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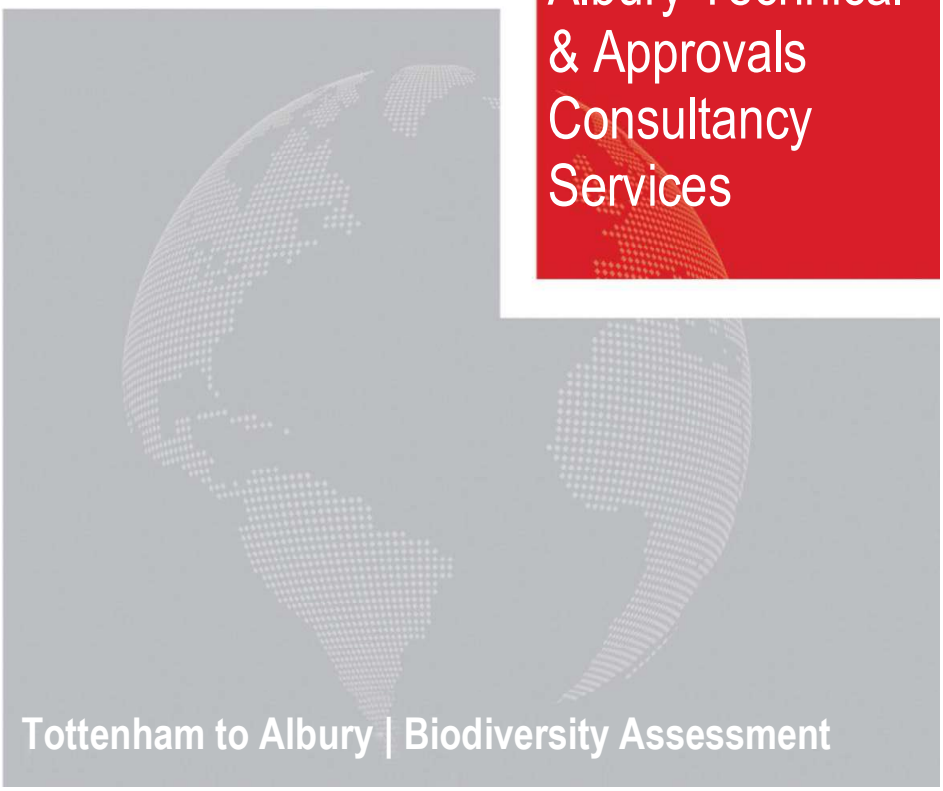
Inland Rail Phase 2 Tottenham to Albury Technical & Approvals Consultancy Services



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Tottenham to Albury | Biodiversity Assessment

Tottenham to Albury | Biodiversity Assessment

Inland Rail Phase 2 Tottenham to Albury Technical & Approvals Consultancy Services

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The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is to **assess biodiversity values** in accordance with the scope of services set out in the contract between KBR and **Australian Rail Track Corporation** ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

KBR derived the data in this report primarily from **visual inspections and examination of records in the public domain made on the dates indicated**. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, KBR has relied upon and presumed accurate certain information (or absence thereof) relative to **the project areas** provided by government officials and authorities, the Client and others identified herein. Except as otherwise stated in the report, KBR has not attempted to verify the accuracy or completeness of any such information.

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Revision History

Revision	Date	Comment	Signatures			
			Originated by	Checked by	Technical Approval	Project Approval
0	25/02/20	Final	A. Rigg	R. Hunt	R. Hunt	D. Phimister
						

Contents

APPENDICES

List of figures

List of tables

Summary

Introduction

This Biodiversity Assessment Report identifies the biodiversity values within and surrounding the project areas which form part of the Inland Rail Tottenham to Albury Project. The project proposes work at discrete sites to provide the required clearance for double-stacked freight trains to operate along the existing corridor.

Discrete sites include:

- 'Enhancement Sites' where design solutions to provide the required clearance under bridges are limited to:

– lowering the existing rail track, or

– replacing the bridges (road and pedestrian footbridges).

- Track Slewing, which are small adjustments to the alignment of existing rail tracks
- Signal Gantry Modifications: relocation or raising of existing rail signal gantries.
- Overhead powerline modifications

As the location of the rail intermodal terminal facility at the southern end of the T2A project is yet to be determined, the T2A project is currently being progressed in two stages. The first stage is comprised of discrete work areas from Beveridge to Albury (T2A - Stage 1). Sites north of Beveridge are currently at reference design. Further engineering design and environmental surveys on the sites south of Beveridge have been placed on hold. Development of the sites south of Beveridge is contingent on the intermodal decision and as such sites may not be constructed if the intermodal terminal is built at Beveridge.

Scope of this Report

This report includes an assessment of biodiversity values and impacts in work areas north and south of Beveridge. A biodiversity assessment of overhead powerlines is assessed separately from this report (KBR 2020c). Additional targeted surveys for threatened birds and flora have been completed north of Beveridge; these are also reported separately (KBR 2020b, KBR 2020d).

The combined overall impact to biodiversity for all project scope between Beveridge and Albury will be considered for the purpose of assessing the project against *Environment Effects Act 1978* (EE Act) referral criteria and the potential for a significant impact to a matter of national environmental significance protected

under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act), as well as other approvals required for impacts to biodiversity.

Investigations

This report documents the outcomes of ecological surveys that have been completed for the project during Reference Design phase (2017-2019). These surveys built upon initial detailed ecological surveys of Investigation Areas during the development of the Concept Design by WSP/PB (2016), which included identification and mapping of threatened ecological communities, habitat for threatened flora and fauna, and completion of habitat hectare assessments.

Methods

The findings of this report are based on desktop assessments, including reviewing and confirming data assessed by WSP/PB (2016), and then completing detailed ecological assessments (habitat hectare assessments and mapping of observed threatened species, threatened ecological communities and threatened species habitat), for expanded investigation areas beyond the area assessed by WSP/PB (2016).

Habitat hectare assessments were completed in accordance with current guidelines from the Department of Environment, Land, Water and Planning (DELWP), including *Guidelines for the removal, destruction and lopping of native vegetation* (DELWP 2017) and *Assessor's handbook. Applications to remove, destroy or lop native vegetation – Version 1.1 October 2018* (DELWP 2018). This included determining extent and measuring quality of native vegetation patches and mapping large and scattered trees.

The determination of the presence and extent of threatened ecological communities was completed using characteristics identified in Commonwealth and Victorian Government policy documents. Habitat mapping for threatened species was completed through the identification of suitable habitat values based on the habitat requirements for threatened species identified in relevant literature and government policy documents.

South of Beveridge, targeted surveys were undertaken for spiny rice-flower (*Pimelea spinescens* ssp. *spinescens*) at McIntyre Road (Sunshine) and golden sun moth (*Synemon plana*) at Tullamarine Freeway Precinct. A targeted tile grid survey was partially completed for striped legless lizard (*Delma impar*) at three sites south of Beveridge (two grids at Calder Freeway Precinct and one grid at the Tullamarine Freeway Precinct).

Results

Native vegetation

The results of the ecological assessment recorded a total of 36.465 ha of native patch vegetation and 426 scattered trees across all sites north and south of Beveridge (refer to Table 10), comprising 16 different Ecological Vegetation Classes (EVCs) spread across four bioregions.

The majority of the vegetation 34.56 ha was recorded in the regional Victorian sites, north of Beveridge. Approximately 1.905 ha of native vegetation was recorded at the sites south of Beveridge. Most of the native vegetation and scattered trees was recorded at the sites around Broadford, Tallarook and Seymour, plus other locations further north around Benalla, Wangaratta and Wodonga.

Threatened ecological communities

Several vegetation communities were also found to meet criteria as a *Flora and Fauna Guarantee Act 1988* (FFG Act) and/or Commonwealth EPBC Act listed threatened ecological community (TEC). These include the EPBC Act-listed communities Grey box grassy woodland and derived native grassland (GBGW) and White box-yellow box-Blakely's red gum grassy woodland and derived native grassland (WBYBBRGGW) located north of Beveridge; and Natural temperate grassland of the Victorian volcanic plain (NTG), present south of Beveridge and at one site north of Beveridge at Wallan.

Victorian FFG Act listed ecological communities recorded were the Victorian temperate woodland bird community (VTWBC), north of Beveridge, and Western (basalt) plains grassland community, present south of Beveridge and at Wallan, north of Beveridge. Locations of recorded communities are included in Appendix D.

Threatened flora

One nationally listed flora species, the spiny rice-flower was recorded north of McIntyre Road Overbridge (Sunshine) Investigation Area, outside of the project area.

Two state-listed flora species, the large-flower crane's-bill (*Geranium sp.1*) and buloke (*Allocasurina luehmannii*), were recorded in the Barry Road Overbridge (Dallas) and Seymour Avenel Road Overbridge (Seymour) Investigation Areas, respectively. Barry Road Overbridge (Dallas) is located south of Beveridge and Seymour-Avenel Road Overbridge (Seymour) is north of Beveridge.

Potential habitat for threatened flora species was considered present at several of the Investigation Areas. These include matted flax-lily (*Dianella amoena*), Euroa guinea-flower (*Hibbertia humifusa subsp. erigens*), swamp everlasting (*Xerochrysum palustre*), swamp fireweed (*Senecio psilocarpus*), crimson spider-orchid (*Caladenia concolor*) and purple diuris (*Diuris punctata*). Locations of threatened flora habitat is provided in Appendix G. Targeted surveys for threatened flora from September to November 2019 have been undertaken for sites north of Beveridge and no threatened flora species were identified (KBR 2020b).

Threatened fauna

No threatened fauna species listed under Victorian or Commonwealth legislation were recorded during the field investigations, including during targeted species surveys for the critically endangered golden sun moth and striped legless lizard at sites south of Beveridge.

Habitat for threatened fauna species has been identified at several locations. This includes for growling grass frog (*Litoria raniformis*), striped legless lizard, golden sun moth, painted honeyeater (*Grantiella picta*), regent honeyeater (*Anthochaera phyrgia*), swift parrot (*Lathamus discolor*), brush-tailed phascogale (*Phascogale*

tapoatafa) and squirrel glider (*Petaurus norfolcensis*). Locations of threatened fauna habitat is provided in Appendix G.

Impact Assessment

Changes in design and construction planning have been made to avoid and minimise impacts to potential habitat for threatened flora, fauna and ecological communities. A broader investigation area was initially assessed and then refined to produce a 'project area' for each site (investigation areas and project areas are shown in Appendix A). Project areas include the extent of the permanent works footprint and temporary works, including for diversion roads, access roads, and stockpile areas for laydown and construction compounds and have been reduced to the extent practical.

The impact assessment to ecological values has been completed based on an assumption that all values within the project area extents will be directly impacted. The significance of impacts has been assessed in accordance with:

- significant impact guidelines (including species-specific impact guidelines) for matters of national environmental significance listed under the EPBC Act, and
- EES referral criteria for native vegetation and matters listed under the FFG Act.

Matters of national environmental significance listed under the EPBC Act

A total loss of 3.543 ha of GBGW is predicted at Seymour-Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour). The impact is considered significant due to the reduction in extent of the community (predicted to be 0.001% of the remaining extent within Victoria) and fragmentation of the community that extends within the immediate landscape. Both of these sites are north of Beveridge and form part of T2A - Stage 1.

Potential habitat for critically endangered and endangered species (swift parrot and regent honeyeater), and vulnerable species (crimson spider-orchid and Euroa guinea-flower) has been identified within five project areas between Broadford and Seymour, north of Beveridge. This habitat is generally considered to be a dispersal habitat for threatened fauna, with a modified understorey which has reduced habitat quality for threatened flora. As no individuals or populations of EPBC Act listed flora or fauna have been recorded within the project areas north of Beveridge, the project is not considered to impact on any populations of listed species or their critical habitat, and therefore project impacts are not considered to be significant.

South of Beveridge there is a predicted loss of 0.849 ha of NTG at McIntyre Road (Sunshine) and Hume Highway Overbridge (Craigieburn). This impact may be considered significant due to the reduction in extent (0.007 % of the remaining extent within Victoria) of the critically endangered community.

Three project areas south of Beveridge: McIntyre Road Overbridge (Sunshine), Barry Road Overbridge (Dallas) and Hume Highway Overbridge (Craigieburn) have potential habitat for spiny rice-flower, golden sun moth,

growling grass frog and striped legless lizard. Spiny rice-flower plants, recorded north of McIntyre Road Overbridge (Sunshine), have been avoided. Habitat for all four species is considered small and isolated, with impacts to these habitats not considered to be significant. If construction is required at the above sites with mapped potential habitat for spiny rice-flower, golden sun moth, growling grass frog and striped legless lizard, further assessment of impacts may be required.

Environmental Effects Statement Referral Criteria

There is a predicted impact of 9.123 ha to endangered EVCs across the project areas north and south of Beveridge. This figure is below the single EES referral trigger of potential removal of greater than 10 ha of an endangered EVC.

Ecological-based EES referral triggers as part of a combination of referral triggers have been met based on the following impacts:

- Loss of a significant area (7.501 ha) of habitat for the *Flora and Fauna Guarantee Act 1988* (FFG Act) listed VTWBC
- Loss of greater than 10 ha of native vegetation, comprising a cumulative total of 13.913 ha, which includes 9.123 ha of endangered EVCs and 4.79 ha of vulnerable EVCs (refer to Table 1).

Note that the impacts associated with overhead line works have also been considered in the assessment against referral criteria and will be included in referrals.

The summary of native vegetation impacts against the EES referral criteria is further divided between sites north and south of Beveridge in Table 1.

Table 1 Predicted impacts to native vegetation (excluding overhead lines)

Bioregional conservation significance	Estimated impact – Entire Project Area	Estimate impact south of Beveridge	Estimated impact north of Beveridge
Endangered	9.123 ha.	1.092 ha	8.031 ha
Vulnerable	4.79 ha	0.00 ha	4.79 ha
Total	13.913 ha.	1.092 ha	12.821 ha

Most of the impact to native vegetation is at sites north of Beveridge, with loss of vegetation at sites south of Beveridge totalling 1.092 ha.

Impacts to the FFG Act-listed VTWBC have been significantly reduced by 27.621 ha through refinement of project areas. The predicted impact to the community (a predicted loss of 7.501 ha), occurs predominately within the five project areas listed below (located north of Beveridge); with the remainder occurring at signal gantry 18 and 19 (<0.006 ha):

- 0.675 ha at Short Street Overbridge (Broadford), including 2 large trees
- 1.221 ha at Marchbanks Road Overbridge (Broadford), including 7 large trees
- 1.898 ha at Hume Highway Tallarook Precinct (Tallarook), including 10 large trees
- 1.707 ha at Seymour-Avenel Road Overbridge (Seymour), including 6 large trees
- 1.994 ha at Hume Highway Seymour Precinct (Seymour), including 7 large trees.

In consideration of the extent of the predicted loss of the FFG- Act listed VTWBC, including the loss of complex understorey and sites with several large trees, the impact is considered to be a loss of a 'significant area' of the listed community triggering the need for an EES referral.

Potential habitat has been identified at the five project areas listed above for several FFG Act-listed species. Based on current surveys, there is potential that a small number of individuals of listed species may be present, however, it is unlikely that an important population is present, or that the habitat is critical for the species. Therefore, the predicted impacts to FFG species are not considered to meet the EES referral criteria (DSE 2006).

