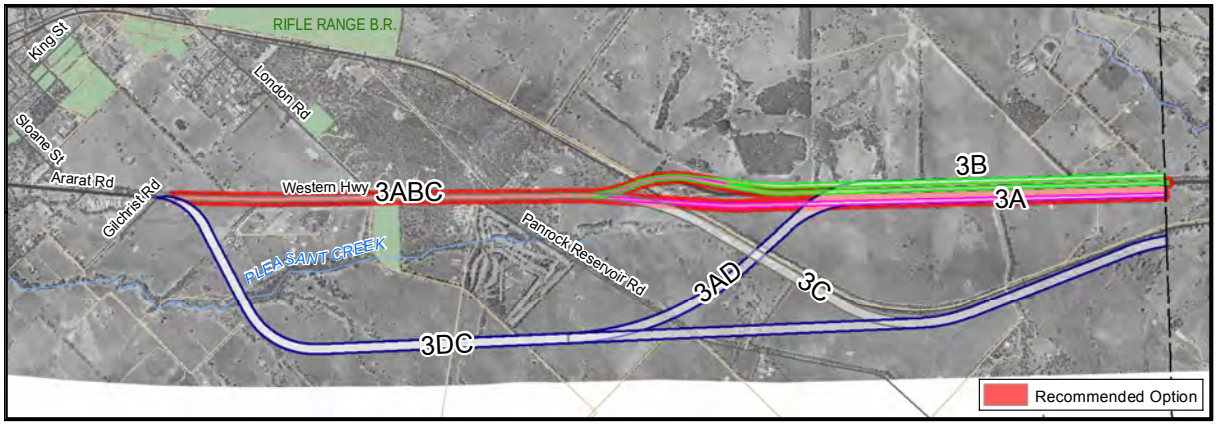


Figure 22 Zone 3 shortlisted and recommended option

Table 27 Options Assessment Matrix for Section 3

SECTION 3				Specialist Area	1			2				3				
					1A*	1C*	1E*	2B*	2C*	2D*	2E*	3A*	3B*	3C*	3AD	3DC
VicRoads Project Objectives		**Evaluation Criteria**														
1	Provide safer conditions for all road users by: * reducing the incidence of head-on and run-off-road crashes; * improving safety at intersections; and * improving safety of access to adjoining properties.	a	Impact on road safety	**Traffic and Transport**	WELL	WELL	WELL	WELL	WELL	WELL	WELL	WELL	WELL	WELL	WELL	WELL
2	Improve efficiency of freight by designing for High Productivity Freight Vehicles	b	Impact on travel times during constuction phase - includes impact to rail users	**Traffic and Transport**	LOW	LOW	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	LOW	NEGLIGIBLE	LOW	LOW	NEGLIGIBLE	LOW	NEGLIGIBLE
		c	Travel times for highway road users during operation phase	**Traffic and Transport**	MODERATELY WELL	MODERATELY WELL	MODERATELY WELL	VERY WELL	VERY WELL	VERY WELL	VERY WELL	MODERATELY WELL	MODERATELY WELL	MODERATELY WELL	NEGLIGIBLE	NEGLIGIBLE
		d	Degree to which AMP3 requirements are met	**Traffic and Transport**	MODERATELY WELL	MODERATELY WELL	MODERATELY WELL	PARTIAL	PARTIAL	PARTIAL	PARTIAL	MODERATELY WELL	MODERATELY WELL	MODERATELY WELL	PARTIAL	PARTIAL
3	Provide adequate & improved rest areas		N/A - incorporated into design of all options													
4	Locate alignment to allow for possible future bypasses of Beaufort and Ararat.		N/A - screened during Rapid Assessment													
				Rank	2	2	1	1	1	4	1	2	2	1	4	5
				Weighted Score	7.0	7.0	7.1	7.5	7.5	7.4	7.5	7.0	7.0	7.1	6.1	4.6
Draft EES Evaluation Objectives		**Evaluation Criteria**														
5	To provide for the duplication of the Western Highway between Ararat and Stawell to address safety, efficiency and capacity issues.		N/A - this is the objective of the project and addressed in Criteria 1 and 2 above													
6	To avoid or minimise effects on species and ecological communities listed under the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth) and/or the Flora and Fauna Guarantee Act 1988 (Vic).	a	Impacts to Matters of National Environmental Significance (MNES).	**Flora and Fauna**	POOR	POOR	LOW	NEGLIGIBLE	NEGLIGIBLE	LOW	LOW	LOW	LOW	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE
		b	Avoid impacts to species, communities and processes listed under the FFG Act	**Flora and Fauna**	POOR	LOW	POOR	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	POOR	POOR	LOW	POOR	POOR
				Rank	3	2	1	1	1	3	3	4	4	1	2	2
				Weighted Score	2.0	2.8	3.2	4.2	4.2	3.6	3.6	3.2	3.2	4.6	3.8	3.8
7	To comply with requirements and best meet the objectives of 'Victoria's Native Vegetation Management – A Framework for Action' and to minimise impacts on wildlife corridors.	c	Impact to native habitat and vegetation which is of very high conservation significance.	**Flora and Fauna**	VERY POOR	LOW	VERY POOR	POOR	POOR	LOW	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	LOW
		d	Net gain requirements for removal of native vegetation.	**Flora and Fauna**	POOR	POOR	VERY POOR	POOR	VERY POOR	POOR	POOR	MODERATELY POOR	MODERATELY POOR	POOR	MODERATELY POOR	MODERATELY POOR
		e	Impact on wildlife corridors (considering extent, connectivity and known species records).	**Flora and Fauna**	LOW	POOR	LOW	POOR	POOR	LOW	NEGLIGIBLE	LOW	LOW	POOR	LOW	MODERATELY POOR
				Rank	2	1	3	3	4	1	2	2	2	5	2	1
				Weighted Score	2.0	2.8	1.6	2.0	1.6	3.2	3.0	3.2	3.2	2.4	3.2	3.4
8	To avoid or minimise disruption and other adverse effects on infrastructure, land use (including agriculture) and households, as well as road users during construction and/or resulting from the highway alignment.	a	Impact on major utility services	**Planning and Landuse**	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE
		b	Extent and impact of change to **existing land use** (consistency with applicable planning policies)	**Planning and Landuse**	NEGLIGIBLE	LOW	NEGLIGIBLE	LOW	LOW	MODERATELY POOR	MODERATELY POOR	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	MODERATELY POOR	MODERATELY POOR
		c	Extent and impact of change to **future land use** (consistency with applicable planning policies)	**Planning and Landuse**	NEGLIGIBLE	LOW	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	LOW	LOW	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	MODERATELY POOR	MODERATELY POOR
				Rank	1	3	1	1	1	3	3	1	1	1	4	4
				Weighted Score	5.0	4.2	5.0	4.5	4.5	3.7	3.7	5.0	5.0	5.0	3.4	3.4
		d	Impact on Access, mobility and social severance	**Social**	NEGLIGIBLE	LOW	NEGLIGIBLE	LOW	LOW	MODERATELY POOR	MODERATELY POOR	NEGLIGIBLE	NEGLIGIBLE	LOW	LOW	LOW
		e	Impact of the full or partial acquisition of properties	**Social**	NEGLIGIBLE	LOW	LOW	LOW	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	NEGLIGIBLE	LOW	LOW	LOW	MODERATELY POOR
		f	Experiences of the local environment • Impacts from dislocation effects	**Social**	NEGLIGIBLE	MODERATELY POOR	NEGLIGIBLE	LOW	LOW	MODERATELY POOR	MODERATELY POOR	PARTIAL	NEGLIGIBLE	LOW	LOW	LOW
		g	Experiences of the local environment - • Impacts on community facilities	**Social**	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	LOW	LOW	PARTIAL	PARTIAL	LOW	LOW	LOW
		h	Community Context • The expressed preferences and concerns of local people	**Social**	NEGLIGIBLE	LOW	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	MODERATELY POOR	MODERATELY POOR	LOW	LOW	LOW	LOW	MODERATELY POOR
				Rank	1	3	2	1	2	3	3	1	2	3	3	5
				Weighted Score	5.0	3.9	4.8	4.3	4.1	3.1	3.1	5.0	4.6	4.0	4.0	3.5
		i	Businesses affected by acquisition	**Economic**	LOW	MODERATELY POOR	LOW	LOW	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	LOW	LOW	LOW	MODERATELY POOR	MODERATELY POOR
		j	Impact on accessibility for industry and tourism opportunities	**Economic**	NEGLIGIBLE	LOW	NEGLIGIBLE	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	LOW	LOW
		k	Impact on rail operations during construction	**Economic**	LOW	LOW	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	LOW	NEGLIGIBLE	LOW	LOW	NEGLIGIBLE	LOW	NEGLIGIBLE
				Rank	2	3	1	1	2	4	2	3	3	1	3	1
				Weighted Score	4.5	3.5	4.5	3.6	3.1	3.1	3.1	3.5	3.5	3.6	3.5	3.6
9	To protect Aboriginal and non-Aboriginal cultural heritage.	a	Impact on potential Victorian Aboriginal Heritage Register (VAHR) places excluding mortuary trees and burnt mounds.	**Aboriginal Cultural Heritage**	MODERATELY POOR	POOR	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	POOR	POOR	MODERATELY POOR	MODERATELY POOR	POOR	MODERATELY POOR	POOR
		b	Impact on registered and potential Victorian Heritage Inventory (VHI) places, local planning schemes Heritage Overlay (HO) places, Victorian Heritage Register (VHR) places and other Historical Heritage Registers.	**Historical Cultural Heritage**	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	LOW	LOW	LOW	LOW	LOW	NEGLIGIBLE	MODERATELY POOR	NEGLIGIBLE	MODERATELY POOR
		c	Impact on potential mortuary trees and burnt mounds (VAHR places).	**Aboriginal Cultural Heritage**	LOW	POOR	LOW	MODERATELY POOR	MODERATELY POOR	POOR	POOR	MODERATELY POOR	MODERATELY POOR	POOR	POOR	VERY POOR
				Rank	1	3	1	1	1	3	3	2	1	4	3	5
				Weighted Score	3.5	2.3	3.5	3.3	3.3	2.6	2.6	3.3	3.6	2.3	3.1	1.8