Legislative implications

Environment Protection and Biodiversity Conservation Act 1999

North of Beveridge

In consideration to the 3.543 ha predicted impact to EPBC Act-listed ecological community GBGW, it is recommended the project be referred to the Commonwealth Minister of the Environment. As the impact to the community at Seymour-Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour), is considered significant, the project will also likely be considered a controlled action under the Act.

Currently the impacts to other matters listed under the EPBC Act are not considered to be significant.

South of Beveridge

There is a predicted loss of 0.849 ha of the critically endangered NTG at McIntyre Road Overbridge (Sunshine) and Hume Highway Overbridge (Craigieburn). This impact may be considered significant due to the reduction in extent of the critically endangered community.

Based on current surveys, the predicted impacts to EPBC Act-listed threatened flora and fauna are not currently considered to be significant. If construction of sites south of Beveridge are to proceed, further targeted surveys may be required to confirm this assessment.

Environmental Effects Act 1978

North of Beveridge

Due to the impacts to native vegetation and the FFG listed ecological community VTWBC, it is considered that the project requires a referral under the Ministerial guidelines (DSE 2006). It is recommended that an EES referral be prepared and submitted.

An EES referral should also consider potential impacts to listed threatened species, including the aforementioned EPBC Act-listed species (which are also listed under the FFG Act), plus the brush-tailed phascogale (*Phascogale tapoatafa*), squirrel glider (*Petaurus norfolcensis*), and barking owl (*Ninox connivens*).

South of Beveridge

The sites south of Beveridge include the following ecological values that are considered within the EES referral criteria:

- 1.092 ha of endangered EVC, which is present as generally small and isolated patches.
- 0.849 ha of the FFG Act-listed Western (basalt) plains grassland threatened ecological community.

These patches of grasslands provide habitat for several nationally and Victorian threatened species, including matted flax-lily, spiny rice-flower, growling grass frog and striped legless lizard. It is unlikely that significant populations are present at these sites.

If construction is required for sites south of Beveridge which contain mapped potential habitat for spiny rice-flower, golden sun moth, growling grass frog and striped legless lizard, further assessment of impacts may be required.

Native vegetation guidelines

The proposed impacts to native vegetation will require approval under the *Planning and Environment Act 1987* and must meet the requirements of the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017). Compliance with the guidelines will necessitate offsets for native vegetation and scattered trees that are impacted by the proposed works.

The refinement of current project areas has resulted in avoidance of large areas of native vegetation and habitat (including threatened ecological communities and species habitat), plus significantly reduced impacts where vegetation loss is unavoidable. Table 2 summarises the reduction in native vegetation impacts achieved by design and construction planning changes.

Table 2 Reduction in impacts for native vegetation in the project areas north and south of Beveridge

Bioregional conservation significance	Total recorded (ha) – Investigation Area	Proposed impact within Project Area
Endangered	19.831 ha	Through re-design and other avoidance and minimisation measures, expected impact is 9.123 ha.
Vulnerable	16.093 ha	Through re-design and other avoidance and minimisation measures, expected impact is 4.79 ha
Total	35.924 ha	13.913 ha

Based on the predicted impact within the project area (north and south of Beveridge), the project would be required to offset impacts to 13.805 ha of native vegetation, which includes 108 large trees. This area excludes an area of patch (0.108 ha of plains grassland) at Hume Highway Overbridge (Craigieburn), which is in the Melbourne Strategic Assessment (MSA) area, and therefore the habitat loss needs to be compensated separately under the MSA.

The estimated offset requirements for predicted impacts to native vegetation outside of the MSA are:

- 12.563 general habitat units
- A minimum strategic biodiversity value score of 0.415
- 128 Large Trees.

Conclusion

Overall, most project areas have been subject to varying levels of modification and disturbance due to previous construction and maintenance of roads and the rail line. A high proportion of native vegetation and habitat is limited to a small number of sites, predominately in regional Victoria, with four sites north of Beveridge, between Broadford and Seymour containing over 70 per cent of the native vegetation recorded. Significant reduction in impacts to threatened ecological communities and habitat for threatened flora and fauna has been achieved at these sites. However, unavoidable impacts to native vegetation, including listed ecological communities will require:

- the project to be referred under the EPBC Act for predicted impacts to GBGW at Seymour-Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour), and
- the project to be referred under the EE Act due to meeting combination referral criteria for the predicted impact to over 10 ha of native vegetation, and the loss of a significant area (7.501 ha) of the FFG VTWBC habitat.

Referrals under the EPBC Act and EE Act will also need to consider impacts to listed threatened flora and fauna species. Based on the surveys completed for the project to date, from 2016 to 2019, predicted impacts to

species are not considered significant, due to lack of populations of any species recorded within the project areas and the current condition of the habitat, which is not considered critical or important for species, including for breeding, nesting and foraging. The current assessment of impacts is included in Table 27 (threatened flora) and Table 28 (threatened fauna).

Planning approval for native vegetation removal under several planning schemes is required. An offset requirement of 12.563 general habitat units, with 128 Large Trees are required to offset impacts for all Enhancement, Track Slew and Signal Modification sites north and south of Beveridge. These offsets will need to be located over three catchment management areas (CMAs), Port Phillip and Westernport, Goulburn Broken and North East CMAs. Native vegetation impacts associated with the overhead powerline scope of the project will need to be added to the above offset requirement to understand the whole of project impact to native vegetation.

1 Introduction

1.1 INTRODUCTION

The Australian Government has committed to delivering a significant piece of national transport infrastructure by constructing a high performance and direct interstate freight rail corridor between Melbourne and Brisbane, via central-west New South Wales (NSW) and Toowoomba in Queensland. Inland Rail is a major national project that will enhance Australia's existing national rail network and serve the interstate freight market.

The Inland Rail route, which is about 1,700 km long involves:

- using the existing interstate rail line through Victoria and southern NSW
- upgrading about 400 km of existing track, mainly in western NSW
- providing about 600 km of new track in northern NSW and south-east Queensland.

Australian Rail Track Corporation Ltd (ARTC) ('the proponent') has developed a ten-year programme to deliver Inland Rail. ARTC was created after the Australian and state governments agreed in 1997 to the formation of a 'one stop shop' for all operators seeking access to the national interstate rail network. Across its network, ARTC is responsible for:

- selling access to train operators
- developing new business
- capital investment in the corridors
- managing the network
- infrastructure maintenance.

1.2 PROJECT DESCRIPTION

The Tottenham to Albury (T2A) enhancement works is the Victorian section and an important part of the Inland Rail project which runs from Brisbane to Melbourne.

This report relates to the biodiversity investigations undertaken on the Victorian section of the project (T2A). All sites from Sunshine to Albury have been considered in ecological desktop and field investigations completed to date.

As the location of the rail intermodal terminal facility at the southern end of the T2A project is yet to be determined, the T2A project is currently being progressed in two stages. The first stage is comprised of discrete project areas from Beveridge to Albury (T2A - Stage 1). Sites north of Beveridge are currently at reference design. During detailed design, further development and assessment will be undertaken in consultation with relevant stakeholders and the community.

Further engineering design and environmental surveys on the sites south of Beveridge have been placed on hold. Development of the sites south of Beveridge is contingent on the intermodal decision and as such sites may not be constructed if the intermodal terminal is built at Beveridge.

The project objective is to provide vertical and horizontal clearance to facilitate the operation of double-stacked freight trains along the existing North East Rail Line. This will be provided by either lowering tracks or replacing bridges with taller structures (referred to as Enhancement Sites). Where bridge replacements are proposed, road realignment to tie into the new bridges is also required. The project will also require the slewing of existing tracks and relocation of signal structures.

There are a total of 38 investigation areas where works (bridge replacement, track slews, and modifications to signalling structures) are proposed at discrete points along 305 km of existing rail corridor; with 24 of these occur north of the proposed intermodal terminal at Beveridge (T2A – Stage 1). There are also additional overhead line project areas that occur at discrete locations along and adjacent to the rail corridor.

The bridge replacement and track lowering works will include major civil and structural construction activities at selected locations where the rail corridor is intersected by an existing road bridge and the required vertical and horizontal clearance for double-stacked freight trains is not currently provided.

Ancillary works includes:

- relocation of overhead power lines
- utility relocation
- establishment of construction site compounds and access roads
- signalling and communications
- signage and fencing.

Biodiversity impacts associated with the overhead power lines scope have been assessed separately from this report (KBR 2020c). The impacts of the project as a whole (combined Enhancement Sites, track slewing, signal structure relocations and overhead power line impacts) will need to be considered in determining legislative requirements, including offsets.

The operation of taller double-stacked freight trains along the existing rail corridor is unlikely to result in impacts to biodiversity. However, further assessment may be required to review any localised impacts (e.g. pruning or trimming of trees) which is beyond the scope of this report.

1.2.1 Proposed project works

Track Lowering

The horizontal and vertical extent of the excavation for track lowering varies. However, the proposed project construction involves the following:

- relocation and/or protection of identified utilities and services
- construction of piled retaining walls
- removal of existing rail infrastructure such as track, sleepers and ballast
- track drainage works. This will consist of pit and pipe drainage system that runs parallel to the tracks. The drainage work will service the lowered tracks and remove surface and subsurface water.
- excavations to lower the track to a maximum depth of 2.7 m and grading to achieve rail design speed and drainage
- reinstatement of railway tracks.

Bridge Replacement

The bridge works at each location will vary depending on the current alignment of the bridge and the height of the bridge and associated embankments. Each bridge requires a clearance of 7.1 m for the double stacked freight trains. The construction activities are as follows:

- vegetation clearing and grubbing
- relocate utilities and services
- bulk earthworks for bridge approaches.
- building the new bridge and approaches:
- landscaping, including planting of vegetation in the road reserve
- upon completion of the new bridge, removal of the existing bridge structure.

Signal Gantries

Signal gantry modification typically involve the relocation of existing signal gantries to provide more space for double-stacked freight trains. Generally, the works require the installation of footings for the new signal gantry, localised trenching and decommissioning and removal of the previous gantry.

Track Slew

Track Slews are minor in nature and range from a slew width of 30 mm to 368 mm. The magnitude of each track slew will determine the construction method required, however for Track Slew less than 100 mm construction can occur via hi-rail machinery with no disturbance outside the existing formation of the rail track. For track slews greater than 300mm, full reconstruction of the formation layer is required.

The following table provides a summary of the works at each location.

Table 3 Summary of track slew construction method at each location

Investigation Area	Maximum slew width (mm)	Construction method
Track Slew Investigation Area A	200	Works will involve widening of the existing ballast shoulder and formation layer subgrade, which will consist of: • Existing ballast shoulder to be 'trimmed' • Widening of formation layer through grading and proof rolling • Place new ballast • Bulk movement of rail to be performed by excavator/ loader • Track tamper to ensure final alignment and pack ballast for stability.
Track Slew Investigation Area B (within Pascoe Vale Road Overbridge and Jacana Station Footbridge (Glenroy))	100	Track tamper to realign existing tracks and pack ballast for stability. Consistent with track tamping that is performed for routine maintenance.
Track Slew Investigation Area C	368	Full reconstruction of formation layer, ballast shoulder and relaying of tracks. Track tamper to ensure final alignment and pack ballast for stability.
Track Slew Investigation Area D	123	Works will involve widening of the existing ballast shoulder and formation layer subgrade, which will consist of:

Investigation Area	Maximum slew width (mm)	Construction method
		• Existing ballast shoulder to be 'trimmed' • Widening of formation layer through grading and proof rolling • Place new ballast • Bulk movement of rail to be performed by excavator/ loader • Track tamper to ensure final alignment and pack ballast for stability.
Track Slew Investigation Area E	30	Track tamper to realign existing tracks and pack ballast for stability. Consistent with track tamping that is performed for routine maintenance, there will be no vegetation or habitat impacts at this location. An engineering waiver will be requested for track Slew E due to the small size of the slew.
Track Slew Investigation Area F	190	Works will involve widening of the existing ballast shoulder and formation layer subgrade, which will consist of: • Existing ballast shoulder to be 'trimmed' • Widening of formation layer through grading and proof rolling • Place new ballast • Bulk movement of rail to be performed by excavator/ loader • Track tamper to ensure final alignment and pack ballast for stability.
Track Slew Investigation Area G (within Seymour Avenel Road Overbridge) (Seymour)	152	Works will involve widening of the existing ballast shoulder and formation layer subgrade, which will consist of: • Existing ballast shoulder to be 'trimmed' • Widening of formation layer through grading and proof rolling • Place new ballast • Bulk movement of rail to be performed by excavator/ loader • Track tamper to ensure final alignment and pack ballast for stability.
Track Slew Investigation Area H	74	Track tamper to realign existing tracks and pack ballast for stability. Consistent with track tamping that is performed for routine maintenance. Track Slew Investigation H will not impact on native vegetation as they will be high-rail projects.
Track Slew Investigation Area I	74	Track tamper to realign existing tracks and pack ballast for stability. Consistent with track tamping that is performed for routine maintenance. Track Slew Investigation I will not impact on native vegetation as they will be high-rail projects.

1.3 INVESTIGATION AREAS

The structures within the 38 investigation areas, locality and works are provided in Table 4, with maps of each investigation area provided in Appendix A. These areas were initially identified based on concept design and broadly identified the areas required for construction including impact areas, laydown and access.

1.4 PROJECT AREAS

During the development of the Reference Design the project completed a constructability review, an assessment of utility impacts and connections and stakeholder and community engagement. Investigation areas were then further refined from this process, extended or adjusted to suit the current design, earthworks and temporary construction requirements, with consideration of environmental impacts, including those identified during field surveys after concept design (see Section 1.3.2). These refined areas are referred to as project areas (Appendix A).

The project areas are considered to allow for the effective construction of the works with the impacts to ecological values minimised to the greatest extent practicable.

Ecological values within the project area for each site are assumed to be directly impacted. The impacts within the project areas formed the basis of assessment against approval and legislative requirements (provided in Section 6).

Table 4 Overview of Tottenham to Albury structures and Investigation Areas

Investigation Area Name	ARTC SID	Structure	Chainage	Map Reference	Bioregion	Local Government Area
McIntyre Road Overbridge (Sunshine)		Signal Gantry 1 (SG1)	14.895	Map 1	Victorian Volcanic Plain	Brimbank
	1-1110-PD-B62-05-RO-15.422	McIntyre Road Bridge	15.422			Brimbank
		Signal Gantry 2 (SG2)	15.608			Brimbank
		Signal Gantry 3 (SG3)	16.453			Brimbank
		Signal Gantry 4 (SG4)	16.578			Brimbank
Keilor Park Drive Overbridge (Keilor East)		Signal Gantry 5 (SG5)	18.452	Map 2	Victorian Volcanic Plain	Brimbank, Moonee Valley
	1-1110-PD-B62-10-RO-18.739	Keilor Park Drive Bridge	18.739			
Signal Gantry 6 (SG6)		Signal Gantry 6	19.232	Map 3	Victorian Volcanic Plain	Brimbank, Moonee Valley
Calder Freeway Precinct (Keilor East)	1-1110-PD-B62-12-RO-20.319	Calder Freeway (Outbound)	20.319	Map 4	Victorian Volcanic Plain	Brimbank, Moonee Valley
	1-1110-PD-B62-12-RO-20.346	Calder Freeway (Inbound)	20.346			
	1-1110-PD-B62-12-RO-20.376	Calder Freeway (On Ramp)	20.376			
	1-1110-PD-B62-12-RO-20.393	Fullerton Road Bridge	20.393			
Westfield Drive Overbridge (Tullamarine)	1-1110-PD-S72-13-SI-22.11	Signal gantry 7 (SG 7)	22.11	Map 5	Victorian Volcanic Plain	Brimbank, Moreland, Moonee Valley
	1-1120-PD-S72-14-SI-22.234	Signal gantry 8 (SG 8)	22.234			
	1-1120-PD-B62-15-RO-23.315	Westfield Drive Bridge	23.315			
Tullamarine Freeway Precinct (Strathmore Heights)	1-1120-PD-S72-16-SI-23.122	Signal gantry 9 (SG9)	23.122	Map 5	Victorian Volcanic Plain	
	1-1120-PD-B62-17-RO-23.265	Melrose Drive Bridge	23.265			

Investigation Area Name	ARTC SID	Structure	Chainage	Map Reference	Bioregion	Local Government Area
	1-1120-PD-B62-18-RO-23.470	Tullamarine Freeway (Northbound)	23.47			Brimbank, Moreland, Moonee Valley
	1-1120-PD-B62-18-RO-23.502	Tullamarine Freeway (Southbound)	23.502			
Track Slew Investigation Area A		Track Slew 1	24.040	Map 5	Victorian Volcanic Plain	Moreland Moonee Valley
		Track Slew 2	24.380			
	1-1120-PD-S72-19-SI-24.906	Signal gantry 10 (SG10)	24.906			
Belair Avenue Overbridge (Glenroy)		Signal gantry 11 (SG11)	25.320	Map 5	Victorian Volcanic Plain	Moreland
	1-1120-PD-B62-21-RO-25.35	Belair Avenue Bridge	25.35			
Pascoe Vale Road Overbridge (Glenroy) and Jacana Station Footbridge (Glenroy) (Includes Track Slew Investigation Area B)	1-1120-PD-S72-23-SI-23.325	Signal gantry 12 (SG12)	25.925	Map 6	Victorian Volcanic Plain	Moreland, Hume
		Track Slew 3	26.2			
	1-1120-PD-S72-22-SI-26.292	Signal gantry 13 (SG13)	26.292			
	1-1120-PD-B62-24-RO-26.639	Jacana Station Footbridge	26.507			
	1-1120-PD-B62-25-FB-26.507	Pascoe Vale Road Bridge	0			
Camp Road Overbridge (Broadmeadows)	1-1120-PD-B62-26-RO-16.578	Camp Road Bridge	16.578	Map 7	Victorian Volcanic Plain	Hume
Riggall Street Overbridge (Broadmeadows)	1-1120-PD-B62-27-RO-17.781	Riggall Street Bridge	17.781	Map7	Victorian Volcanic Plain	Hume
Barry Road Overbridge (Dallas)	1-1120-PD-B62-28-RO-19.02	Barry Road Bridge	19.02	Map 8	Victorian Volcanic Plain	Hume
Signal Gantry 14 (SG14)		Signal Gantry 14 (SG14)	21.833	Map 9	Victorian Volcanic Plain	Hume

Investigation Area Name	ARTC SID	Structure	Chainage	Map Reference	Bioregion	Local Government Area
Hume Highway Overbridge (Craigieburn)	1-1120-PD-B62-30-RO-26.377	Hume Highway Bridge Craigieburn	26.377	Map 10	Victorian Volcanic Plain	Hume
Track Slew Investigation Area C		Track Slew 4	47.52	Map 12	Victorian Volcanic Plain	Mitchell
		Track Slew 5	47.78			
Broadford Road Overbridge (Wandong)	1-1120-PD-B62-31-RO-55.47	Broadford Road Bridge (Wandong)	55.47	Map 11	Central Victorian Uplands	Mitchell
Signal Gantry 15 (SG15)	1-1120-PD-S72-32-SI-66.215	Signal Gantry 15 (SG15)	66.215	Map 13	Central Victorian Uplands	Mitchell
Signal Gantry 16 (SG16)	1-1120-PD-S72-33-SI-69.801	Signal Gantry 16 (SG16)	69.801	Map 14	Central Victorian Uplands	Mitchell
Signal Gantry 17 (SG17)	1-1120-PD-S72-34-SI-73.664	Signal Gantry 17 (SG17)	73.664	Map 15	Central Victorian Uplands	Mitchell
Hamilton Street Overbridge (Broadford)	1-1120-PD-B62-35-RO-75.513	Hamilton Street Bridge (Broadford)	75.513	Map 16	Central Victorian Uplands & Victorian Riverina	Mitchell
Short Street Overbridge (Broadford)	1-1120-PD-B62-36-RO-76.596	Short Street Bridge	76.596	Map 17	Victorian Riverina	Mitchell
Marchbanks Road Overbridge (Broadford)	1-1120-PD-B62-37-RO-77.978	Marchbanks Road Bridge	77.978	Map 18	Central Victorian Uplands	Mitchell
Signal Gantry 18 (SG18)	1-1120-PD-S72-38-SI-79.956	Signal Gantry 18 (SG18)	79.956		Central Victorian Uplands	Mitchell
Signal Gantry 19 (SG19)	1-1120-PD-S72-39-SI-86.247	Signal Gantry 19 (SG18)	86.247		Central Victorian Uplands	Mitchell
Hume Highway Tallarook Precinct (Tallarook)	1-1120-PD-B62-40-RO-88.489	Hume Freeway (southbound)Tallarook	88.489	Map 21	Central Victorian Uplands	Mitchell

Investigation Area Name	ARTC SID	Structure	Chainage	Map Reference	Bioregion	Local Government Area
	1-1120-PD-B62-40-RO-88.533	Hume Freeway (northbound)Tallarook	88.533			
Track Slew Investigation Area D		Track Slew 6	89.019	Map 21	Central Victorian Uplands	Mitchell
Track Slew Investigation Area E		Track Slew 7	95.5	Map 22	Victorian Riverina	Mitchell
	1-1130-PD-S72-41-SI-95.631	Signal gantry at chainage 95.631km	95.631		Victorian Riverina	Mitchell
Track Slew Investigation Area F		Track Slew 8	99.1	Map 23	Central Victorian Uplands	Mitchell
	1-1130-PD-S72-42-SI-99.12	Signal gantry at chainage 99.120km	99.120		Victorian Riverina	Mitchell
Seymour-Avenel Road Overbridge (Seymour) (Includes Track Slew Investigation Area G)	1-1130-PD-B62-43-RO-102.392	Seymour Avenel Road Bridge	102.392	Map 24	Central Victorian Uplands	Mitchell
		Track Slew 9	102.3			
Hume Highway Seymour Precinct (Seymour)	1-1130-PD-B62-44-RO-103.801	Hume Freeway (southbound) Seymour	103.801	Map 25	Central Victorian Uplands	Mitchell
	1-1130-PD-B62-44-RO-103.841	Hume Freeway (northbound) Seymour	103.841			
Track Slew Investigation Area H		Track Slew 10	104.04	Map 25	Central Victorian Uplands	Mitchell
Track Slew Investigation Area I		Track Slew 11	107.88	Map 26	Central Victorian Uplands	Mitchell, Strathbogie
Anderson Street Overbridge (Euroa)	1-1130-PD-B62-45-RO-150.882	Anderson Street Bridge (Euroa)	150.882	Map 27	Victorian Riverina	Strathbogie

Investigation Area Name	ARTC SID	Structure	Chainage	Map Reference	Bioregion	Local Government Area
Benalla Station Approach Road Overbridge (Benalla)	1-1130-PD-B62-46-RO-195.402	Benalla Station Approach Road	195.402	Map 28	Victorian Riverina	Benalla
Beaconsfield Parade Overbridge (Glenrowan)	1-1140-PD-B62-47-RO-218.664	Beaconsfield Parade Bridge (Glenrowan)	218.664	Map 29	Northern Inland Slopes	Wangaratta
Wangaratta Precinct (Wangaratta)	1-1140-PD-B62-48-RO-233.605	Green Street Bridge Wangaratta	233.605	Map 30	Victorian Riverina	Wangaratta
	1-1140-PD-B62-48-UB-233.738	Water Main Bridge	233.738			
	1-1140-PD-S72-48-SI-233.78	Signal gantry 22	233.78			
	1-1140-PD-B62-48-FB-233.895	Cusack Street Footbridge	233.895			
	1-1140-PD-B62-48-RO-233.924	Wangaratta Station Entry Road	233.924			
	1-1140-PD-B62-48-FB-234.002	Wangaratta Station Footbridge	234.002			
	1-1140-PD-B62-48-FB-234.165	Docker Street Footbridge	234.165			
	1-1140-PD-B62-48-RO-234.222	Wangaratta Station Exit Road	234.222			
Murray Valley Highway Overbridge (Barnawartha North)	1-1150-PD-B62-49-RO-285.078	Murray Valley Highway (Barnawartha)	285.087	Map 31	Northern Inland Slopes	Wodonga
Murray River Underbridge (Albury)	1-2110-PD-B62-01-RU-648.487	Murray River Underbridge	311	Map 32	Northern Inland Slopes	Wodonga

1.5 PURPOSE AND OBJECTIVES

The purpose of the assessments was to identify the extent and quality of vegetation and habitat and other ecological values present within the investigation and project areas.

The objectives of the assessment and report is to also determine the potential impact to ecological values and the approvals pathway for the project, in regard to the following environmental legislation:

- Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Victorian *Environment Effects Act 1978* (EE Act)
- Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act)
- Victorian *Planning and Environment Act 1987* (P&E Act)
- Victorian *Water Act 1989*.

Recommendations are also made where further information is required to inform reasonable assessment against applicable legislation (such as targeted species surveys to confirm presence of a species or extent and condition of a community).

2 Methods

2.1 DESKTOP ASSESSMENT

2.1.1 Literature review

A review of previous investigation reports was undertaken to provide an indication of existing flora and fauna present within each investigation area. Resources reviewed included:

- VIC & NSW Enhancement Works Phase 2 Preparatory Works Ecological Assessment – Tottenham to Albury, prepared by WSP/PB (2016)
- South Improvement Alliance Passing Lane 5 to 11 – Flora and Fauna Assessment (Standard Gauge – East Side) Doc No: SOA-PL05-RPT-VL100-PDR-EN-1000-B-03 (KBR 2008).

The WSP/PB completed desktop and field investigations based on the investigation areas at concept design. Information contained within the 2016 report was reviewed and incorporated during site assessments as appropriate.

The KBR (2008) report is comprised of results from targeted flora assessments conducted between 2005 and 2008 within the Melbourne to Albury rail corridor.

2.1.2 Data review

A desktop review of available databases was undertaken to establish the potential presence of species and communities of conservation significance occurring within the defined investigation areas. Local council planning overlays were also reviewed to determine any requirements associated with vegetation or habitat removal.

The results of the database search was tabulated and is included in Appendix B. The information was also mapped and used to support and inform the field assessment.

Databases reviewed included:

- Department of the Environment and Energy (DoEE) Protected Matters Search Tool (PMST) database (DoEE 2017), within 2km
- DELWP Victorian Biodiversity Atlas (DELWP 2019) (VBA), within 5 km
- DELWP NatureKit (DELWP 2019) bioregion location, modelled Ecological Vegetation Class (EVC) distribution and bioregional conservation status within 5 km of investigation areas
- DELWP EnSym Native Vegetation Regulations Tool (DELWP 2017a) for native vegetation databases and offset requirements.

The outcomes of database searches were collated into a master database so that further assessment could be carried out against native vegetation mapping, previous reports and aerial photography in order to determine the potential or likelihood for significant ecological values to occur. The assessment method used for determining likelihood is described below in Section 2.1.4.

Impacts and approval pathways were assessed and identified using the following guidelines:

- Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (DoE 2013)
- Species specific significant impact guidelines (where relevant)
- Ministerial guidelines for assessment of environmental effects under the *Environment Effects Act 1978* (DSE 2006)
- Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017b (the Guidelines).

A small extent at the northern end of the Hume Highway Overbridge (Craigieburn) investigation area intersects with Melbourne's urban growth boundary. Significant vegetation communities, plants and animals within this area are managed under the Melbourne Strategic Assessment (MSA). A patch of remnant vegetation and habitat has been recorded within the MSA boundary. It is noted that no proposed Precinct Structure Plan, nor Conservation Area, apply to this area of the MSA.

As the patch is located within the MSA, the EnSym tool does not contain any modelled information for this area and cannot be included in the offset scenario testing (Section 6.4). Vegetation removal within the MSA must be offset by the payment of habitat compensation obligation fees through DELWP. These actions do not require an additional EPBC Act referral or assessment under the Guidelines.

2.1.3 Database searches

A 5 km search area was applied to each investigation area to identify potential presence of species and communities of conservation significance through database searches. Ecological values that are likely to influence the assessment completed for each Investigation Area were deemed to be threatened and listed flora and fauna species, ecological vegetation classes and biosites.

For any key mobile fauna species, such as growling grass frog and squirrel glider, a broader landscape-wide targeted assessment of habitat connectivity for each investigation area was completed. This assessment extended to an approximate 10 km buffer area around each investigation area and considered each species' ability to move through the landscape. This assessment informed the likelihood of occurrence rating (refer to Section 2.1.4).

Searches of the on-line Commonwealth DoEE database were completed to identify the presence of matters of national environmental significance. A buffer distance of 2 km radius around each investigation area was chosen due to the tool using both known and predicted habitat based on previous records and habitat requirements. This buffer size was also informed by the findings of the previous ecological assessment (WSP 2016). This buffer size enabled known listed matters, such as Ramsar wetlands or heritage sites to be clearly identified for the project and surrounding areas.

2.1.4 Likelihood of occurrence

A list of EPBC Act and FFG Act flora and fauna species was obtained from the desktop assessment and database search (Appendix B).

For threatened species identified during the desktop assessment, an assessment of the likelihood of occurrence was completed following field surveys, based on the species habitat requirements, previous records, likely presence of habitat and the ability to move through the landscape. The assessment rated species as one of three broad categories for each investigation area:

- High; the environment in the investigation area contains most of a species' habitat requirements as determined by previous surveys or with a modelled EVC present over a large portion of the investigation area. The modelled EVC may also correlate with a high modelled condition score

(DELWP 2017d). There is good connectivity to other habitat areas and/or locations with known populations or recent records (less than 10 years old) of the species;

- Moderate; there are previous records of the species (within the last 30 years) within 5 km of the investigation area, and potential linkages for the species in the surrounding landscape (generally for mobile fauna), with potential for one or two key habitat components (such trees identified on aerial photography, modelled EVC present) to be present with likely minimal disturbance from land use, including:
  - Evidence of agricultural activity, including cropping or slashing,
  - Evidence of disturbance, from road or rail activities or adjacent land use changes (residential or industrial development)
- Low; few habitat components are present for a species (minimal vegetation apparent on aerial photography or no modelled EVC present) and the area appears to have been subject to previous disturbance, evidenced either through assessor knowledge or via aerial photography. No or few historic records are present for the species.

Only species with a medium and high likelihood of occurrence rating were considered to have 'potential' to be present. The impact assessment for these species within the project area are discussed in Sections 6.2.1 and 6.3.3 for significance and legislative implications.

2.2 BIODIVERSITY FIELD ASSESSMENT

2.2.1 Approach

Literature and data review comprising desktop searches and previous assessments were used to inform field assessments.