SECTION 3				Specialist Area	1			2				3				
					1A*	1C *	1E *	2B*	2C*	2D*	2E*	3A*	3B*	3C*	3AD	3DC
10	To minimise noise, visual and other adverse amenity effects on local residents and potentially affected land-owners, during the development and operation of the proposed duplicated highway to the extent practicable..	a	• Distances from dwellings and other sensitive receptors (e.g. schools) to road corridor for each option.	**Noise**	LOW	PARTIAL	LOW	PARTIAL	PARTIAL	PARTIAL	PARTIAL	LOW	LOW	LOW	PARTIAL	PARTIAL
				Rank	2	1	2	1	1	1	1	3	3	3	1	1
				Weighted Score	4.0	6.0	4.0	6.0	6.0	6.0	6.0	4.0	4.0	4.0	6.0	6.0
		b	Sensitive receptors within a minimum distance as evaluated by Screening Toolkit using expected, indicative traffic emissions.	**Air**	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE
		c	Construction dust impact on sensitive receptors within close proximity to the road	**Air**	LOW	NEGLIGIBLE	LOW	NEGLIGIBLE	NEGLIGIBLE	LOW	NEGLIGIBLE	LOW	LOW	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE
		d	Emissions into the atmosphere as a measure of potential contribution to regional load of air pollutants.	**Air**	NEGLIGIBLE	NEGLIGIBLE	PARTIAL	PARTIAL	PARTIAL	MODERATELY WELL	PARTIAL	PARTIAL	PARTIAL	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE
				Rank	3	1	2	1	1	4	1	4	4	1	1	1
				Weighted Score	4.5	5.0	4.8	5.3	5.3	5.0	5.3	4.8	4.8	5.0	5.0	5.0
		e	• Impact on views from dwellings	**Visual**	LOW	MODERATELY POOR	LOW	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	LOW	LOW	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR
		f	• Impact on views from significant community spaces e.g. lookouts, golf courses	**Visual**	LOW	NEGLIGIBLE	LOW	MODERATELY POOR	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW
		g	• Impact on sensitive landscape character types	**Visual**	LOW	MODERATELY POOR	LOW	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	LOW	LOW	LOW	LOW	LOW
				Rank	1	3	1	4	1	1	1	1	1	3	3	3
				Weighted Score	4.0	3.7	4.0	3.0	3.3	3.3	3.3	4.0	4.0	3.7	3.7	3.7
11	To protect catchment values, surface water and groundwater quality, stream flows and floodway capacity, as well as to avoid impacts on protected beneficial uses.	a	Potential impact to ecological values of waterways & beneficial uses	**Surface Water**	NEGLIGIBLE	LOW	NEGLIGIBLE	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	NEGLIGIBLE	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR
		b	Potential to increase flooding risk	**Surface Water**	LOW	LOW	LOW	NEGLIGIBLE	NEGLIGIBLE	LOW	LOW	NEGLIGIBLE	NEGLIGIBLE	LOW	NEGLIGIBLE	NEGLIGIBLE
				Rank	1	3	1	2	2	4	1	1	1	5	1	1
				Weighted Score	4.5	4.0	4.5	4.0	4.0	3.5	4.5	4.0	4.0	3.5	4.0	4.0
		c	Potential impacts (decline / deterioration) to groundwater quality	**Groundwater**	LOW	LOW	LOW	LOW	LOW	NEGLIGIBLE	NEGLIGIBLE	LOW	LOW	LOW	LOW	LOW
		d	Minimisation of disruption of groundwater flow (recharge, discharge) i.e. flow paths, availability (for users, environment). Alteration of groundwater levels.	**Groundwater**	LOW	LOW	LOW	LOW	LOW	NEGLIGIBLE	NEGLIGIBLE	LOW	LOW	LOW	LOW	LOW
				Rank	1	1	1	3	3	1	1	1	1	1	1	1
				Weighted Score	4.0	4.0	4.0	4.0	4.0	5.0	5.0	4.0	4.0	4.0	4.0	4.0
		e	Impact of gross contamination from historic land use (including historical landfills)	**Soils and Geology**	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW
		f	Avoid or minimise exposure to watercourse embankments and river beds (potential triggers for erosion/instability criteria).	**Soils and Geology**	LOW	MODERATELY POOR	NEGLIGIBLE	LOW	NEGLIGIBLE	LOW	LOW	LOW	NEGLIGIBLE	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR
		g	Potential impact of poor soils and / or topographic location on road construction or operation activities	**Soils and Geology**	LOW	MODERATELY POOR	LOW	LOW	NEGLIGIBLE	LOW	LOW	NEGLIGIBLE	NEGLIGIBLE	MODERATELY POOR	MODERATELY POOR	MODERATELY POOR
				Rank	2	3	1	2	1	2	2	2	1	3	3	3
				Weighted Score	4.0	3.3	4.3	4.0	4.7	4.0	4.0	4.3	4.7	3.3	3.3	3.3
			Outcomes of Compiling the Options Assessment from Each Specialist for Section 3		1			2				3				
					1A*	1C *	1E *	2B*	2C*	2D*	2E*	3A*	3B*	3C*	3AD	3DC
				Overall Rank	2	3	1	1	2	4	3	2	1	4	3	5
				Overall Weighted Total	54.0	52.5	55.3	55.6	55.5	53.4	54.6	55.3	55.5	52.5	53.1	50.1

10. Phase 3: Environmental Risk Assessment

10.1 Alignment Refinements

During the Phase 3 assessment and ongoing landowner discussions, it became evident that the potential impact on areas of vegetation and landowner assets could be minimised by refinement of the proposed alignment.

The alignment refinements adopted following the Phase 3 risk assessment and landowner consultation include:

- The most significant change was to the proposed alignment north of Great Western in Zone 3. The alignment was altered to essentially adopt Option 3A, however with a much wider median to protect the significant vegetation adjacent to the existing highway and Churchill Crossing Road. The existing highway would become a southbound carriageway and a new carriageway constructed in cleared farmland to the west. This change was made in consultation with landowners and DSE.
- The alignment crossing the railway north of Great Western was changed to include two new bridges crossing the railway south of Oddfellows Bridge. The existing highway then reverts to a service road and south bound onramp, providing connection to Harvey Lane.
- Narrowing of the construction footprint to:
  - Minimise impacts on existing dams adjacent to the existing highway near Armstrong and Delahoy Road;
  - Minimise potential impacts on vineyards south of Petticoat Gully Road, and south of St Ethels Road;
  - Minimise the impact on na historic homestead south of Delahoy Road;
  - Minimise impacts to vegetation near Sisters Rocks;
  - Minimise impact on significant remnant native vegetation to the north-east and east of Great Western; and
  - Minimise impacts on the Stawell Park Caravan Park and Grange Golf Club.
- The alignment for the bypass of Great Western to the north-east was refined to avoid the old landfill as much as possible whilst also being aligned through areas of the old and existing quarry where native vegetation has already been removed.
- To reduce the width of the cut for the bypass of Great Western, 2:1 batter slopes have been proposed.
- Protection of roadside vegetation (DSE reserve) north of Churchill Crossing Road and London Road by realigning the highway alignment into cleared farmland and excluding the vegetation from the construction footprint.
- Provision of access under the ultimate upgrade (freeway) by designing a new service road between Bests Road and Humphrey Lane to allow for access to Great Western for impacted landowners.
- Changing the design standard from AMP3 to AMP1 for the last length of Section 3 from Harvey Lane to Gilchrist Road.
- Development of an interchange at London Road to provide improved access and meet AMP1 design standards.

The risk assessment considered a corridor for the alignment options and was therefore conservative in the estimate of vegetation removal. Following the risk assessment the proposed carriageways and service road alignments were determined with the objective to avoid vegetation to the extent practicable through adopting wide medians and service roads set back from the main carriageways.

During the impact assessment the construction footprint and alignment was refined, and the amount of native vegetation proposed to be removed reduced by over 10 ha. However, the amount of vegetation removal proposed for the Project is expected to be further reduced during detailed design because the assessed footprint is still considered conservative.

10.2 Proposed Alignment

From the recommended options in each zone, a proposed alignment was selected for further assessment in the EES. Through Phase 3 the proposed alignment was refined to further reduce potential impacts.

The impact assessment for the EES was undertaken for this option and is documented in the Technical Appendices of the EES. The option selected is outlined in Table 28 and Figure 23.

Table 28 Section 3 Proposed Alignment

Zone	Option Assessment	Description
1	1E transferring into 1A at the Armstrong Deviation	Duplication generally following the existing highway (partly on the east side and partly west side) and then following the Armstrong Deviation. This option will require a new railway crossing adjacent to the Armstrong Deviation bridge.
2	2B	North-eastern bypass of Great Western with a new dual carriageway. Bypass begins north-west of Delahoy Road, running directly through existing quarry and gravel pit and re-joining existing highway at Briggs Lane.
3	3A	New dual carriageway on south-weastern side of existing highway.

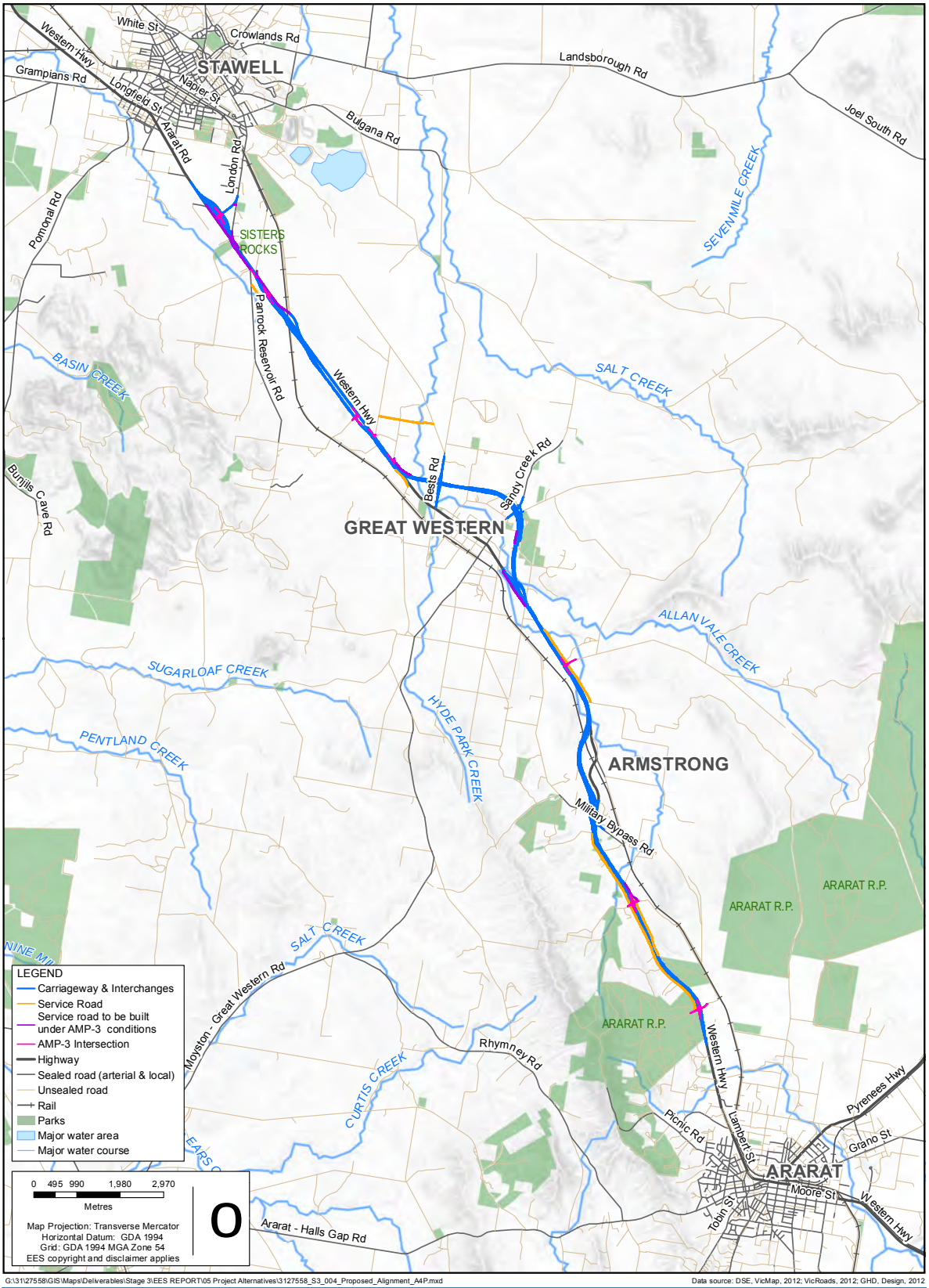


Figure 23 Proposed Alignment assessed in the EES

11. Conclusion

As a result of the three phase assessment process and taking into consideration feedback received at community information sessions, VicRoads presents a proposed final alignment for consideration as part of the EES.