A detailed ecological survey was completed for all 38 investigation areas (Appendix A), including vegetation quality assessments, assessment of threatened ecological communities' presence and habitat assessments for threatened flora and fauna species. Where possible, seasonal surveys for threatened flora and fauna species, to assess the presence or likelihood of presence of listed threatened species with potential habitat. Where survey timing was outside standard survey periods for threatened flora and fauna species, potential habitat areas were identified and mapped. The results of the assessments are displayed in Appendix D (vegetation and threatened ecological communities) and Appendix H (threatened species habitat).

A limited ecological survey was completed at Track Slew E, where a waiver is being sought for the existing horizontal clearance. Therefore, no works are likely to occur at the site, however, if works are required this would be completed solely by on-track machinery and no impacts to vegetation would occur. Therefore, no vegetation quality assessments were completed, with only patch extents and habitat mapped.

2.2.2 Staged Investigations

Field ecological investigations were completed to verify the extent and condition of native vegetation and habitat. This was completed in two stages; Stage 1 was completed following the concept design phase between December 2017 and February 2018.

The second stage of assessment occurred in June 2019, following further design work, which resulted in additions and modifications to accommodate design changes to several investigation areas assessed during Stage 1. Maps of each investigation area, and which areas were subject to the investigations at each stage is provided in Appendix A.

Slight variations occurred in the survey method between the two stages, as described in in the below sections for methods on vegetation assessments and assessments for threatened ecological communities, flora and fauna.

2.2.3 Vegetation assessment

Teams, comprised of two ecologists per team, conducted vegetation assessments for Stage 1 on 19-20, 22 December 2017, 3-5, 9-11 January and 1-2, 6-7 February 2018, and for Stage 2 on 3-14 June 2019, of the areas identified in Appendix A.

The vegetation assessment was conducted using the random meander technique as described by Cropper (1993). This method involved a team of two ecologists walking throughout the project area in no set pattern, searching all potential habitats and recording species observed.

All ecological values were marked by plotting the areas using a hand-held Global Positioning System (GPS) and mapped (see Appendix D). A vegetation quality assessment was completed on any native patch recorded within Investigation Areas by a DELWP competent Native Vegetation Assessor using the habitat hectares method (DSE 2004a).

The following information was gathered during the vegetation assessments:

- extents and condition of native vegetation using the habitat hectare method (DSE 2004b, DELWP 2017b);
- presence of Large Trees (LOTs) (DELWP 2017b);
- scattered trees (DELWP 2017b);
- characteristics to qualify as a threatened ecological community listed under the FFG Act or EPBC Act;
- locations of observed threatened flora individuals listed under the EPBC Act or FFG Act (including aquatic species)
- presence of noxious weeds and weeds of national significance.

Native vegetation identified within the investigation area was characterised in accordance with the Guidelines (DELWP 2017b) and is described below.

Patch of native vegetation

A patch of native vegetation (quantified in hectares) is defined as the following in accordance with DELWP (2017b):

- an area of vegetation where at least 25 per cent of the total perennial understorey plant cover is native; or
- any area with three or more native canopy trees where the drip line of each tree touches the drip line of at least one other tree, forming a continuous canopy; or
- any mapped wetland included in the current wetlands map.

Any areas of native vegetation that were found to meet the definition of a native patch were assessed for their quality according to Victoria's *Vegetation Quality Assessment Manual: Guidelines for applying the habitat hectares scoring method Version 1.3* (DSE 2004a). The results of the habitat hectare assessment are included in Appendix E.

DELWP has also classified native vegetation in Victoria according to EVCs, which are described according to floristic, life form and ecological characteristics. The results of the quality assessment included in this report have been scored relative to these EVC benchmark areas in order to determine offset requirements if the patch were to be impacted. Accurate representation of the proposed extent of

native vegetation removal and minimisation of vegetation loss can greatly influence the time and expense of the offset application approval process.

Where existing vegetation information (WSP/PB 2016) was present within the current investigation area (such as extent and quality scores for recorded patches or criteria for threatened communities), this information was reviewed and verified during the vegetation assessment. Information was updated when the extent or the vegetation condition was considered to not accurately represent the current quality or extent of the vegetation patch in accordance with DSE (2004a) habitat hectares method.

The digitised site survey information of native patches and scattered trees was entered into the DELWP EnSym Native Vegetation Regulations Tool to determine the extent of impacts to native vegetation and habitat predicted by the project. The EnSym Tool produces an estimate of predicted impacts within the Project Areas as a Scenario Testing Report. As the extent of the canopy loss within a patch is unknown, the area of impact of a patch, included in the EnSym Tool, includes a buffer in accordance with DELWP requirements (DELWP 2018). The buffer was applied to patches of vegetation being intersected by project impacts (i.e. where only part of the whole patch is being removed). To comply with DELWP (2018) the area of the patch adjacent to the impact area is included in the offset calculation, to a minimum 18 m from the extent of impact, extending up to 25 m (depending on the density of large trees within buffer area). Where the native patch did not extend up to 18 m from the impact zone, the entire patch was assumed lost. These buffers are required to account for the loss of vegetation defined by the canopy edge (DELWP 2018).

The Scenario Testing Report, with estimated offset requirements, is included in Appendix E. The required buffers applied to the patch loss (DELWP 2018) is considered to be a conservative estimate of impacts. It is recommended that the canopy edge of lost vegetation be mapped prior to vegetation to confirm project impact and offset requirements.

When applying for a permit or seeking approval to remove native vegetation, the shapefiles of the impacted vegetation and condition scores are required to be submitted to DELWP to obtain a Biodiversity Offset Report (DELWP 2017b).

Scattered trees

A scattered tree is a mature tree that is greater than three metres in height and is normally found in the upper layer of a vegetation type (DELWP 2017b).

All scattered trees within each investigation area were recorded and mapped (Appendix D). Scattered tree data, including the diameter at breast height (DBH) was documented and is provided in Appendix F.

Scattered Trees were also included in the DELWP EnSym Native Vegetation Regulations Tool which assigns an extent and condition score to each field-recorded scattered tree. The offset requirements for scattered trees are included in the Offset Scenario Test Report (Appendix E).

Planted native vegetation

Under the Victoria Planning Provisions (VPP), Clause 52.17 requires a permit to remove, lop or destroy native vegetation. The VPP (Clause 72) define native vegetation more broadly than the DELWP VQA manual, as any ‘plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses’. This frequently results in the assessment of planted native vegetation or trees which may not be indigenous to the investigation area.

In accordance with Clause 52.17, planted vegetation is exempt from requiring a permit. Further guidance is provided in DELWP (2017c), which states “*This exemption does not apply to native vegetation planted or grown with public funding for the primary purposes of enhancing biodiversity or protection of land*”.

Planted trees were identified by aspects, including their location, age, arrangement, species and species mix, plus presence of old stakes and guards at the base of trees. If vegetation was considered to be planted, it was not recorded during the survey, as it is not considered to require a permit for removal.

2.2.4 Threatened flora surveys

In areas observed to have moderate to high quality habitat, or where an individual of a threatened flora species was observed, the habitat was recorded, and a supplementary targeted survey was undertaken using the grid survey technique. This method involves an intensive grid pattern search of the area, walked in parallel lines at a maximum spacing of 5 m (Cropper 1993). However, given that threatened flora species are generally cryptic and small, the survey was reduced to a spacing of 2 m. Any findings were noted, and locations of individual plants were captured using a hand-held GPS and mapped.

Spiny rice-flower

A targeted survey for spiny rice-flower was completed north of the McIntyre Road Overbridge (Sunshine) investigation area (south of Beveridge). This site was identified for a targeted survey due to the high number of previous records in the adjacent reserve and the high likelihood of occurrence.

The methodology was undertaken in accordance with the recommended survey guidelines (DEWHA 2009). The guidelines note that transect surveys should be undertaken when the plants are in flower (generally from April to August) at any location containing suitable habitat for spiny rice-flower. A transect survey of suitable habitat was conducted on 29 August 2018 by two suitably qualified ecologists experienced with the identification of spiny rice-flower. Ecologists walked transects at 2 m spacing in suitable habitat and transects at 5 m spacing in poor quality/disturbed areas between suitable habitats (Appendix H).

All observed spiny rice-flower individuals were recorded and mapped using a hand-held GPS unit. The location of these individuals is provided in Appendix D.

In addition to undertaking surveys for the species, the following habitat characteristics were assessed to comply with the survey guidelines (DEWHA 2009):

- habitat quality
- site history and time since last management event, including current management regime
- proximity to other known populations, including on adjacent sites
- presence of similar habitat connecting the site to occupied areas or other areas of grassland or grassy woodland.

Following completion of the targeted survey for the spiny rice-flower, the project area was expanded into adjacent land to the east of the rail reserve. This additional area, outside the investigation area, contains suitable habitat for the species but has not been subject to a targeted survey.

2.2.5 Threatened vegetation communities

Vegetation communities considered to qualify as EPBC Act and FFG Act listed threatened ecological communities (TECs) were identified and mapped (Appendix D).

Particular EVCs, identified in the desktop assessment, are synonymous with particular listed TECs (DEH 2006, DEPI 2013a, DSEWPAC 2012). Table 5 provides a summary of the modelled vegetation communities and listed TECs.

Where relevant EVCs (Table 5) were recorded during the field assessment, the extent, quality and species composition, was assessed in accordance with the listing advice for each FFG Act and EPBC Act

listed TEC, as to whether the patch meets the defining characteristics of the listed community. The assessment took into consideration the timing of the survey (summer in Stage 1 and winter in Stage 2) in relation to any seasonally influenced diagnostic characteristics and condition thresholds of each community.

A conservative approach was applied when considering whether a particular community does not meet one or more of the determining characteristics to be classified as a TEC. For instance, where understorey cover and species diversity of a patch are slightly below the defining characteristic target, the patch may be identified as a TEC, where the assessor believes there is reasonable potential for additional species to emerge or percentage overall cover to change when assessed at a different, or under more optimal conditions.

Table 5 Potential threatened ecological community presence based on modelled ecological vegetation classes

EVC Name	Bioregion	Potentially relevant TEC – EPBC Act	Potentially relevant TEC – FFG Act
Plains grassland	Victorian volcanic plain	Natural temperate grassland of the Victorian volcanic plain.	Western (basalt) plains grassland community
Plains grassy woodland	Victorian volcanic plain	Grassy eucalypt woodland of the Victorian Volcanic Plain	Western basalt plains (River red gum) grassy woodland community
Plains grassy woodland	Central Victorian Uplands Victorian Riverina Northern Inland Slopes	Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Grey Box - Buloke Grassy Woodland Community Victorian temperate woodland Bird Community
Grassy woodland	Central Victorian Uplands Victorian Riverina Northern Inland Slopes	Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Grey Box - Buloke Grassy Woodland Community Victorian temperate woodland Bird Community
Box-ironbark forest	Central Victorian Uplands Victorian Riverina Northern Inland Slopes	Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Grey Box - Buloke Grassy Woodland Community Victorian temperate woodland Bird Community

2.2.6 Fauna surveys

Incidental observations of fauna were recorded using a hand-held GPS during vegetation assessment surveys.

Fauna habitat assessment

Fauna desktop information, including results from WSP/PB (2016), was used to inform the likelihood of threatened fauna species being present.

During the site assessment suitable habitat for state and federally listed fauna species was identified and mapped. The location and extent of the habitat for threatened fauna was recorded using a hand-held GPS. The extent of the habitat was mapped by walking the boundary of the area or vegetation considered suitable habitat. Any single fauna habitat features, such as hollow-bearing trees, were identified and location recorded using a GPS, including information such as species and DBH.

Vegetation which was deemed to provide important wildlife habitat and corridor linkages for wildlife movement across the landscape was identified and recorded using the GPS. The presence of habitat features including large trees with hollows or other habitat was also identified within private land adjacent to the rail reserve that has the potential to be impacted by the proposed construction. As no access was available to these adjacent lands, any sites identified during the field assessment was noted and manually digitised on GIS using aerial photography. These areas are not considered to be detailed assessments and are intended to be used for information in assessing habitat connectivity through the landscape, plus provide further information for project and construction planning.

Habitat assessment for threatened fauna species were performed during the field survey. Relevant habitat features (identified in Table 6) were recorded and mapped through the study area surveyed. The presence of these habitat features informed the assessment of project impact for threatened fauna species.

Table 6 Threatened Species Habitat Assessment

Attribute	Habitat features recorded	Potential Fauna Species
Grasslands (native)	Patch extents, in accordance with native vegetation Guidelines (DELWP). Generally, these patches are comprised mostly of native grass species, with varying levels of exotic species. Other features to note: • Amount of tussock cover • Inter-tussock space • Rocky areas, crevices • Substrate and other disturbances • Cover of herbaceous weeds	Striped Legless Lizard [L, VU] Golden Sun Moth [L, CR] Growling Grass Frog [L, VU] Plains-wanderer [L, CR]
Grasslands (exotic)	Generally, these patches are comprised of mostly exotic grass species, particularly tussock species, such as Chilean needle-grass (*Nassella neesiana*). Other features to note: • Amount of tussock cover • Inter-tussock space • Rocky areas, crevices • Substrate and other disturbances • Cover of herbaceous weeds	Striped Legless Lizard [L, VU] Golden Sun Moth [L, CR] Growling Grass Frog [L, VU] Plains-wanderer [L, CR]
Stream, waterway and wetland attributes	The attributes of the waterway (whether ephemeral or permanent, amount of water, condition of the bed / bank, and condition of adjoining vegetation)	Eastern Great Egret [L] Growling Grass Frog [L, VU] Baillon's Crake [L] Eastern Great Egret [L] Lewin's Rail [L] Little Bittern [L] Brown Toadlet [L] Eastern Snake-necked Turtle [L, VU] Blue-billed Duck [L] Freckled Duck [L]

Attribute	Habitat features recorded	Potential Fauna Species
Woodlands	Presence of woodlands that provide habitat for threatened birds and mammals. High quality areas have good connectivity in the landscape, hollows, logs, large trees and a diverse understorey	Barking Owl [L] Grey-headed Flying-fox [L, VU] Regent Honeyeater [L, CR] Brush-tailed Phascogale [L] Squirrel Glider [L] Swift Parrot [L, EN] Grey-crowned Babbler [L] Hooded Robin [L] Turquoise Parrot [L]
Larger bird nests	The location of any larger bird nests (>30cm estimated diameter). Where detected, the proximity to habitat features such as watercourses and woodland was also noted.	Square-tailed Kite [L] Grey Goshawk [L] White-bellied Sea-eagle [L]
Tree hollows	Presence of tree hollows, including where it can be discerned, size, either small (~10cm diameter) moderate (~10 – 30cm diameter) or large (~>30cm diameter) or "spouts". Any sign of use was also noted.	Barking Owl [L] Powerful Owl [L] Spot-tailed Quoll [L, EN] Squirrel Glider [L] Brush-tailed Phascogale [L] Regent Honeyeater [L,CR] Swift Parrot [L,E] Superb Parrot Turquoise Parrot [L] Painted Honeyeater
Food trees	Presence of following trees, generally mature specimens in larger patches: • Yellow box (*Eucalyptus melliodora*) • River red gum (*E. camaldulensis*) • Blakely's red gum (*E. blakelyi*) Connectivity in the landscape, including linkages along waterways, was also considered.	Regent Honeyeater [L,CR] Swift Parrot [L,E] Superb Parrot Painted Honeyeater

Based on the above assessment and presence of habitat features, this information was used to inform the likelihood of occurrence assessment for threatened fauna species. The assessment for each species is provided in Appendix C.

To support the assessment of likelihood of occurrence, a landscape assessment was completed for fauna species with potential occurrence in the investigation area. This was completed using VBA records to 10 km from investigation areas, EVC mapping and aerial photography to determine how the habitat recorded within the investigation area exists within the landscape context. This was completed to provide greater understanding of the potential for specific species to occur within the investigation areas.

The location of mapped habitat is provided in Appendix H. The results of the habitat assessment were used to inform further recommendations for additional targeted threatened species surveys.

2.2.7 Stage 1 threatened fauna surveys

Targeted golden sun moth (*Synemon plana*) and striped legless lizard (*Delma impar*) surveys were undertaken during the assessment period for Stage 1 (Summer 2017/2018) at sites south of Beveridge. The methods for these surveys are provided below.

No targeted fauna surveys were completed during Stage 2 (winter 2019); other than for key species within the FFG Act-listed VTWBC.

Golden sun moth targeted survey

Golden sun moth targeted surveys were conducted within the Tullamarine Freeway Precinct (Strathmore Heights) Investigation Area, at two discrete sites where appropriate habitat had been identified.

Site 1 Melrose Drive, Airport West is located to the west of the Tullamarine Freeway Precinct Bridge. The site is an approximately 0.42 ha rectangular site bordered by the rail line to the east, Caterpillar factory to the west, Melrose Drive road-over-rail bridge to the north and degraded grassland within the rail reserve to the south.

Site 2 Gowanbray Drive, Airport West is located on the east side of the Tullamarine Freeway bridge and is an approximately 0.27 ha rectangular site bordered by the rail line to the south, and residential housing accessed from Gowanbray Drive to the north. The site is approximately 200 m from the road-over-rail bridge, and 400 m from the top of the descending escarpment to Moonee Ponds Creek.

Targeted survey methodology

The methodology is aligned with the recommended survey guidelines for detecting golden sun moth detailed in the Commonwealth EPBC Act policy statement 3.12, *Significant impact guidelines for the critically endangered golden sun moth (Synemon plana)* (DEWHA 2009). The guidelines note that surveys for the species should:

- describe the context of the site within the broader landscape
- maximise the chance of detection of the moth
- be conducted by a suitably qualified person
- allow for uncertainty and error.

The survey method for golden sun moth is focussed on the detection of flying male moths but has a secondary aim of detection of laying female moths and the observation of eggs and pupal cases, if present, to confirm that reproduction is occurring on the site. Searches for eggs and /or pupal cases at the base of the recognised host grass species is included in the survey. In the event that presence of the moth is established, surveys then focus on determining the local distribution of the species within the site.

A minimum of four surveys are required, spaced approximately one week apart in suitable weather conditions, (DEWHA 2009). Suitable conditions are defined in the significant impact guidelines for golden sun moth as:

- Warm to hot day, above 20 degrees Celsius by 1000 hours
- During the warmest part of the day, between 1000 to 1400 hours
- Clear or mostly cloudless sky
- Still to light wind conditions during the survey period
- At least two days since any rainfall.

The surveys are timed to occur during the local flying season, which has been determined by an industry golden sun moth flying notification list managed by Biosis, with reference to the VBA online database managed by DELWP.

In addition to meeting the survey guidelines outlined above, the following physical characteristics of the survey sites are required to be assessed and recorded to address the significant impact guidelines (DEWHA 2009), as indicators of the likely presence of golden sun moth and the quality of the habitat:

- Abundance of suitable host plants, including wallaby grasses (*Rytidosperma* spp.), native spear grasses (*Austrostipa* spp.) and exotic spear grasses (*Nassella* spp.).
- Presence of pupal casings at the base of host grasses

- Other native and exotic vegetation on the sites
- Amount of shading from tree cover, buildings and structures
- Amount of bare ground (providing inter-tussock spaces)
- Presence of rocky areas
- Site aspect
- Soil characteristics
- Site history, including fertiliser, pesticide/herbicide use, biomass management and current management
- Proximity to other known populations, including on adjacent sites
- Presence of similar connecting habitat providing habitat linkages to other areas of grassland or grassy woodland habitat.

On each site the physical characteristics were documented and for each survey details of weather conditions were assessed using Bureau of Meteorology weather data.

The survey was conducted by foot-based meandering traverse technique undertaken by two suitably qualified ecologists familiar with the identification of golden sun moth walking in line for the length of each site separated by no more than 5 m. The traverses were repeated until all the area of each site was surveyed. The ecologists searched for eggs and pupal cases periodically during the traverses of the site. Each site was fully surveyed twice during each of the four visits, aiming to vary the location of each traverse and maximise the opportunity to detect golden sun moth.

Striped legless lizard

The striped legless lizard is listed as vulnerable under the EPBC Act and as a threatened species under the FFG Act. This species occurs in NSW, ACT and Victoria where it has declined across much of its former range. Remaining Victorian populations are found scattered across the state with remnant populations in the western and northern suburbs of Melbourne.

Survey guidelines recommend using roof tiles, active searches and pitfall traps (DSEWPC 2011a, 2011b). Roof tiles form artificial shelters. Maximum detection using roof tiles occurs in September and October (O'Shea 2005). Typically, tiles are laid in June-July and tiles are surveyed in mid-Spring.

WSP/PB (2016) laid tile grids in four location within three investigation areas:

- St Albans Road (Sunshine North) (this site was removed from the project scope and is not considered further)
- Calder Freeway Precinct (Keilor East) (two separate grids either side of the bridge)
- Tullamarine Freeway Precinct (Strathmore Heights).

WSP/PB (2016) noted the following in the design of the tile grid, which reflects the narrow linear project area with no ability to expand into adjacent areas:

> *As a minimum, two tile arrays consisting of 50 tiles each for sites less than two hectares in size are recommended. One array per three hectares for sites up to 30 hectares, and 10 arrays for sites greater than 30 hectares in size (DSEWPC 2011a). However, this is not always suitable or possible where sites are narrow or restricted. Therefore, a mix of tile laying (up to 50 tiles per site) and active searching will be undertaken for this project.*
>
> *For this project, a combination of laying roof tiles and noting habitat attributes such as the presence of cracking clays, basalt rocks and grassland community presence was undertaken.*

These tiles remained in each of the project areas for approximately 15 months, until the Stage 1 surveys, in December 2017. A review of tiles present on site was undertaken, and a single tile check was performed at these sites in order to determine the presence of fauna, including striped legless lizard.

2.2.8 Waterway survey

A visual assessment of waterways intersected by the investigation areas was included in the detailed field assessment during Stage 1 in December 2017. The waterways assessed were Sunday Creek, One Mile Creek and the Murray River. No waterway surveys were undertaken during Stage 2.

As no major civil works are expected to occur in waterways, no aquatic assessments were completed. Visual assessments were undertaken of riparian areas during the field surveys and included recording the following factors:

- Physical characteristics, including:
  - Bank condition and erosion
  - Instream habitat, including logs and vegetation
  - Artificial barriers to fauna movement
- Streamside vegetation, including:
  - Native cover (a vegetation quality assessment will be completed where riparian vegetation is considered to meet native patch definition)
  - Weed cover
- Water quality, including:
  - Turbidity recorded as high, medium or clear
  - Odour
  - Visible pollutants including non-organic litter, oils, detergents
- Aquatic habitat, including:
  - Fauna observed including frogs, fish, birds and macroinvertebrates.

Low level impacts to unnamed waterways and drainage lines are predicted at Short Street Overbridge (Broadford), Track Slew Investigation Area D and Track Slew Investigation Area G. As these are minor tributaries or drainage lines, they generally do not hold water or have defined banks. As impacts are also not expected to be significant, these minor tributaries were not included in the waterway assessment. Any ecological values, including habitat for threatened species and native vegetation, were identified and recorded within the vegetation and habitat assessment methods described above.

2.3 LIMITATIONS

This report presents the findings of two stages of ecological surveys completed in summer 2017/2018 (Stage 1), and winter 2019 (Stage 2). These times are generally considered to be outside of the optimal spring survey period, where there is greater likelihood of species being present, observable and identifiable, particularly annual flora species, that may not have any observable or identifiable (flowers) material present.

The surveys were largely contained to public land, primarily rail reserve, where access was granted, and road reserve, with private land assessed with prior agreement from the landholders. Private land was not assessed where landholder agreement was not obtained. Private land locations that were not assessed are indicated on maps included in Appendix A. The approximate area of private land within the project

areas (north and south of Beveridge) that has not been assessed is 16.22 ha. The ecological values within private land affected by the project are very low based on the surveys completed to date. These areas of private land have been selected for temporary construction activities to avoid environmental impacts, targeting previously disturbed land where there were no known cultural heritage and environmental values present, however, these areas will need to be surveyed following receipt of landholder consent to confirm the presence of ecological values.

Where the assessors were unsure of land tenure, they did not enter the site. Assessment was completed via 'over-the-fence' view, where possible, to determine presence of patch vegetation, potential habitat and TEC presence. Where no obvious patch and habitat was present, no detailed surveys were completed. Detailed surveys will need to be completed once landholder agreement has been obtained.

The database search and desktop assessment did not include species listed under the Victorian advisory list that are not listed under the EPBC Act or as threatened under the FFG Act, excepting those that were included in the initial desktop assessment (WSP/PB 2016). These species were found to be present in some locations, which may be locally significant, however, as they do not influence approval requirements under the assessed legislation, these species were not considered under the threatened species results and assessments.

3 Desktop assessment results

3.1 LITERATURE REVIEW

WSP/PB (2016) completed site assessments on sites that were considered to be a high or moderate risk of containing native vegetation or habitat for state or federally listed flora and fauna species and ecological communities, based on desktop information.

From this site assessment the risk classification of each site was refined based on the conditions and presence of values. The basis of this risk assessment is stated in Table 7.

Table 7 Risk assessment of Inland Rail project areas from WSP/PB (2016).

Risk rating	Ecological conditions and presence of values
Low	No native vegetation defined as 'remnant patches' or 'scattered trees'. Unlikely any FFG Act listed species or communities or species listed under DELWP 'advisory lists '. Unlikely any Matters of National Environmental Significance (MNES) including EPBC Act listed species or communities.
Moderate	Some patches of native vegetation defined as 'remnant patches' or 'scattered trees '. Moderate likelihood of occurrence of FFG Act listed species or communities or species listed under DELWP 'advisory lists' Moderate likelihood of occurrence of MNES including EPBC Act listed species or communities.
High	Extensive areas of native vegetation defined as 'remnant patches' or 'scattered trees '. Presence of or high likelihood of occurrence of FFG Act listed species or communities or species listed under DELWP 'advisory lists '. Presence of or high likelihood of occurrence of MNES including EPBC Act listed species or communities.

From the site assessment, WSP/PB (2016) found a total of 4.63 ha of native vegetation present over 30 sites. These were predominately located in regional Victorian sites, which contained more intact vegetation communities and were subject to less disturbance. Within the sites south of Beveridge, there was considered to be potential golden sun moth and striped legless lizard habitat at five sites, with Barry Road Overbridge (Dallas) the only metropolitan site considered to have potential for threatened flora species.

Thirteen regional Victorian sites were found to have either threatened ecological communities, or potential for threatened species to occur, including woodland and wetland bird species and, around Broadford, golden sun moth. Overall, based on findings of the site assessments, the rating for each site was refined to:

- 9 sites considered low biodiversity and legislative risk
- 16 sites considered moderate biodiversity and legislative risk
- 5 sites considered high biodiversity and legislative risk.

The five sites that were considered to be of high biodiversity and approvals risk were all located in regional Victoria (north of Beveridge):

- Hamilton Street Overbridge (Broadford)
- Hume Highway Tallarook Precinct (Tallarook)
- Seymour-Avenel Road Overbridge (Seymour)
- Hume Highway Seymour Precinct (Seymour)
- Murray River Underbridge (Albury).

These sites were all found to contain either EPBC Act or FFG Act-listed ecological communities, except for the Murray River Underbridge (Albury) site, which was considered to have high likelihood of threatened species present in the waterway. The Murray River Underbridge (Albury) project area has undergone significant modification. Works in Victoria are limited to provision of a temporary construction laydown and rail access via hi-rail machinery for the southernmost New South Wales Inland Rail project – Albury to Illabo (A2I). The A2I project works involve modifying the existing rail bridge structure at the Murray River, with no physical works in the waterway or on the riverbanks.

Following the completion of the WSP/PB (2016) report, several modifications have been made to the project options and design solutions. Project areas have been substantially modified. However, the results of this assessment, including the habitat hectare assessment, location of threatened ecological communities and threatened species likelihood assessment were considered in the desktop assessment and design of the Stage 1 and 2 field surveys. All sites assessed by WSP/PB (2016) were re-assessed for currency and confirmation of biodiversity values.

3.2 DESKTOP ASSESSMENT

The results of the desktop assessment for vegetation communities, threatened flora and fauna within 5 km from investigation areas are provided in Appendix B. Each of the ecological values are discussed below.

3.2.1 Vegetation communities

The 38 investigation areas occur across 4 bioregions, Victorian Volcanic Plain, Central Victorian Uplands, Victorian Riverina and Northern Inland Slopes.

NatureKit modelled information identified 12 EVCs as present across the 38 investigation areas, including:

- Box Ironbark Forest
- Creekline Grassy Woodland
- Floodplain Riparian Woodland
- Granitic Hills Woodland
- Grassy Woodland
- Plains Grassland
- Plains Grassy Woodland
- Plains Grassy Woodland/Grassy Woodland Complex
- Riparian Forest
- Stream Bank Shrubland
- Valley Grassy Forest
- Valley Grassy Forest/Grassy Woodland Complex

The presence of these EVCs was confirmed during the site assessment and used as a benchmark for the Vegetation Quality Assessment (DELWP 2017, DSE 2004).

3.2.2 Threatened ecological communities

The above EVCs within the applicable bioregion also have similarities to State and Commonwealth listed threatened ecological communities, which are indicated in Section 2.2.3. Preliminary field surveys (WSP/PB 2016) identified the following two nationally listed EPBC Act communities:

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Critically Endangered) (WBYBBRGGW) located Hamilton Street Overbridge (Broadford) Investigation Area (south of Beveridge)
- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (GBGW) located at and signal gantry 19, Hume Highway Tallarook Precinct (Tallarook), Seymour Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour) Investigation Areas (north of Beveridge)

The EPBC Act-listed NTG was identified during the desktop assessment within investigation area south of Beveridge. However, the community was not considered present within these investigation areas assessed by WSP/PB (2016), where only small, low quality grassland patches were observed.

The investigation areas to the west and north of Melbourne, located south of Beveridge, may also have potential for the critically endangered grassy eucalypt woodland of the Victorian volcanic plain. Although this was not identified during the previous assessment (WSP/PB 2016)

Three communities listed under the FFG Act were also identified at the following locations (WSP/PB 2016):

- Western (Basalt) Plains Grasslands Community at Barry Road Overbridge (Dallas) (south of Beveridge). This community is characteristically dominated by perennial native grasses, with very few eucalypts and shrubs, and an almost complete absence of introduced grasses and weeds (DEPI 2013a)
- Grey Box – Buloke Grassy Woodland community at signal gantry 16, signal gantry 19, Hume Highway Tallarook Precinct (Tallarook) and Seymour - Avenel Road Overbridge (Seymour) (north of Beveridge). This community is characterised by grey box *(Eucalyptus microcarpa*) usually being the structurally dominant tree over a lower stratum of buloke (*Allocasuarina luehmannii*) (DEPI 2013a)
- Victorian Temperate Woodland Bird Community (VTWBC) likely to be supported at all sites comprising intact woodland habitat between Broadford and Albury (north of Beveridge). This community is defined as a suite of bird species mainly associated with drier woodlands on the slopes and plains north of the Great Dividing Range (DEPI 2013a)

The occurrence of these threatened ecological communities was confirmed during the field assessment, see Section 4.