The proposed alignment meets Project Objectives and delivers the desired benefits of improved road safety and transport efficiency.

Through the options assessment process, it became evident that the lowest impact option was one which followed the existing road reserve and avoided roadside vegetation where possible.

The proposed alignment utilises the existing highway corridor on either side of Great Western in part to reduce the potential impacts on landowners, Aboriginal cultural heritage values and the environment. The proposed alignment was refined following Phase 3 in order to avoid native vegetation where possible.

A bypass of Great Western is proposed to the north-east. The alignment impacts on a large area of native vegetation of high and very conservation significance. A bypass to the south-west would have less impact on native vegetation, however, have more impact on confirmed and potential Golden Sun Moth habitat and scattered large and very large old trees.

The proposed bypass to the north-east was also assessed as having lower potential social and economic impacts through less land severance; provides better connectivity to Great Western with interchanges on either side of the town, and would not restrict the future growth of Great Western, or place additional pressure upon services proposed by Council due to land severance.

Overall, it was considered that the potential impacts associated with a bypass to the south-west were, on balance, more substantial than the impacts to significant native vegetation from a north-east bypass of Great Western.

A key consideration for selection of the proposed alignment between Great Western and Stawell was the potential impacts to cultural heritage values. Sisters Rocks is a ceremonial Aboriginal heritage site (although not listed on the Aboriginal Heritage Register) that is located adjacent to the intersection of the existing highway and London Road. There is a visual connection between Sisters Rocks and the Black Range, located to the south-west and outside the Project area, which has high Aboriginal cultural significance. Sisters Rocks also have historical cultural significance and is listed on the DSE heritage register.

The proposed alignment has lower potential impact on Aboriginal cultural heritage values than the other options as it would minimise the impact on the visual connection between Sisters Rocks and Black Range.

The proposed alignment impacts on areas of native vegetation, however this could be reduced through such measures as adopting minimum median widths between carriageways and restricting the construction footprint in sensitive areas. A conservative footprint was adopted for the alignment options assessment which has been refined through the impact assessment and would be further refined during detailed design.

Appendix A

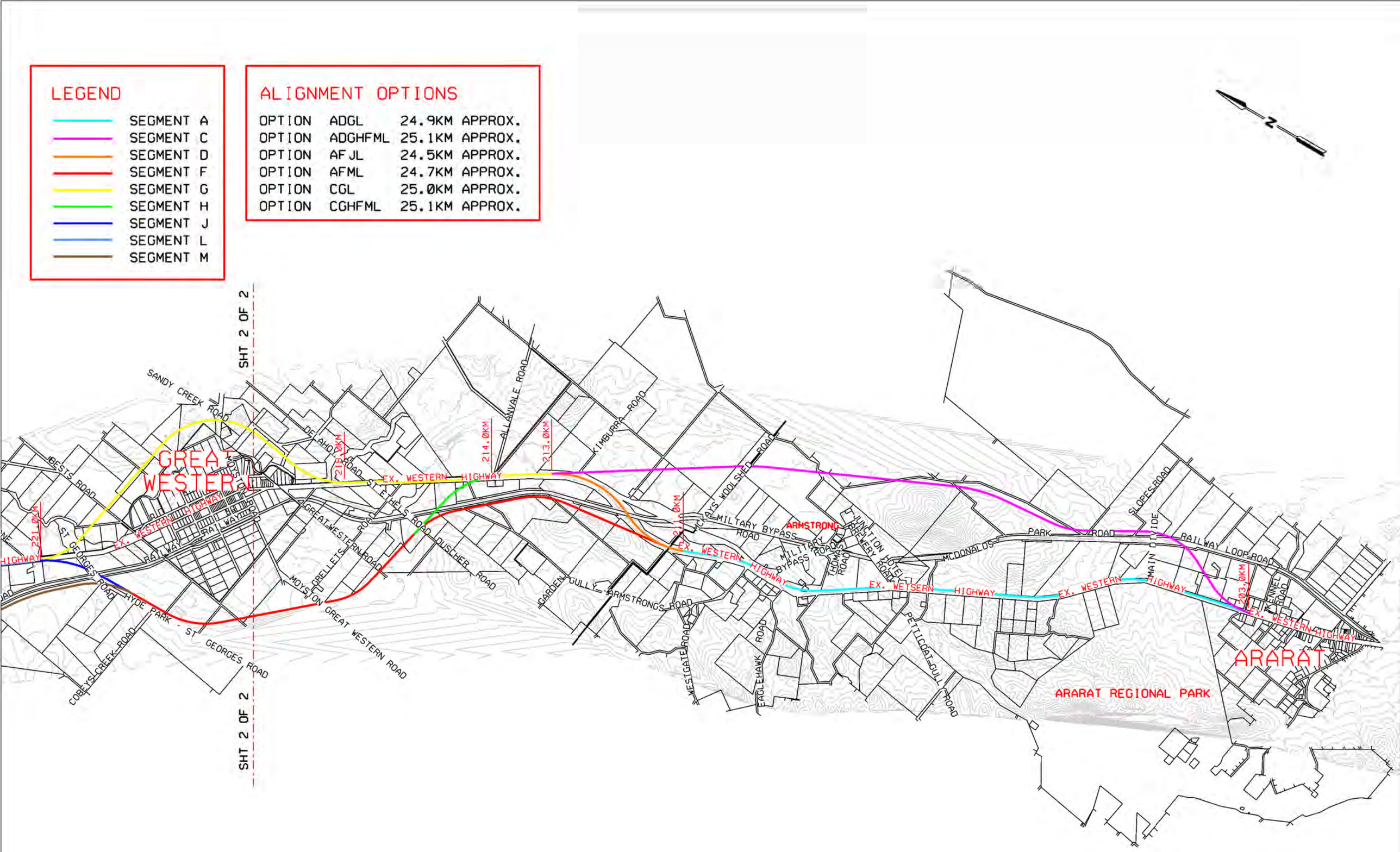
VicRoads Alignments Prior to the EES

LEGEND

- SEGMENT A
- SEGMENT C
- SEGMENT D
- SEGMENT F
- SEGMENT G
- SEGMENT H
- SEGMENT J
- SEGMENT L
- SEGMENT M

ALIGNMENT OPTIONS

OPTION	ADGL	24.9KM APPROX.
OPTION	ADGHFML	25.1KM APPROX.
OPTION	AFJL	24.5KM APPROX.
OPTION	AFML	24.7KM APPROX.
OPTION	CGL	25.0KM APPROX.
OPTION	CGHFML	25.1KM APPROX.



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FOR DISCUSSION PURPOSES ONLY

WESTERN HIGHWAY DUPLICATION
ARARAT TO STAWELL - (SECTION 3)

SHT 1 OF 2

LEGEND

- SEGMENT A
- SEGMENT C
- SEGMENT D
- SEGMENT F
- SEGMENT G
- SEGMENT H
- SEGMENT J
- SEGMENT L
- SEGMENT M

ALIGNMENT OPTIONS

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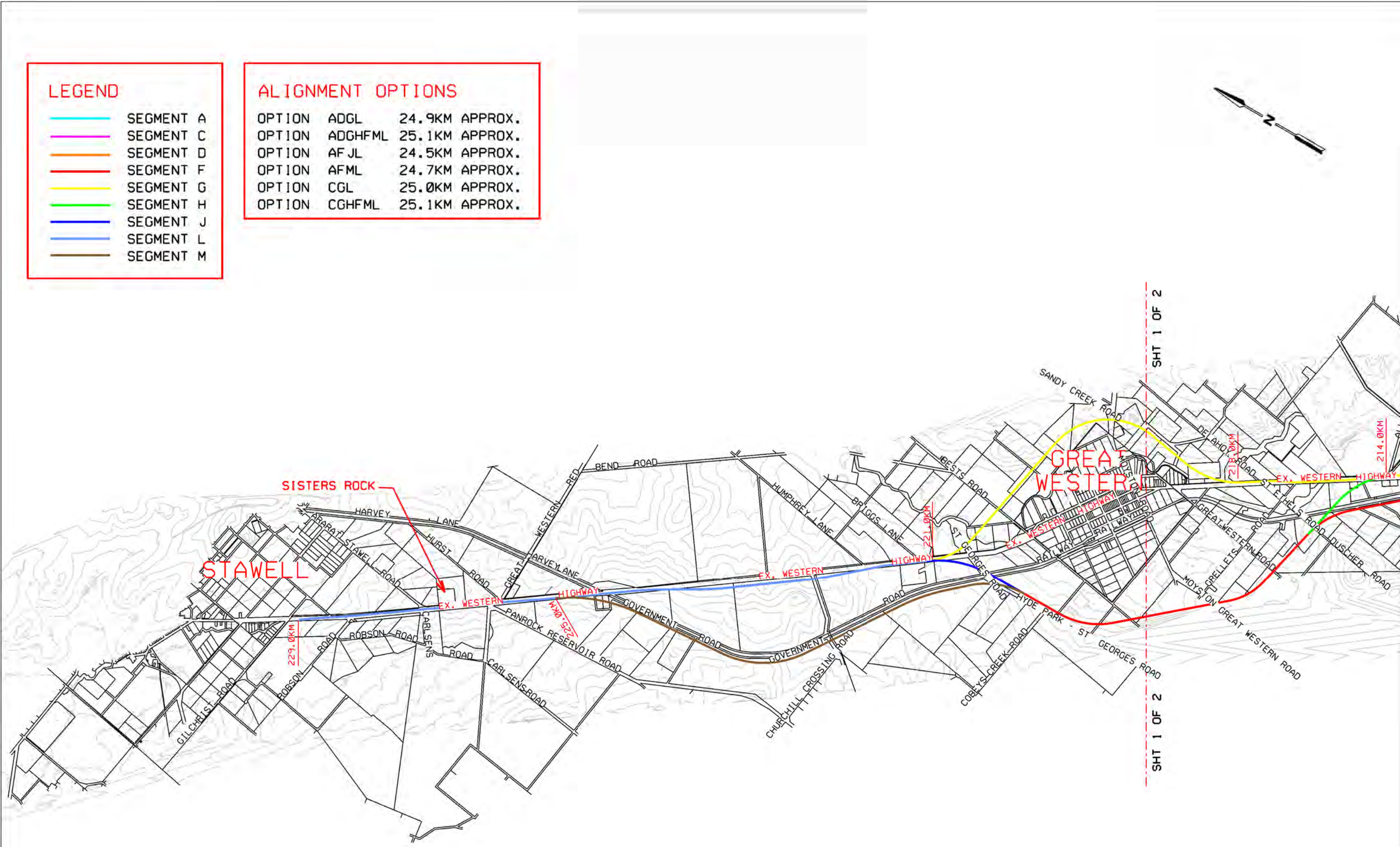

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WESTERN HIGHWAY DUPLICATION ARARAT TO STAWELL - (SECTION 3)

SHT 2 OF 2

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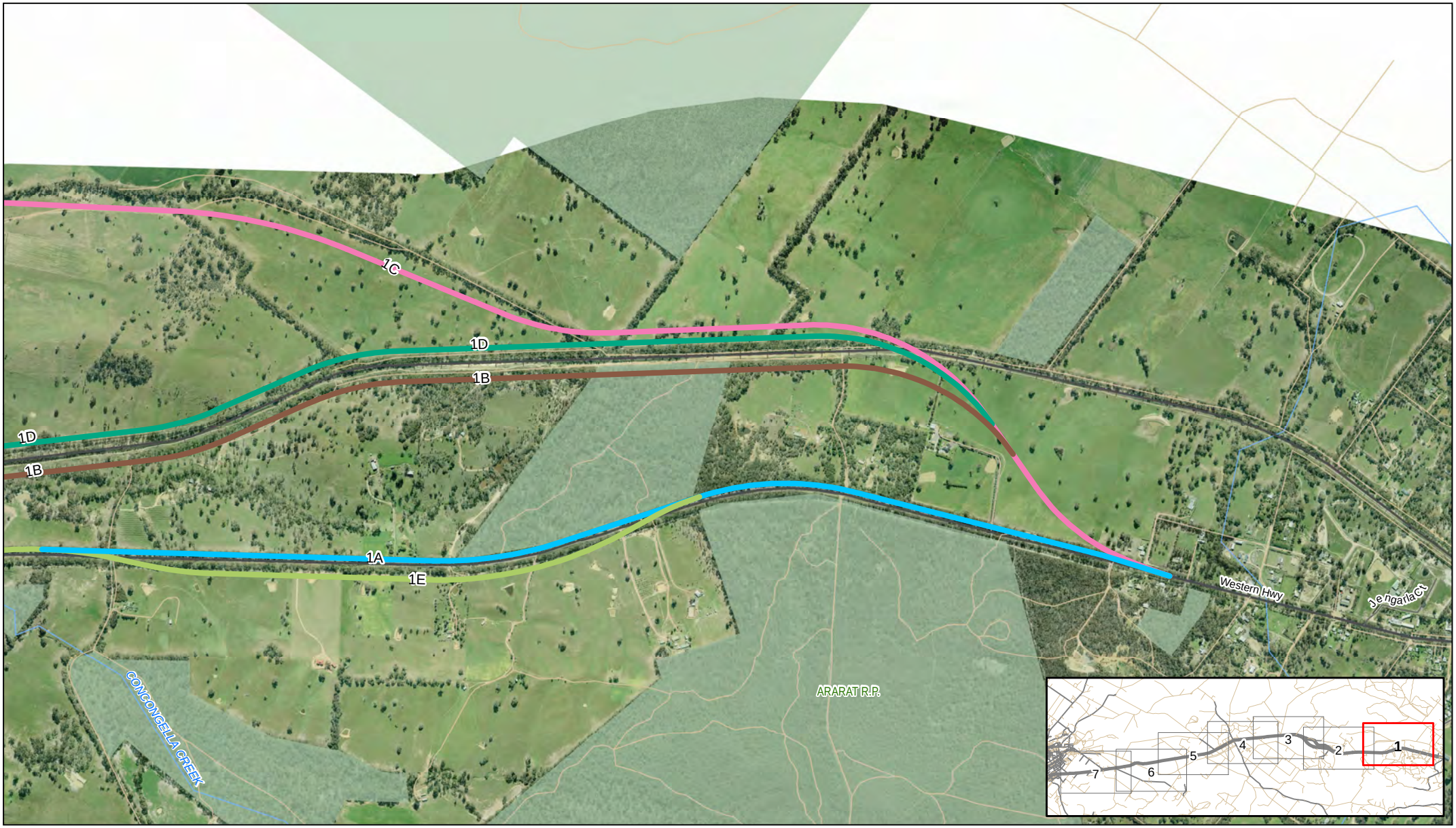

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Grid: GDA 1994 MGA Zone 54

LEGEND

- Zone Boundary
- Rail
- Highway
- Sealed road (arterial & local)
- Unsealed road
- Major water area
- Major water course

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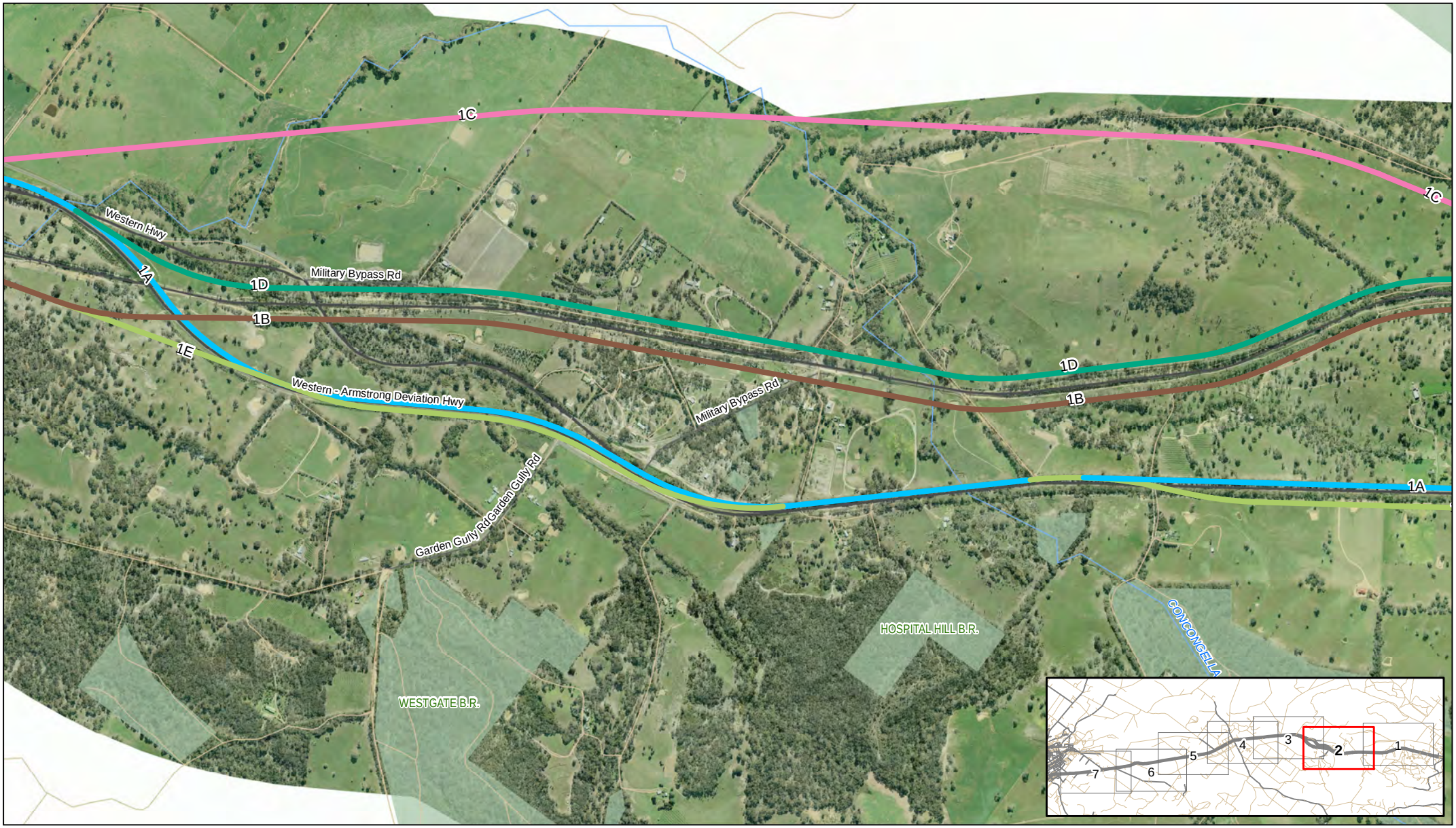