3.2.3 Biosites

The VBA search identified numerous Sites of Biological Significance (biosites) within 5 km of the investigation areas (Appendix B). This includes the following sites that are considered to be of national significance:

- Imaroo Grassland Reserve – Former Albion Explosives Factory – within 5km of McIntyre Road Overbridge (Sunshine) and Keilor Park Drive Overbridge (Keilor East)

- St Albans Rail Reserve – within 5km of McIntyre Road Overbridge (Sunshine) and Keilor Park Drive Overbridge (Keilor East)
- Sunshine Rail Reserve – within 5km of McIntyre Road Overbridge (Sunshine)
- Craigieburn Grasslands Flora and Fauna Reserve - within 5km of Camp Road Overbridge (Broadmeadows), Riggall Street Overbridge (Broadmeadows), Barry Road Overbridge (Dallas) and Hume Highway Overbridge (Craigieburn)
- Nubrik Quarry Craigieburn – within 5km of Hume Highway Overbridge (Craigieburn)
- Craigieburn East Grasslands – within 5km of Hume Highway Overbridge (Craigieburn)
- Hernes Swamp – within 5km of Track Slew Investigation Area C
- Lavers –Oats Gap South – within 5 km of Murray Valley Highway Overbridge (Barnawartha North)
- Barnawatha Scenic Reserve – within 5km of Murray Valley Highway Overbridge (Barnawartha North)

3.2.4 Threatened flora

The desktop review of the VBA and EPBC Act PMST was undertaken to identify threatened flora species that have potential to occur within 5 km of each investigation area.

The search identified 18 flora species listed under the EPBC Act and 38 flora species listed under the FFG Act known or predicted to occur within 5 km of the investigation areas.

The listed species identified during this database assessment are listed in Appendix B and have informed the site assessment. A likelihood of occurrence assessment has been completed and is provided in Appendix C.

The vast majority of these records are greater than 20 years old and associated with the metropolitan investigation areas, south of Beveridge. These records are generally associated with biosites within the vicinity of these investigation areas, including

- St Albans Road Reserve and Solomon Heights/Maribyrnong River Edge (McIntyre Road Overbridge (Sunshine))
- Maribyrnong Valley - Barry Road (Barry Road Overbridge (Dallas))
- Cooper Street Grasslands and Maygar Army Barracks (Riggall Street Overbridge (Broadmeadows) and Camp Road Overbridge (Broadmeadows))
- Craigieburn Grasslands and Merri Creek – Craigieburn to Donnybrook (Hume Highway Overbridge (Craigieburn)).

Of these biosites, Maribyrnong Valley - Barry Road, Solomon Heights/Maribyrnong River Edge and Merri Creek – Craigieburn to Donnybrook are contiguous with investigation areas.

The most recent flora records of threatened flora are large-flower crane's-bill (*Geranium sp 1.*) which was recorded in 2016 adjacent to the Barry Road Overbridge (Dallas) investigation area. This observation is likely associated with the adjacent biosites of Maribyrnong Valley - Barry Road grassland remnant and Coolaroo Biosite - Metro Network Protected Flora Site. Coolaroo Biosite is located within the Barry Road Overbridge (Dallas) Investigation Area.

Numerous spiny rice-flower records occur adjacent to McIntyre Road Overbridge (Sunshine). These records are concentrated within the Solomon Heights/Maribyrnong River Edge and St Albans Road Reserve biosites. The Solomon Heights/Maribyrnong River Edge biosite is adjacent to the rail corridor north of McIntyre Road Overbridge (Sunshine).

Flora species identified in the WSP/PB (2016) as having a high or moderate likelihood of occurrence with potential for a significant impact include:

- Euroa guinea-flower (*Hibbertia humifusa* subs. *erigens*)
- Narrow goodenia (*Goodenia macbarronii*)
- Purple diuris (*Diuris punctata*)
- Small milkwort (*Comesperma polygaloides*)

Matted flax-lily (*Dianella amoena*) have also been previously observed in the rail reserve within proximity to the investigation areas in northern Metropolitan Melbourne, around Somerton (pers. obs.). This species has been recorded near the following sites, south of Beveridge, and may have potential habitat:

- Hume Highway Overbridge (Craigieburn)
- Signal Gantry 14 (SG14)
- Barry Road Overbridge (Dallas)
- Camp Road Overbridge (Broadmeadows)
- Riggall Street (Broadmeadows).

3.2.5 Threatened fauna

The desktop review of the VBA search was undertaken to identify threatened fauna species that are known to occur within 5 km of each investigation area.

The search identified 25 fauna species listed under the EPBC Act and 65 fauna species listed under the FFG Act that are known or predicted to occur within 5 km of the investigation areas.

The listed species identified during this database assessment are listed in Appendix B and have informed the site assessment. A likelihood of occurrence assessment has been completed and is provided in Appendix C.

The majority of species records are associated with grassland habitats and biosites around Metropolitan sites in the west and north of Melbourne, south of Beveridge. This includes high numbers of records for three key threatened grassland fauna species, namely: striped legless lizard, golden sun moth and growling grass frog (DELWP 2019).

Sites in regional areas, north of Beveridge, were found to contain significant areas of woodland vegetation (WSP/PB 2016) that provide habitat for numerous bird species, including species listed under the FFG Act-listed VTWBC. Sites, particularly around Seymour, provide large areas of woodland habitat that is contiguous with woodland corridors along the rail and adjacent road reserve. Woodland habitat supports a variety of birds, such as owls, parrots and smaller birds, such as grey-crowned babbler (*Pomatostomus termporalis*) and diamond firetail (*Stagnopleura guttata*), which have previous records identified during the desktop assessment.

The WSP/PB (2016) report highlighted three listed threatened species as having moderate to high likelihood of occurrence and warranting further targeted surveys. These species are discussed individually, below.

Striped legless lizard

Striped legless lizard is listed as vulnerable under the EPBC Act and threatened under the FFG Act. The striped legless lizard has been recorded a high number of times, concentrated within the biosites recorded around western Melbourne, south of Beveridge. Several of these records occur in locations

adjacent to the investigation areas, notably the north end of McIntyre Road Overbridge (Sunshine) Investigation Area (DELWP 2019).

The most recent threatened fauna records for striped legless lizard were recorded within 5 km of (DELWP 2019):

North of Beveridge

- Hamilton Street Overbridge (Broadford), recorded in 2010.
- Short Street Overbridge (Broadford), Marchbanks Road Overbridge (Broadford) and Signal Gantry 18, recorded in 2012

South of Beveridge

- McIntyre Road Overbridge (Sunshine), Keilor Park Drive Overbridge (Keilor East) and Signal Gantry 6, recorded in 2017
- Calder Freeway Precinct (Keilor East), Westfield Drive Overbridge (Tullamarine), Tullamarine Freeway Precinct (Strathmore Heights), Track Slew Investigation Area A, Belair Avenue Overbridge (Glenroy), Pascoe Vale Road Overbridge and Jacana Station Footbridge (Glenroy), recorded in 2011

WSP/PB (2016) identified the following investigation areas, south of Beveridge, to have potential striped legless lizard habitat:

- Calder Freeway Precinct (Keilor East) (2 locations) – potential marginal habitat
- Tullamarine Freeway Precinct (Strathmore Heights) – potential marginal habitat.

Golden sun moth

Golden sun moth is listed as critically endangered under the EPBC Act and threatened under the FFG Act.

The golden sun moth also has a high number of records adjacent to Barry Road Overbridge (Dallas) Investigation Area (DELWP 2019). This location has a high likelihood of suitable habitat present. There is also likely potential for habitat, including exotic habitat dominated by Chilean needle-grass, to occur within Tullamarine Freeway Precinct (Strathmore Heights) and Track Slew Investigation Area A, east of Moonee Ponds Creek. Grassland habitat has also been modelled around the northern end of Hume Highway Overbridge (Craigieburn).

The golden sun moth has been recorded within 5 km of the following investigation areas (DELWP 2019):

North of Beveridge

- Track Slew Investigation Area C, recorded in 2017
- Broadford Road Overbridge (Wandong), Signal Gantry 16, Signal Gantry 17, Hamilton Street Overbridge (Broadford), Short Street Overbridge (Broadford) and Marchbanks Road Overbridge (Broadford), recorded in 2016
- Signal Gantry 15, recorded in 2013
- Signal Gantry 18, recorded in 2012

South of Beveridge

- Track Slew Investigation Area A, Belair Avenue Overbridge (Glenroy), Pascoe Vale Road Overbridge and Jacana Station Footbridge (Glenroy), Camp Road Overbridge (Broadmeadows), Riggall Street Overbridge (Broadmeadows) and Barry Road Overbridge (Dallas), recorded in 2017
- Westfield Drive Overbridge (Tullamarine) and Tullamarine Freeway Precinct (Strathmore Heights), recorded in 2011

- McIntyre Road Overbridge (Sunshine), recorded in 2010
- Signal Gantry 14 and Hume Highway Overbridge (Craigieburn), recorded in 2008

WSP/PB (2016) identified the following investigation areas to have potential golden sun moth habitat:

North of Beveridge

- Hamilton Street Overbridge (Broadford) – potential habitat in cleared areas
- Hume Highway Tallarook Precinct (Tallarook) - potential habitat in cleared areas.

South of Beveridge

- Calder Freeway Precinct (Keilor East) (east of bridge) – potential marginal habitat
- Tullamarine Freeway Precinct (Strathmore Heights) – potential marginal habitat.
- Barry Road Overbridge (Dallas) – potential habitat

Growling grass frog

Growling grass frog is listed as vulnerable under the EPBC Act and threatened under the FFG Act.

The growling grass frog has a number of records identified in the desktop assessment. This includes several records along waterways in western Melbourne, south of Beveridge, including the Maribyrnong River (McIntyre Road Overbridge (Sunshine)), Steele Creek (Calder Freeway Precinct (Keilor East)) and Moonee Ponds Creek (Tullamarine Freeway Precinct (Strathmore Heights) and Track Slew Investigation Area A). These waterways occur in deep escarpments, which may restrict connectivity to investigation areas and restricted waterway habitat present within the sites.

Investigation areas at Hume Highway Overbridge (Craigieburn) and Track Slew Investigation Area C, occur in close proximity to the Merri Creek. This creek is a known habitat corridor for the species.

The most recent records for growling grass frog are at the following sites south of Beveridge:

- Camp Road Overbridge (Glenroy), Barry Road Overbridge (Dallas) and Hume Highway Overbridge (Craigieburn), recorded in 2017
- Calder Freeway Precinct (Keilor East), Westfield Drive Overbridge (Tullamarine), Tullamarine Freeway Precinct (Strathmore Heights), Track Slew Investigation Area A, Belair Avenue Overbridge (Glenroy) and Pascoe Vale Road Overbridge (Glenroy), recorded in 2016
- McIntyre Road Overbridge (Sunshine), Keilor Park Drive (Keilor East) and Signal Gantry 6, recorded in 2013
- Signal Gantry 14, recorded in 2008

Hume Highway Overbridge (Craigieburn) (south of Beveridge) and Wangaratta Precinct (Wangaratta) (north of Beveridge) are the only investigation areas which intersect or are in close proximity to waterways and have recent growling grass frog records.

A review of the ecological values at both of these locations, plus additional areas identified above, indicate the investigation areas generally lack wetland habitat and connectivity and are significantly disturbed due to historical use of the railway.

4 Field assessment results

This section discusses the results of the vegetation recorded and observed during Stage 1 (December 2017 and February 2018) and Stage 2 (June 2019) field surveys at each investigation area. This includes the following values:

- 16 EVCs over 4 different bioregions
- three threatened ecological communities listed under the EPBC Act
- two threatened ecological communities listed under the FFG Act
- three threatened flora species listed under the EPBC and FFG Act.

Potential habitat for eight additional threatened flora species has also been identified within several investigation areas. These are discussed below.

4.1 GENERAL DESCRIPTION OF THE VEGETATION

The investigation areas were generally located in modified environments, adjacent to high activity areas for road and rail maintenance around bridges, level crossings and stations. A small number of investigation areas appear to be subject to minimal disturbance, these were generally located in regional areas outside of regional towns.

The majority of investigation areas within the metropolitan areas of Melbourne (south of Beveridge) contained remnants of ballast stockpiles, ballasted access tracks, and signalling equipment and utilities that have been laid underground, resulting in high levels of disturbance. At greater distances away from bridges, less modified environments are present, and these areas tend to have remnants of native vegetation and habitat.

Examples of typical investigation area environments are shown in Figures 1-3

Figure 1 Rail Reserve at Keilor Park Drive Overbridge (Keilor East)

Figure 2 Rail Reserve at Calder Freeway Precinct (Keilor East)

North of Beveridge, the regional Victorian investigation areas, which contain railway stations— Seymour, Euroa, Benalla, Glenrowan and Wangaratta—have also been subject to significant disturbance, from intensive rail activities, storing of ballast and other materials and car parking.

At regional investigation areas away from rail stations, there is generally less disturbance to the vegetation and soil. These areas often contain canopy and large remnant trees, though ground layers are often disturbed. Areas with less disturbance and more intact understorey, are generally contiguous with vegetation within adjacent road reserves, particularly along Seymour-Avenel Road Overbridge (Seymour), north of Seymour and along the adjacent Gairns Lane, south of Tallarook. In these locations, the vegetation within the road and rail reserves forms a wider corridor varying from 20 to 80 m wide.

Figure 3 Rail Reserve at Hume Highway Seymour Precinct (Seymour)

Overall the vegetation within the investigation areas generally represented disturbed and modified environments. Often colonising species were dominant, including blanket weed (*Galenia pubescenes*), artichoke thistle (*Cynara cardunculus*), cat's ear (*Hypochaeris radicata*) and ribwort (*Plantago lanceolata*), and exotic pasture grasses, such as phalaris (*Phalaris aquatica*), paspalum (*Paspalum dilatatum*), brown-top bent-grass (*Agrostis capillaris*) and rye-grass (*Lolium rigidum*). This was also reflected in the dominant native species, which often comprised windmill grass (*Chloris truncata*), silky blue-grass (*Dicantheum sericeum*), jersey cudweed (*Laphangium luteoalbum*) and sifton bush (*Cassinia sifton*). These species often appeared to be colonising disturbed areas.

4.2 THREATENED ECOLOGICAL COMMUNITIES

4.2.1 Nationally listed ecological communities

The field survey identified that the following investigation areas contained areas of vegetation which meet criteria of the nationally listed ecological community:

North of Beveridge

- GBGW at the following sites:
  - Seymour-Avenel Road Overbridge (Seymour)
  - Hume Highway Seymour Precinct (Seymour)
  - Track Slew Investigation Area G
  - Track Slew Investigation Area H
  - Track Slew Investigation Area I
- WBYBBRGGW at Beaconsfield Parade Overbridge (Glenrowan)
- NTG at Track Slew Investigation Area C Investigation Area.