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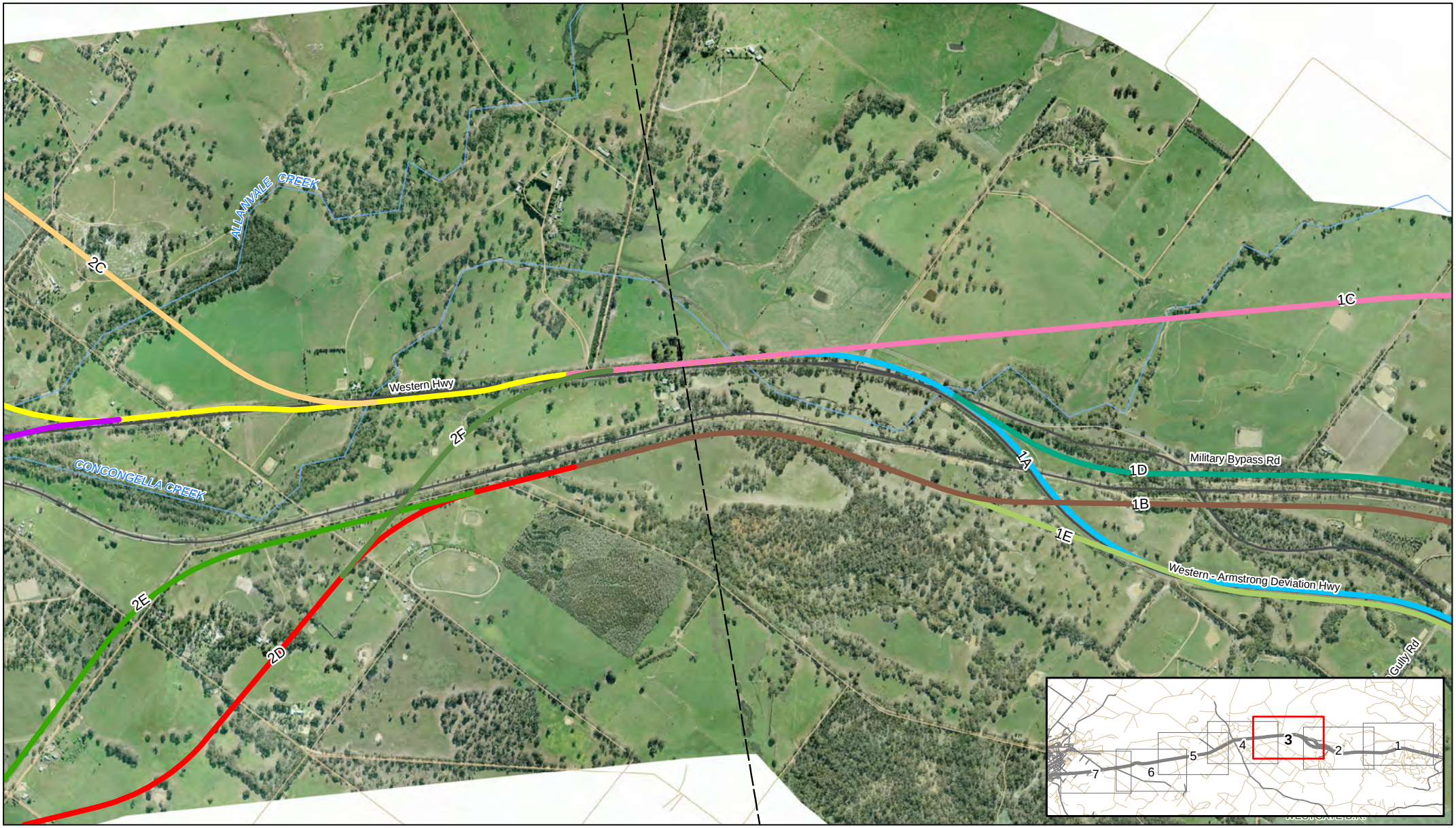

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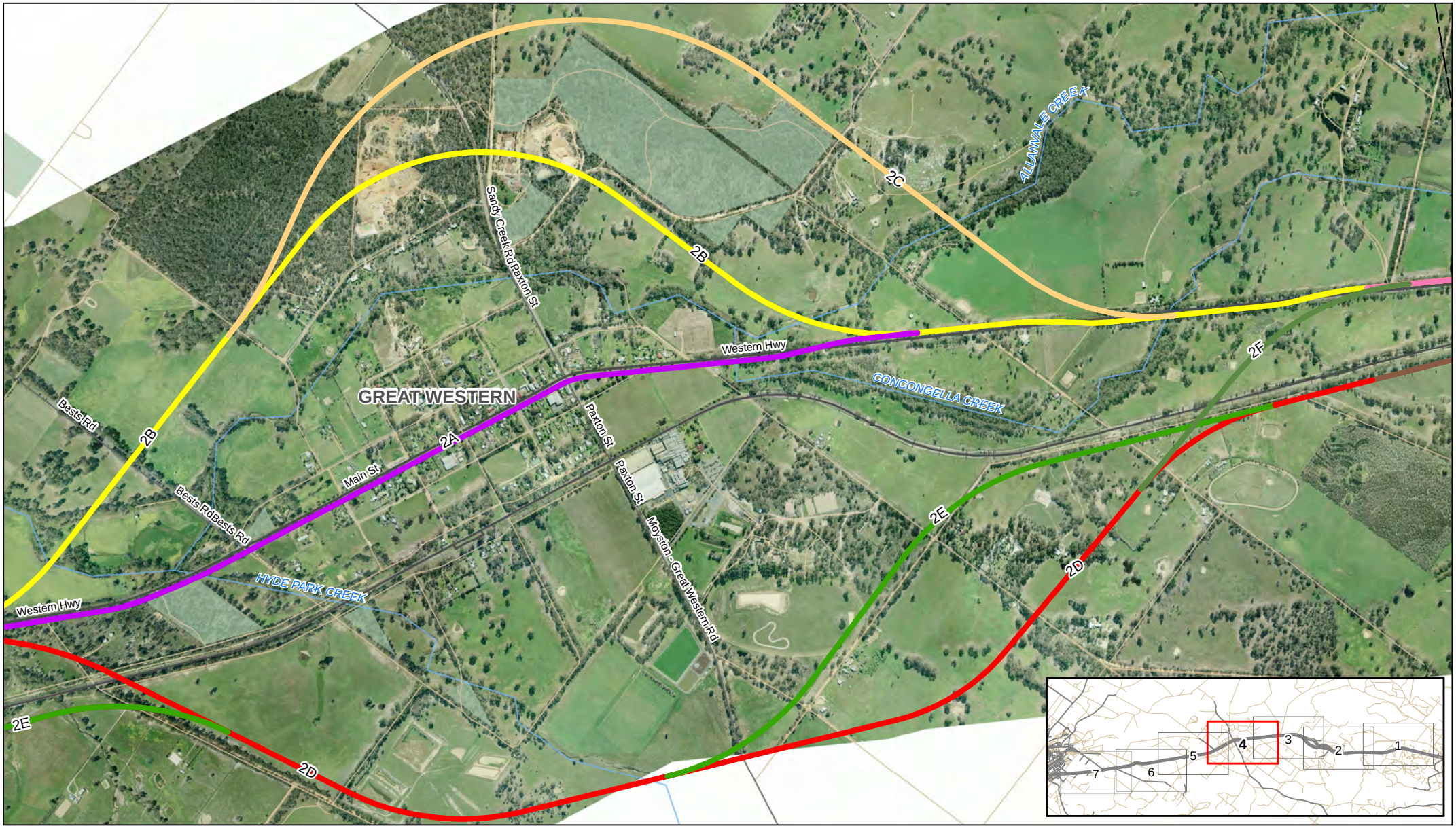

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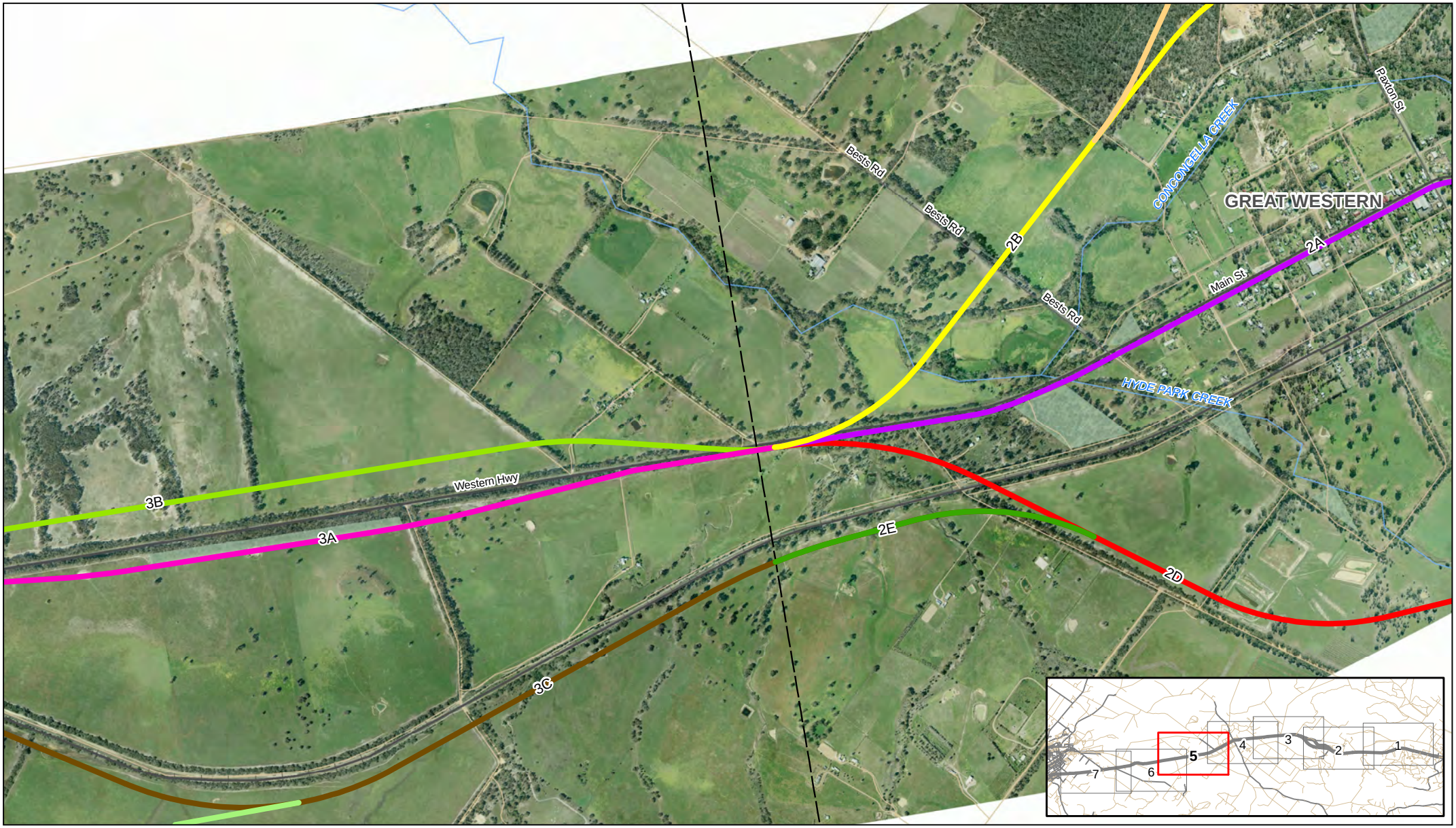

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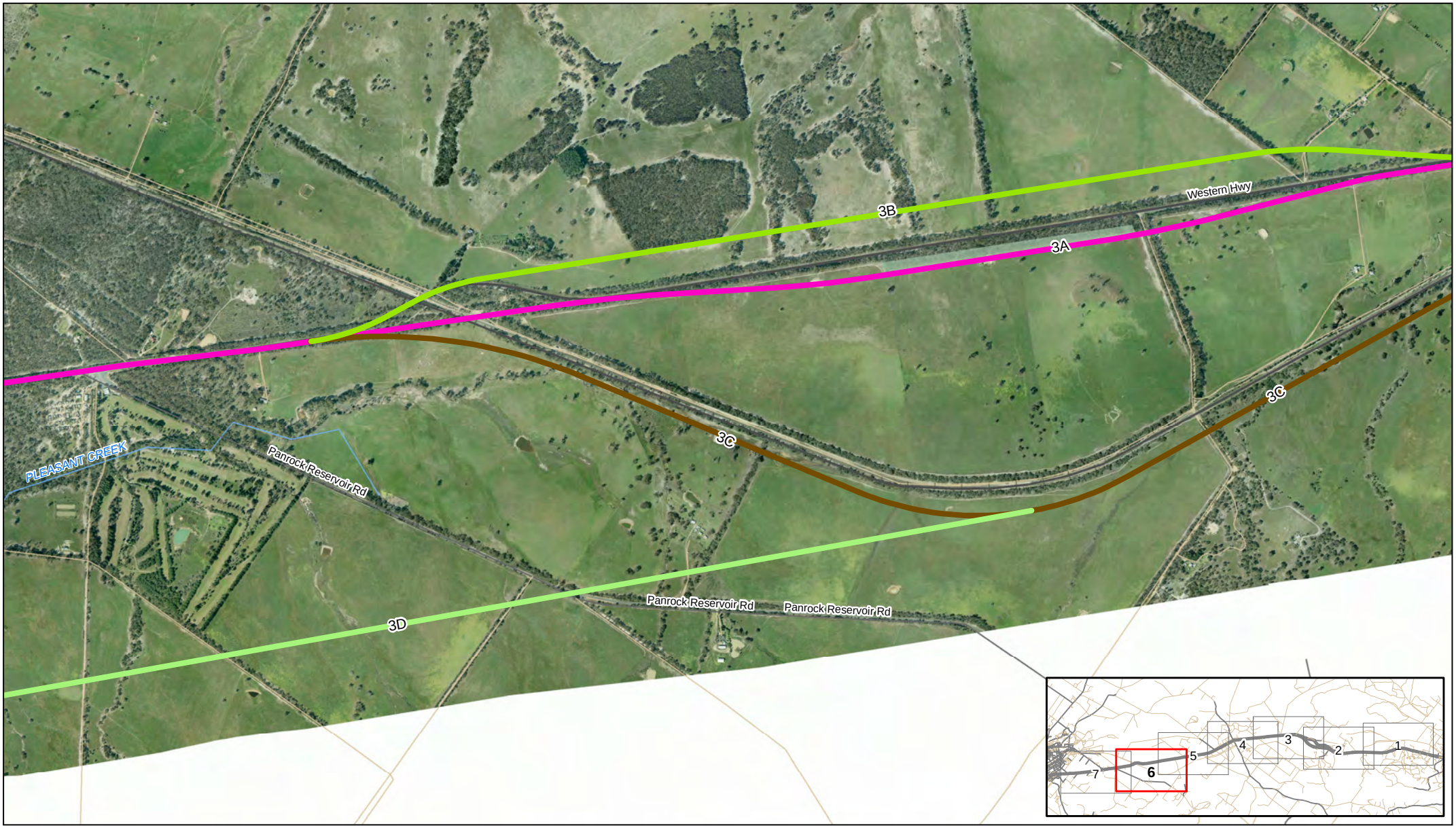

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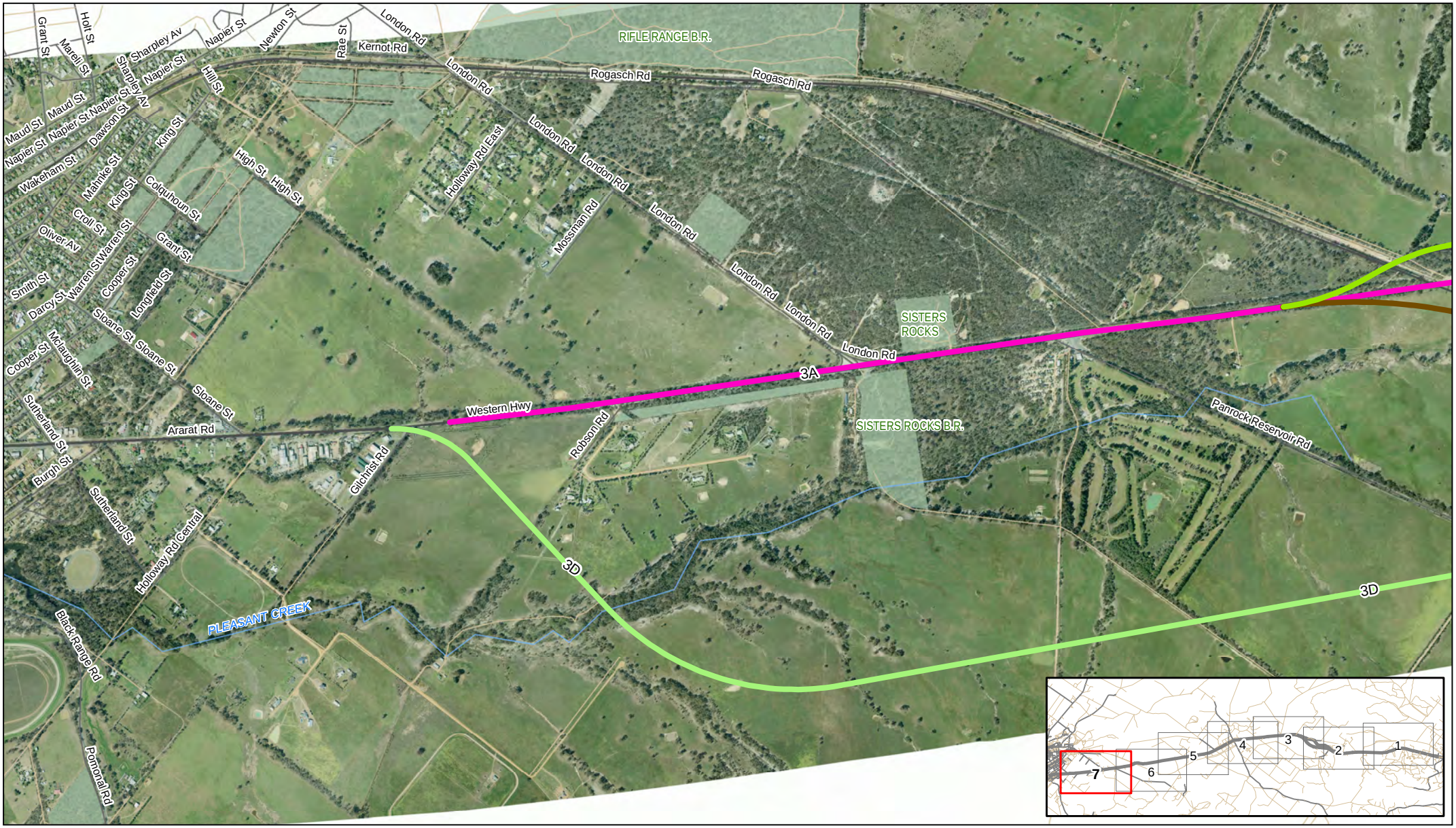

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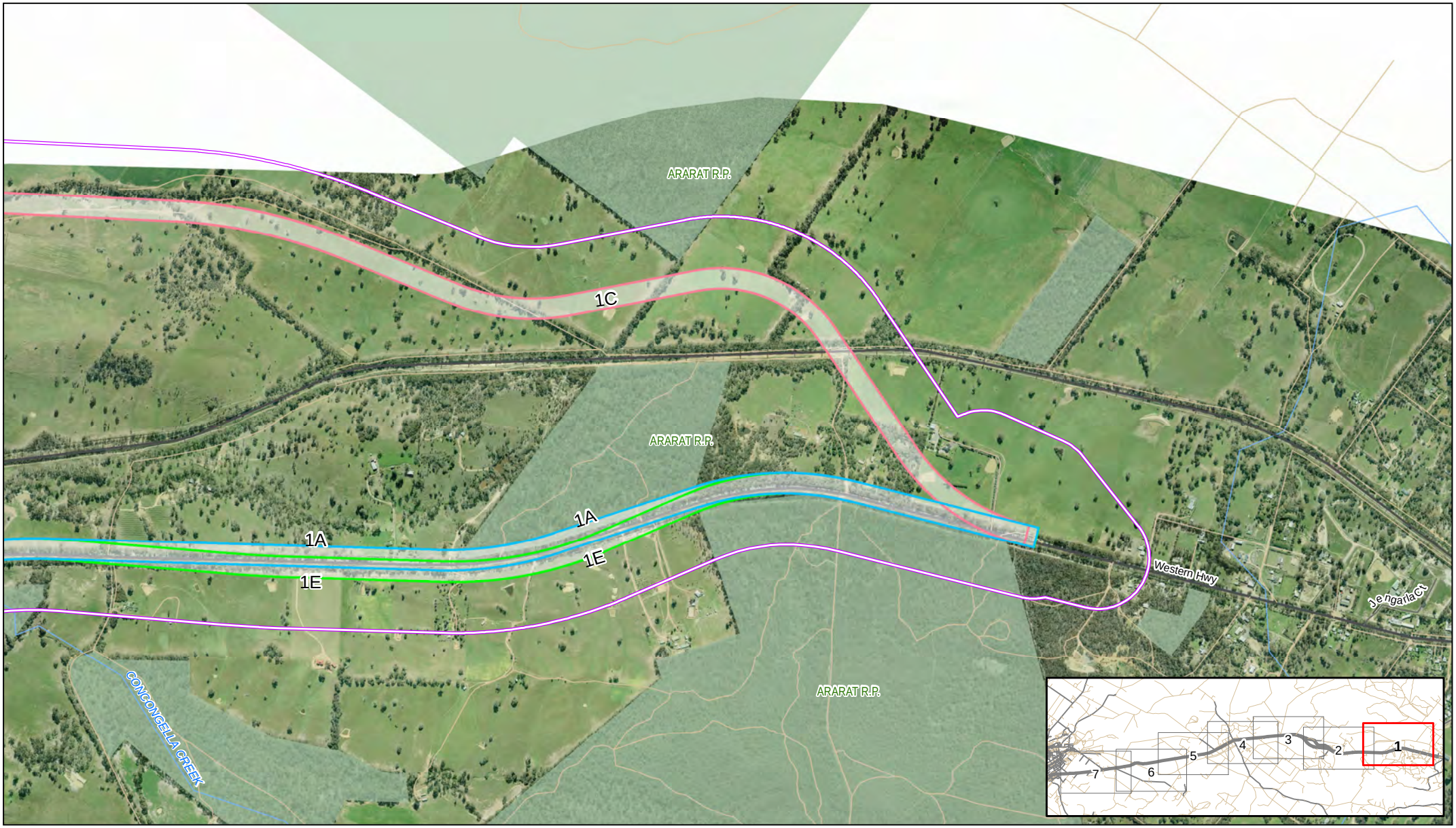
180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