South of Beveridge

- NTG at the following sites: McIntyre Road (Sunshine), Calder Freeway Precinct (Keilor East), Barry Road Overbridge (Dallas), and Hume Highway Overbridge (Craigieburn).

The assessment of each community is discussed separately below.

No other nationally listed ecological community was considered present within the investigation areas. This included assessing areas of potential grassy and other red gum dominated areas for Grassy eucalypt woodland of the Victorian volcanic plain, which was not considered present, based on the community listing advice and defining characteristics.

Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands

The biodiversity assessment identified five investigation areas north of Beveridge in the Seymour area where there was likely presence of GBGW (Table 8). All locations have remnant vegetation present within the rail reserve that extends into adjacent road reserve. These areas are relatively undisturbed and contain a diverse understorey with a mature overstorey, though most of the mature trees are in adjacent road reserves (Figure 4).

Figure 4 GBGW at Track Slew Investigation Area I between Seymour and Mangalore

The vegetation within these areas merges naturally between plains grassy woodland and box-ironbark forest EVCs using the Victorian EVC benchmarks (DSE 2004a). However, as noted above (Table 5), both EVCs are synonymous with GBGW, and both EVCs were assessed against the determining characteristics of the community (Table 8). Both EVC types within the investigation areas were dominated by grey box. High shrub cover in the box-ironbark EVC patches, contained the required size, diversity and structure to meet the criteria as the listed community (DSEWPAC 2012).

The following table provides the assessment of recorded patches against criteria as the nationally listed GBGW. In total 31 patches were assessed.

Table 8 Determination of GBGW

Key characteristics of community	Patch assessment
Located within or near the area shown on the GBGW distribution map	Patches which have the potential for listed grey box community: SA_HZ01, SZ_HZ02, SA_HZ03, SA_HZ04, SA_HZ05, SA_HZ06, SA_HZ07, SA_HZ08, SA_HZ09, SA_HZ10, SA_HZ11, SA_HZ12, SA_HZ13, HFS_HZ01, HFS_02, HFS_03, HFS_05, HFS_06, HFS_07, HFS_08, TSI_HZ01, TSI_HZ02, TSI_HZ03, TSI_HZ04, HFS_HZ09, HFS_HZ10, HFS_HZ11, HFS_HZ12, TSG_HZ2, SA_HZ19 and SA_HZ20 located within Central Victorian Uplands in areas of potential GBGW.

Key characteristics of community	Patch assessment
At least 50% of the plant cover in the ground layer made up of perennial native species? OR At least 10% of plant cover in ground layer made up of perennial native grass species?	• SA_HZ01, SZ_HZ02, SA_HZ03, SA_HZ04, SA_HZ05, SA_HZ06, SA_HZ07, SA_HZ08, SA_HZ09, SA_HZ10, SA_HZ11, SA_HZ12, SA_HZ13, HFS_HZ01, HFS_02, HFS_03, HFS_05, HFS_06, HFS_07, HFS_08,TSI_HZ01, TSI_HZ02, TSI_HZ03, TSI_HZ04, HFS_HZ09, HFS_HZ10, HFS_HZ12 and TSG_HZ02 : Yes >50% of the ground layer is made up of perennial native species • HFS_HZ11, SA_HZ19 and SA_HZ20: Inadequate cover of native species in the ground layer to be considered further
The current (or was previously) most common tree species is grey box	• SA_HZ01, SZ_HZ02, SA_HZ03, SA_HZ04, SA_HZ05, SA_HZ06, SA_HZ07, SA_HZ08, SA_HZ09, SA_HZ10, SA_HZ11, SA_HZ12, SA_HZ13, HFS_HZ01, HFS_02, HFS_03, HFS_05, HFS_06, HFS_07, HFS_08, TSI_HZ01, TSI_HZ02, TSI_HZ04, HFS_HZ09, HFS_HZ10 and HFS_HZ12: Yes, the most common tree species was grey box. • TSI_HZ03: No the patch is a wetland with no dominant overstorey. • TSG_HZ02: No the eucalyptus tree species were a mix of river red gum, yellow box and grey box
The patch at least 0.5 ha in size	• SA_HZ01, SZ_HZ02, SA_HZ03, SA_HZ04, SA_HZ05, SA_HZ06, SA_HZ07, SA_HZ08, SA_HZ09, SA_HZ10, SA_HZ11, SA_HZ12, SA_HZ13, HFS_HZ01, HFS_HZ03, HFS_HZ05, HFS_HZ06, HFS_HZ07, HFS_HZ08, TSI_HZ02, TSI_HZ04, HFS_HZ09, HFS_HZ10 and HFS_HZ12 Yes, these patches are >0.5ha in size. • HFS_HZ02: No the patch was 0.043ha, too small to be considered further
Non-grass weeds make up more than 30% of the plant cover in the ground layer	• SA_HZ01, SZ_HZ02, SA_HZ03, SA_HZ04, SA_HZ05, SA_HZ06, SA_HZ07, SA_HZ08, SA_HZ09, SA_HZ10, SA_HZ11, SA_HZ12, SA_HZ13, HFS_HZ01, HFS_HZ03, HFS_HZ05 HFS_HZ06, HFS_07, HFS_HZ08, TSI_HZ02, TSI_HZ04, HFS_HZ09, HFS_HZ10 and HFS_HZ12 non-grass weed cover is less than 30%
EACH SITE IS ASSESSED AGAINST THE BELOW SECTION, BASED ON AMOUNT OF TREE COVER PRESENT.	
Tree cover is at least 10 per cent:	27 patches had greater than 10 % tree cover:
The patch is bigger than 2 ha: AND at least 8 trees/ha that either contain hollows or are greater than 60 cm DBH, with at least 10 per cent of ground cover made up of perennial native grass species. OR – At least 20 live trees/ha with a diameter of > 12 cm DBH and at least 50 per cent of the plant cover in the ground layer is made up of perennial native species	SA_HZ05 (2.177ha) has >8 trees/ha greater than 60 cm DBH and at least 10 per cent native grass species.
The patch is smaller than 2 ha, AND • Contains at least 8 perennial native species in the mid and ground layers, AND	• SA_HZ02, SA_HZ05, SA_HZ06, SA_HZ10, SA_HZ11, SA_HZ12, SA_HZ13, HFS_HZ01, HFS_HZ03, HFS_HZ05 HFS_HZ06, HFS_07, HFS_HZ08, TSG_HZ02, TSG_HZ03, TSI_HZ02, TSI_HZ04, HFS_HZ09 and, HFS_HZ10 sites have

Key characteristics of community	Patch assessment
• At least 50 per cent of the plant cover in the ground layer is made up of perennial native species	more than 8 perennial native species in mid and ground layers and >50% in ground layer is made up of perennial native spp. • However, although site SA_HZ01, SA_HZ03, SA_HZ04, SA_HZ07, SA_HZ08, SA_HZ09, TSI_HZ01, HFS_HZ12 have less than 8 perennial native species and a perennial native species the cover is <50%, so are not considered further.
Tree cover is less than 10 per cent:	One site was found to have grey box cover less than 10%:
There is evidence that grey box trees where once common, and • Contains at least 12 perennial native species in the mid and ground layers, and • At least 50 per cent of the plant cover in the ground layer is made up of perennial native species	TSG_HZ01 was primarily a derived grassland, with the tree layer largely removed. The patch is highly likely to have been dominated by Grey box as it is dominant in the immediate surrounding area. The patch contains a diverse understorey, dominated by kangaroo grass.

GBGW communities were found to be present at Seymour Avenel Road Overbridge (Seymour), Hume Highway Seymour Precinct (Seymour), Track Slew Investigation Area G and Track Slew Investigation Area I (21 patches; SA_HZ02, SA_HZ05, SA_HZ06, SA_HZ10, SA_HZ11, SA_HZ12, SA_HZ13, HFS_HZ01, HFS_HZ03, HFS_HZ04, HFS_HZ05, HFS_HZ06, HFS_HZ07, HFS_HZ08, HFS_HZ09, HFS_HZ10, TSG_HZ01, TSG_HZ02, TSG_HZ03, TSI_HZ02 and TSI_HZ04).

In total, these 21 patches comprise a total area of 17.675 ha of the threatened ecological community present within and immediately adjacent to the investigation areas. Due to the significant areas of the community recorded, project areas for each site have been significantly reduced (by 14.132 ha to a predicted 3.543 ha) to minimise impacts to this community (refer to Section 6).

Natural temperate grasslands of the Victorian volcanic plain

Several grassland patches that were considered to meet the Victorian patch definition (DELWP 2017b) as plains grassland community were present at sites south of Beveridge (McIntyre Road Overbridge (Sunshine), Keilor Park Drive Overbridge (Keilor East), Calder Freeway Precinct (Keilor East), Westgate Drive Overbridge (Tullamarine), Tullamarine Freeway Precinct (Strathmore Heights), Barry Road Overbridge (Dallas), Hume Highway Overbridge (Craigieburn) and north of Beveridge at Track Slew C), and were assessed against the defining characteristics of NTG (DSEWPC 2011, TSSC 2008). The key defining characteristics of the community are provided in Table 9 with an assessment against these characteristics for each potential plain's grassland patch. An example of a patch meeting the requirements for classification of NTG can be seen in Figure 5.

Figure 5 Kangaroo Grass dominated patch at Track Slew Investigation Area C

Table 9 Determination of NTG

Key characteristics of community	Patch Assessment
Located within the Victorian Volcanic Plain bioregion, and small areas of adjoining bioregions, Otway Plain, Central Victorian Uplands and Dundas Tablelands Quaternary basaltic plain with volcanic cones and stony rises.	Patches considered to be potential listed grassland are KP_HZ01, CF_HZ01, CF_HZ02, CF_HZ03, CF_HZ04, WD_HZ01, WD_HZ02, TF_HZ01, BR_HZ01, BR_HZ02, BR_HZ03; TSC_HZ02, TSC_HZ09, TSC_HZ11, MR_HZ01, CF_HZ05, BR_HZ04 and HFC_HZ04 and are located within the northern eastern end of the Victorian volcanic plain.
For native vegetation patches <1ha in size, the minimum contiguous size of the patch is 0.05ha, and the crown cover of trees and shrubs over one meter tall should not exceed 5%. For vegetation patches >1ha the minimum contiguous size of the patch is 0.5ha, and the density of mature trees should not exceed 2 trees per hectare.	The size of each of the considered patches are: • KP_HZ01 is 0.056 • CF_HZ01 is 0.017 ha, too small to be considered further • CF_HZ02 is 0.084 • CF_HZ03 is 0.006 ha, too small to be considered further • CF_HZ04 is 0.024 ha, too small to be considered further • WD_HZ01 is 0.018 ha, too small to be considered further • WD_HZ02 is 0.018 ha, too small to be considered further • TF_HZ01 is 0.034 ha, too small to be considered further • BR_HZ01 is 0.011 ha, too small to be considered further • BR_HZ02 is 0.005 ha, too small to be considered further • BR_HZ03 is 0.011 ha, too small to be considered further • TSC_HZ02 is 0.029 ha, too small to be considered further • TSC_HZ09 is 0.25 ha • TSC_HZ11 is 0.37 ha • MIR_HZ01 is 0.280 ha • CF_HZ05 is 0.103 ha • BR_HZ04 is 0.013 ha, this patch is continuous with grassland in adjacent land that was not assessed. • HFC_HZ04 is 0.112 ha

Key characteristics of community	Patch Assessment
Vegetation is mainly limited to a layer of grasses and herbs. The main grass species present are kangaroo grass (*Themeda triandra*), wallaby-grass (*Rytidosperma* spp.), spear-grasses (*Austrostipa* spp.) and tussock-grasses (*Poa* spp.). The herbs are generally tussock forming, from families including daisy (*Asteracae*), lily (*Anthericacae, Asphodelaceae, Phormiaceae),* pea (*Fabaceae*) and orchid (*Orchidaceae*) families. Trees and shrubs are absent to sparse.	The vegetation composition of each patch is: • KP_HZ01 has a low, degraded understorey and moderate weed cover. The patch is located on the bridge embankment and is considered modified quality located in an urban environment, which is not consistent with floristic requirements of the listed community, with poor connectivity to remnant patches. • MIR_HZ01 is contiguous with a patch that extends into the adjacent biosite. The patch contained with the rail reserve is of slightly lower quality due to an edge effect, however, is considered part of the patch that is dominated by kangaroo grass. • CF_HZ02 is dominated by wallaby grasses, with extensive bare ground. The patch extends outside of the assessed investigation area and this extent is considered to be of higher quality. • BR_HZ04 is located adjacent to the Barry Road grassland biosite. This patch is dominated by kangaroo grass, which extends into the adjacent biosite. • HFC_HZ04 is located at the northern end of the investigation area near Malcolm Creek. At the time of the assessment the area was grazed close to bare ground. However, assessor knowledge of the site indicates a good quality grassland dominated by spear-grasses and wallaby-grasses. • TSC_HZ11 vegetation is comprises predominantly of native grass species as kangaroo grass and spear-grasses. A low cover of herbs were present on site (2%) including daisy (*Asteracae*), lily, and *Geranium spp.* Tree and shrub cover was sparse (*Acacia melanoxylon*; <10% cover) • TSC_HZ09 vegetation comprises of predominantly of native grass species such as kangaroo grass and tussock-grasses (*Poa* spp.). A low cover of herbs were present on site (3%) daisy (*Asteracae*), chocolate lily (*Arthropodium spp.)* and *Geranium spp*. Tree and shrub cover was present but low (*Acacia melanoxylon*; 17% cover)
The present species composition must be at least 50% of the dominant native species and the perennial tussock cover, or Non-grass weeds represent less than 30% of ground cover, or Native forbs comprise at least 50% of total vegetation cover during spring-summer.	• KP_HZ01 is dominated by grassy and herbaceous weeds and contains a native grass and forb cover of below 50 per cent • MIR_HZ01 comprises approximately 50 % native cover of all perennial grasses present* with 4% cover of native herbs. Weed cover is approximately 40 % cover of generally grassy weeds. • CF_HZ05 comprises approximately 50 % native cover of all perennial grasses present* with approximately 50 % cover of generally grassy weeds. The site contained high cover of bryophytes and lichens and bare ground. • BR_HZ04 comprises approximately 60% native cover of all perennial grasses present* with 3% cover of native herbs. Weed cover is low approximately 20 % cover of generally grassy weeds with high cover of bare ground.

Key characteristics of community	Patch Assessment
	• HFC_HZ04 from previous knowledge is considered to be greater than 50% cover of spear-grasses and wallaby-grasses. This patch is assumed to be the listed community. • TSC_HZ11 site comprises of sufficient native grassland species and cover, totalling of all vegetation cover, 47% cover of native grass tussocks, with 3% native herbs*. • TSC_HZ09 site comprises of predominantly native grassland species; with overall cover being 54% cover of native grasses and 3% native herbs*.

**Note that cover is low and given the time of year (June) that the survey was completed, this has potential to increase in spring/summer.*

Across six patches recorded, there was found to be 0.946 ha of NTG community present within the McIntyre Road (Sunshine), Calder Freeway Precinct (Keilor East), Barry Road Overbridge (Dallas), Hume Highway Overbridge (Craigieburn) and Track Slew C Investigation Areas.