Data source: GHD, 2012; DSE, VicMap, 2012; VicRoads, 2012. Created by:splaird

Appendix C

Short List



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

LEGEND

- Study Area
- Zone Boundary
- Rail
- Highway
- Sealed road (arterial & local)
- Unsealed road
- Major water area
- Major water course

CLIENTS | PEOPLE | PERFORMANCE

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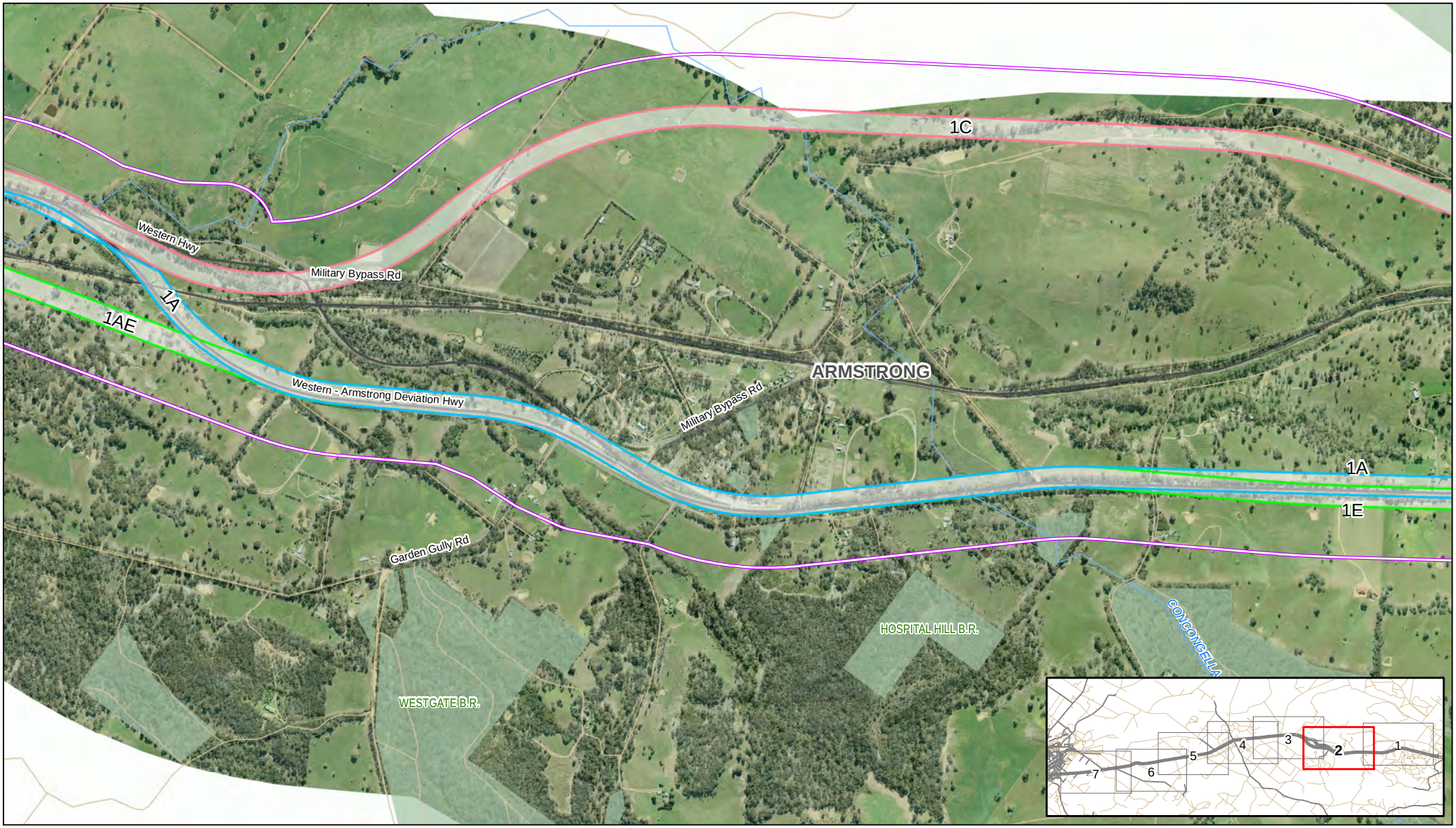
Data source: GHD, 2012; DSE, VicMap, 2012; VicRoads, 2012. Created by:splaird



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Map Projection: Transverse Mercator
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Grid: GDA 1994 MGA Zone 54

LEGEND

- Study Area
- Zone Boundary
- Rail
- Highway
- Sealed road (arterial & local)
- Unsealed road
- Major water area
- Major water course

CLIENTS | PEOPLE | PERFORMANCE

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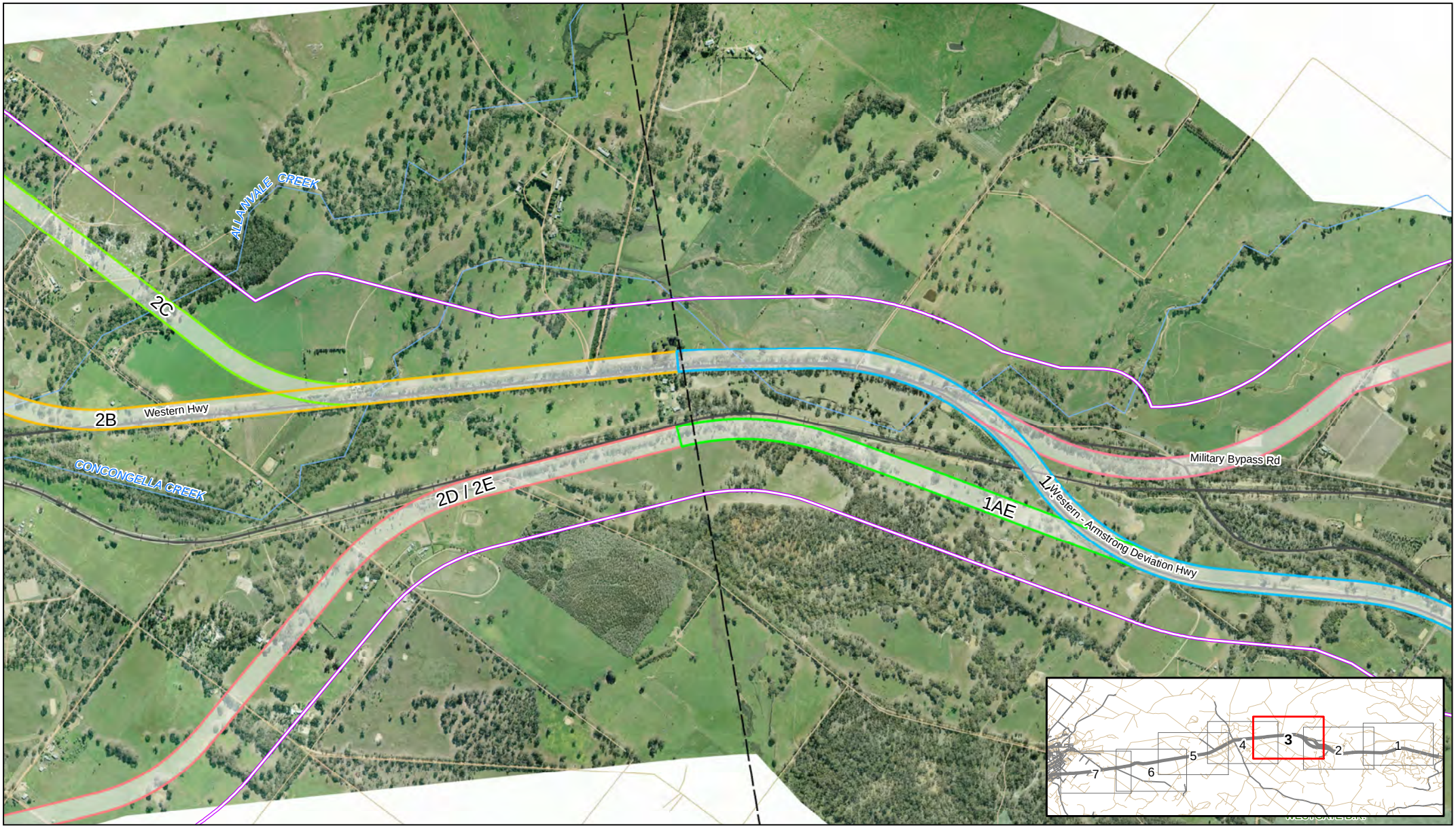
Data source: GHD, 2012; DSE, VicMap, 2012; VicRoads, 2012. Created by:splaird



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

LEGEND

- Study Area
- Zone Boundary
- Rail
- Highway
- Sealed road (arterial & local)
- Unsealed road
- Major water area
- Major water course

CLIENTS | PEOPLE | PERFORMANCE

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Ararat to Stawell

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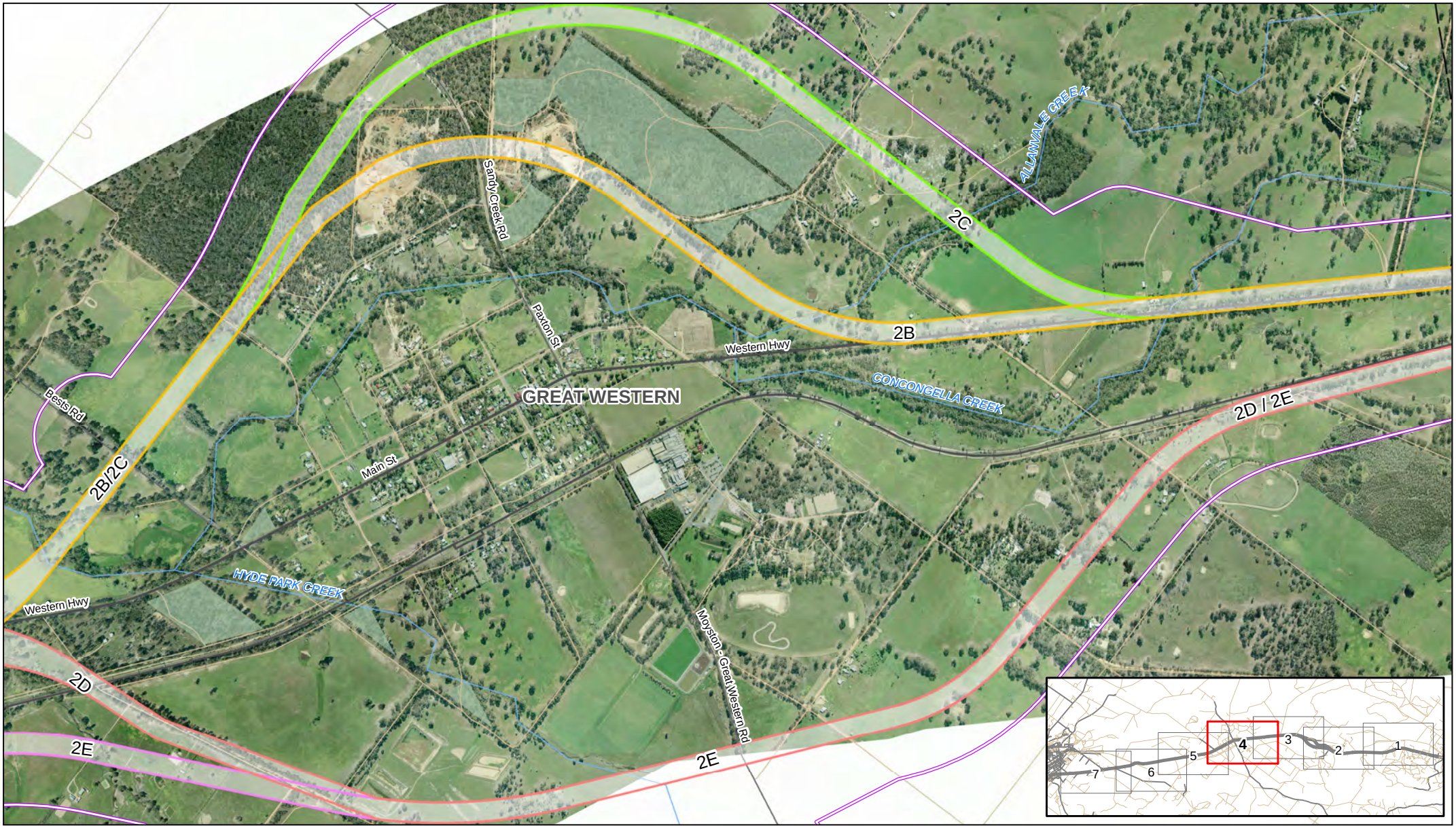

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

LEGEND

- Study Area
- Zone Boundary
- Rail
- Highway
- Sealed road (arterial & local)
- Unsealed road
- Major water area
- Major water course

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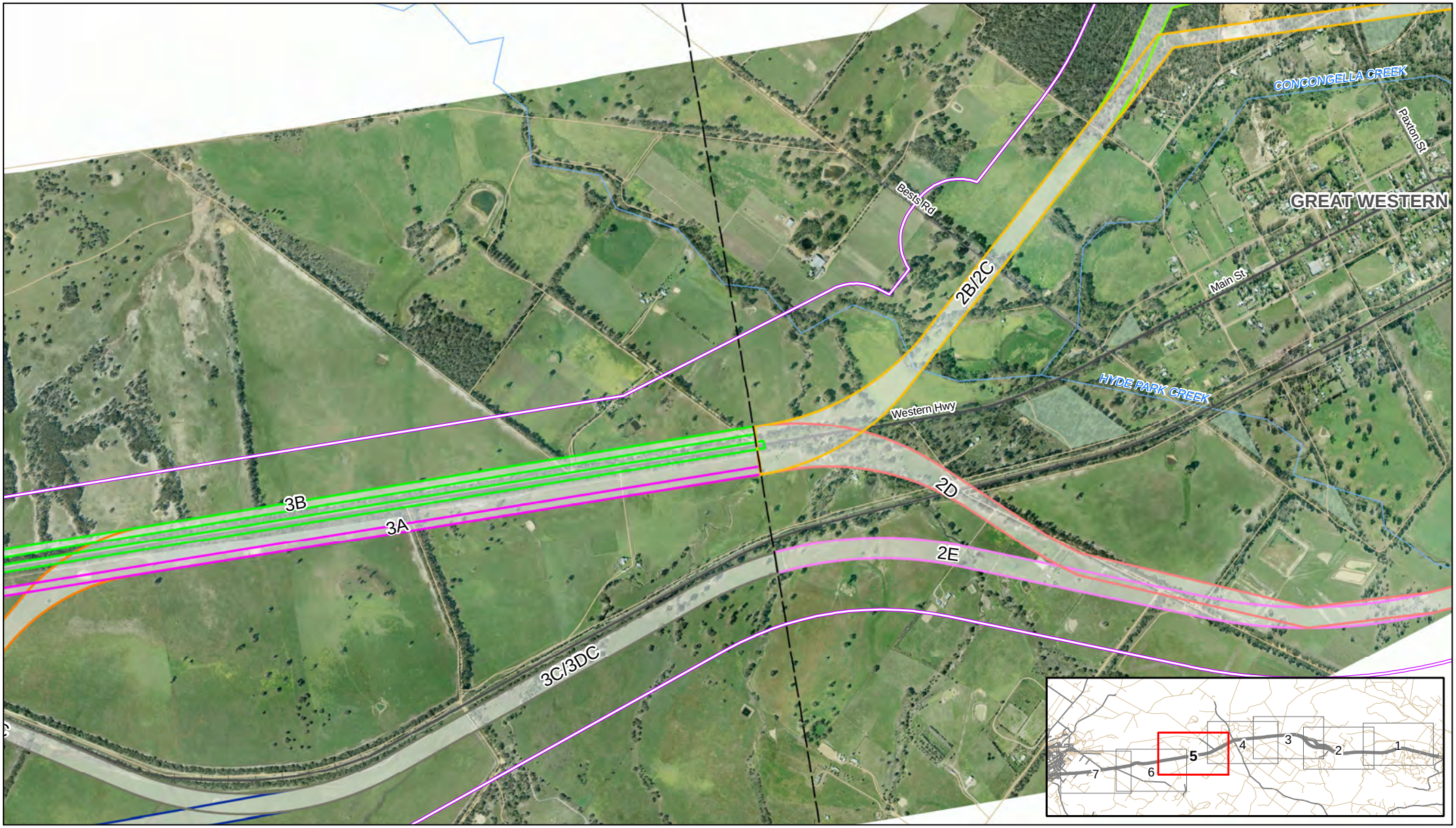

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

LEGEND

- Study Area
- Zone Boundary
- Rail
- Highway
- Sealed road (arterial & local)
- Unsealed road
- Major water area
- Major water course

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0 100 200 400 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

LEGEND

- Study Area
- Zone Boundary
- Rail
- Highway
- Sealed road (arterial & local)
- Unsealed road
- Major water area
- Major water course

GHD CLIENTS | PEOPLE | PERFORMANCE

vicroads

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Short List
Ararat to Stawell

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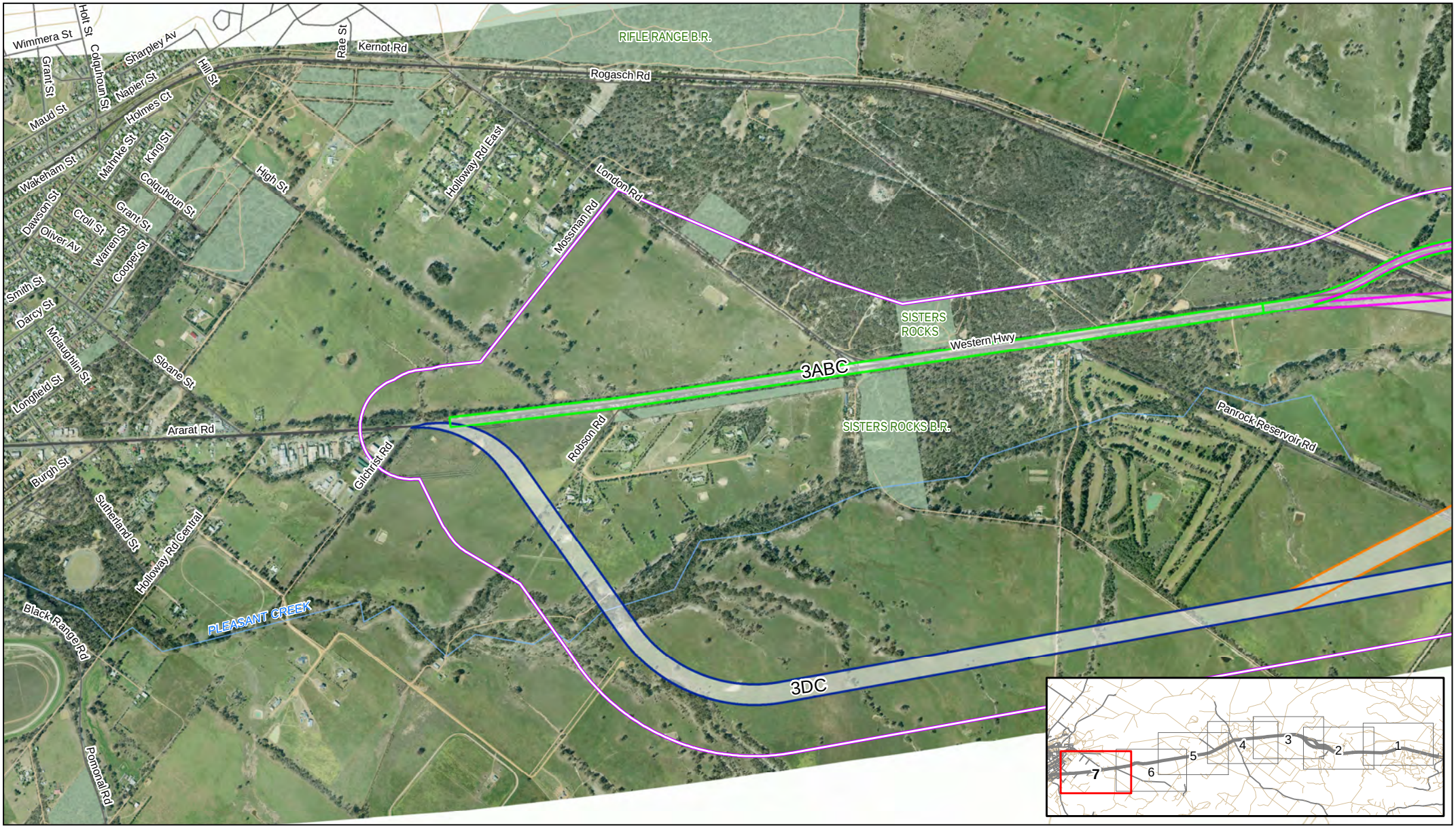

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

LEGEND

- Study Area
- Zone Boundary
- Rail
- Highway
- Sealed road (arterial & local)
- Unsealed road
- Major water area
- Major water course

CLIENTS | PEOPLE | PERFORMANCE

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