Several grassland patches were present and recorded at the investigation areas (see Appendix D for mapped locations and Appendix E for the quality assessment scores). However, many were too small and did not meet the minimum patch size of 0.05ha for the national listing. Patches that did meet the size requirements, were predominately dominated by grassy and herbaceous weeds and contained native grass and forb cover of well below 50 per cent, and were therefore considered not to be the nationally listed TEC.

Two patches at Track Slew Investigation Area C (north of Beveridge), were large enough and contained at least 50 per cent cover of native grassland species. Hence, these two patches, TSC_HZ09 and TSC_HZ11, are considered to be the NTG community. These patches were surrounded by weeds, including high threat perennial grasses, phalaris and cocksfoot, plus thickets of gorse (*Ulex europaeus*). Patch TSC_HZ11 also contained some areas that appear to be inundated, with a small area of cumbungi. The native grassland surrounded this area, including an area that appears to be occasionally boggy, with kangaroo grass and *Poa spp.* dominating the drier areas. It was decided that the area was small enough to not warrant an additional assessment and that it could be considered part of the overall grassland patch and habitat. This patch is considered to provide potential habitat for striped legless lizard and growling grass frog, plus three flora species (swamp everlasting (*Xerochrysum palustre*), swamp fireweed (*Senecio psilocarpus*) and matted flax-lily).

Grassland sites within the Melbourne metropolitan areas, south of Beveridge, were small and isolated patches, containing wallaby-grasses and spear-grasses, with some areas, such as Barry Road Overbridge (Dallas), containing kangaroo grass. The NTG patch at Hume Highway Overbridge (Craigieburn), was heavily grazed at the time of assessment, however, previous knowledge of the site indicates a high-quality grassland dominated by spear-grass. This area is assumed to be NTG based on this previous knowledge.

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

Some woodland and native grassland areas considered possible representations of the WBYBBRGGW ecological community were assessed against the defining characteristics for the community (DEH 2006), see Table 10.

Those patches that were assessed against the community characteristics were located in the northern Victorian sites (north of Beveridge), where the characteristic white box (*Eucalyptus albens*), yellow box (*E. melliodora*) and Blakely's red gum (*E. blakelyi*) were all recorded. White box and Blakely's red gum were

not observed in investigation areas south of Glenrowan, whereas yellow box (*E. melliodora*) was recorded in several locations from Broadford to Wangaratta.

Figure 6 WWBYBBRGGW located at Beaconsfield Parade Overbridge (Glenrowan)

Table 10 Determination of WWBYBBRGGW

Key characteristics of community	Site Assessment
The ecological community is geographically widespread, but now highly fragmented. It occurs from the tablelands of Queensland through to Victoria, in areas between 170-1200m above sea level that receive between 400-800mm of annual rainfall. Areas where the overstorey is missing is then classified as derived native grassland.	Habitat zones within the Beaconsfield Parade Investigation Area, BP_HZ02, BP_HZ03, BP_HZ04, BP_HZ06 and BP_HZ07 were located in the appropriate region.
A patch must be at least 0.1ha and have 12 or more native understory species. If less than 12 native understory species are present the patch must be at least 2 ha or greater.	• BP_HZ02 is 0.405 ha and contains 14 native understorey species • BP_HZ03 is 0.166 ha and contains 14 native understorey species • BP_HZ04 is 0.077 ha and contains 6 native understorey species, too small to be considered further • BP_HZ06 is 0.112 ha and contains 11 native understorey species. Although this is below the diversity limit, a conservative approach will be taken and this patch will be considered further • BP_HZ07 is 0.058 ha and contains 6 native understorey species, too small to be considered further • BP_HZ08 is 0.091 ha and contains 11 native understorey species, too small to be considered further
The vegetation community must be or have previously been dominated or co-dominated by one or more of the key overstorey species – white box (*Eucalyptus albens*), yellow box (*E. melliodora*) or Blakely's red gum (*E. blakelyi*), or hybrids of these species with any other Eucalyptus species.	• BP_HZ02 the vegetation community is currently dominated by the key overstorey species white box, yellow box and Blakely's red gum.

Key characteristics of community	Site Assessment
	• BP_HZ03 the vegetation community is currently dominated by the key overstorey species white box, yellow box and Blakely's red gum. • BP_HZ06 and BP_HZ08 contains a mix of grey box, river red gum and only occasional Blakely's red gum. Most are regenerating trees from previous removal due to overhead powerlines (now redundant).
The understory species composition is highly variable, but the ground layer usually contains open cover of kangaroo grass (*Themeda triandra*), grey tussock-grass (*Poa sieberiana*) and/or Common tussock-grass (*Poa labillardieri*), interspersed with other grasses and forbs.	• BP_HZ02 understorey is variable with 5 shrubs species, and 11 species of forb and herb species. However the cover for understorey species is low (15% cover) with a high cover of litter. There is potential for the diversity and cover of native grasses and forbs to increase during spring. • BP_HZ03 understorey is variable with 5 shrubs species, and 11 species of forb and herb species. However the cover for understorey species is low (15% cover) with a high cover of litter. There is potential for the diversity and cover of native grasses and forbs to increase during spring. • BP_HZ06 and BP_HZ08 contain low covers of native grasses and forbs (6 % cover), with a high cover of weeds (40 %).

This community was considered present in two patches, BP_HZ02 and BP_HZ03 as they meet the required size and species composition to be classified as WBYBBRGGW (shown in Appendix D). There is a total of 0.726 ha of the listed community present within the Beaconsfield Parade (Glenrowan) Investigation Area. The project area has been revised following the outcomes of this assessment and these patches will not be impacted (refer to Section 6 for further details).

Patches BP_HZ06 and BP_HZ08 were not considered to be part of the listed community. This was due to the lack of relevant tree species dominating the overstorey and poor cover of native grasses and forbs and high cover of weeds.

Woody weeds are also significant issues in some areas, including European olive (*Olea europaea*), African olive (*Olea europaea* subsp. *cuspidata*), hawthorn (*Crataegus monogyna*), sweet briar (*Rosa rubiginosa*), scotch broom (*Cytisus scoparius*), African boxthorn (*Lycium ferocissimum*), radiata pine (*Pinus radiata*), blackberry (*Rubus fruticosus*) and privets (*Ligustrum* spp.).

The TEC is particularly susceptible to weed invasion due to the narrow and highly fragmented nature of the investigation areas. Weedy species of note include perennial grasses such as Chilean needle-grass (*Nassella neesiana*), African love-grass (*Eragrostis curvula*), serrated tussock (*Nassella trichatoma*), phalaris, perennial herbs including St John's wort (*Hypericum perforatum*) and wild sage (*Salvia verbenaca*), annual grasses including false and wild oats (*Avena* spp.), bromes (*Bromus* spp.), rye-grasses (*Lolium* spp.), veldt-grasses (*Ehrharta* spp.) and fescues (*Vulpia* spp.), plus herbs including clovers (*Trifolium* spp.), medics (*Medicago* spp.), thistles and Paterson's curse (*Echium plantegineum*).

4.2.2 Victorian listed ecological communities

The presence of three potential threatened ecological communities listed under the FFG Act were assessed within the investigation areas. These are discussed below.

Victorian Temperate Woodland Bird Community

The FFG-listed VTWBC was recorded within 12 investigation areas and impacts are predicted at 5 project areas, all north of Beveridge. The character description for the community identified vegetation that consists of larger, continuous remnants with suitable habitat features in northern Victoria, including large trees with hollows and nests (DEPI 2013).

Woodland birds, also individually listed under EPBC Act or FFG Act, that have previously been recorded in the vicinity of the investigation areas include apostlebird (*Struthidea cinerea*), barking owl (*Ninox connivens connivens*), bush stone-curlew (*Burhinus grallarius*), diamond firetail, grey-crowned babbler, ground cuckoo-shrike (*Coracina maxima*), hooded robin (*Melanodryas cucullata cucullata*), painted honeyeater (*Grantiella picta*), powerful owl (*Ninox strenua*), regent honeyeater (*Anthochaera Phrygia*), speckled warbler (*Chthonicola sagittata*), swift parrot (*Lathamus discolor*) and turquoise parrot (*Neophema pulchella*).

This community was concentrated between Broadford to Mangalore, north of Seymour, corresponding with grassy woodland, plains grassy woodland and box-ironbark forest EVC patches. These patches have been identified as an FFG Act-listed community and mapped in Appendix D and indicated in the habitat hectare assessment in Appendix E. Patches that are considered to be the VTWBC are located at the following areas:

- 0.726 ha recorded at Beaconsfield Parade Overbridge (Glenrowan)
- 0.302 ha recorded at Track Slew D
- 6.872 ha recorded at Track Slew E
- 0.305 ha recorded at Track Slew G
- 3.406 ha recorded at Track Slew I
- 1.499 ha recorded at Short Street Overbridge (Broadford)
- 1.644 ha recorded at Marchbanks Road Overbridge (Broadford)
- 4.368 ha recorded at Hume Highway Tallarook Precinct (Tallarook)
- 7.655 ha recorded at Seymour-Avenel Road Overbridge (Seymour)
- 6.844 ha recorded at Hume Highway Seymour Precinct (Seymour)
- 1.501 ha recorded adjacent to the Murray River Underbridge (Albury) Investigation Area
- Minor amounts recorded at Signal Gantry 18 (0.005) and Signal Gantry 19 (0.001).

These patches total 35.122 ha of the EVC listed community throughout the investigation areas. Project areas for each site have been significantly reduced (predicted 7.501 ha of potential impact) to minimise impacts to this community (refer to Section 6).

Figure 7 VTWBC located at Hume Freeway Seymour Precinct (Seymour)

The mapped community at these locations generally contained a consistent tree cover, typically with large trees, including several with hollows (notably at Track Slew E and Seymour-Avenel Road Overbridge (Seymour)). Hollow-bearing trees are considered an important habitat feature for several woodland birds and also other fauna species. The location of hollow-bearing trees is included in Appendix H.

The understorey generally contains a high species diversity and cover of understorey, particularly shrubs, with high cover of organic litter and debris. Although some locations, such as Marchbanks Road Overbridge (Broadford) and Track Slew E, do contain a high understorey weed cover. Typically, these patches are connected to larger patches of woodland habitats in the landscape, occurring in adjacent road reserves and waterways, such as the Goulburn River and Murray River.

Western (Basalt) Plains Grasslands Community

Patches of plains grassland vegetation on the Victorian volcanic plains bioregion, were assessed for consistency with the listed Western (Basalt) Plains Grasslands Community. All recorded patches of plains grassland EVC patches were assessed for consistency with characteristics of Western (Basalt) Plains Grasslands Community.

The character description provides the following detail on the community, which has been used in the assessment (DSE 2013):

> *"The vegetation is characteristically dominated by perennial native grasses, with very few eucalypts and shrubs, and an almost complete absence of introduced grasses and weeds"*

Additionally, the description notes that 'only scattered remnants now remain on the Victorian Volcanic Plain, mainly on long-uncultivated sites. In consideration of the description, it was determined that many of the small patches of plains grassland recorded within the investigation areas that often-comprised re-growth vegetation with high weed cover, were not consistent with the community description, and therefore not considered to be present.

This is due to the significant modification and disturbance of the investigation areas, and the high incidence of introduced grasses and weeds, including blanket weed, artichoke thistle, phalaris, brown-top bent, paspalum and ryegrass.

However, six patches that were of sufficient quality to classify as EPBC listed NTG, where also considered to be Western (Basalt) Plains Grasslands Community. These patches are KP_HZ01 (Keilor Park Drive), MIR_HZ01 (McIntyre Road, Sunshine), CF_HZ05 (Calder Freeway), BR_HZ04 (Barry Road,

Broadmeadows), HFC_HZ04 (Hume Highway, Craigieburn), TSC_HZ03 and TSC_HZ09 (Track Slew C, Wallan), which are mapped in Appendix D. Note that of these sites, only Track Slew C is north of Beveridge. The total area of these patches is 0.946 ha.

Grey Box – Buloke Grassy Woodland Community

WSP/PB (2016) identified the potential presence of Grey box–buloke grassy woodland community present at several sites in central Victoria, north of Beveridge, including Signal Gantry 16, Signal Gantry 19 and Track Slew Investigation Area I.

Grey box–buloke grassy woodland community is characterised by grey box (*Eucalyptus microcarpa*) usually being the structurally dominant tree over a lower stratum of buloke (DEPI 2013a). The community is characterised by

> "*a mainly grassy woodland found on flat or very gently undulating plains in northern Victoria and a few places in central Victoria. It tends to develop in the absence of fire on sites with relatively fertile, fine-grained soils*."

The habitat zones TSI_HZ01, TSI_HZ02, TSI_HZ03, TSI_HZ04, HFS_HZ09, HFS_HZ10, HFS_HZ11, HFS_HZ12, TSG_HZ2, SA_HZ19 and SA_HZ20, were considered further for potential Grey box–buloke grassy woodland communities. Habitat zones TSI_HZ04, HFS_HZ09 and HFS_HZ10 are also considered to be the EPBC listed GBGW.

The above mapped patch vegetation located north of Seymour, although contain grey box as a dominant overstorey, did not occur on fertile, fine-grain soils, but rather rocky poor soils on top of the undulating hills. Within the lower, fertile areas with sandier soils, river red gum and yellow gum were the dominant species. Additionally, these investigation areas with the potential to support this community did not contain a dominant lower stratum of buloke. Therefore, in considering the above, this community was not considered present in any of the investigation areas north of Seymour.

Additionally, no sites south of Seymour were considered to support this community, due to:

- recorded vegetation communities were mixed eucalypt forests co-dominated by river red gum, grey box, yellow box, red box and long-leaf box
- no buloke was observed in the surrounding region.
- the location of the sites which is mainly in central and southern Victoria

4.3 THREATENED FLORA SPECIES

Two listed threatened flora species, large-flowered crane's-bill and buloke, both listed solely under the FFG Act, were observed during Stage 1 (December 2017 and February 2018). No other listed threatened species were observed.

Habitat for threatened flora species listed under the EPBC Act and FFG Act was identified, are listed in Table 11 and discussed further below.

Table 11 Identified habitat for listed flora species

Species or group	Legislation	Site	Potential/ Known habitat
Matted Flax-lily	EPBC Act, FFG Act	Track Slew Investigation Area C Hume Highway Overbridge (Craigieburn).	Potential habitat.
Swamp Everlasting	EPBC Act, FFG Act	Track Slew Investigation Area C.	Potential habitat.

Species or group	Legislation	Site	Potential/ Known habitat
Swamp Fireweed (*Senecio psilocarpus*)	EPBC Act, FFG Act	Track Slew Investigation Area C.	Potential habitat.
Spiny Rice-flower	EPBC Act, FFG Act	McIntyre Road (Sunshine)	Species recorded, known habitat.
Euroa Guinea-flower	EPBC Act, FFG Act	Hume Highway Seymour Precinct (Seymour) Track Slew Investigation Area G Track Slew Investigation Area H	Potential habitat.
Crimson spider-orchid (*Caladenia concolor*)	EPBC Act, FFG Act	Hume Highway Tallarook Precinct (Tallarook), Track Slew Investigation Area D Seymour-Avenel Road Overbridge (Seymour) Hume Highway Seymour Precinct (Seymour) Track Slew Investigation Area G Track Slew Investigation Area H Beaconsfield Parade, Glenrowan	Potential habitat.
Purple diuris	FFG Act	Hume Highway Tallarook Precinct (Tallarook), Track Slew Investigation Area D Seymour-Avenel Road Overbridge (Seymour) Hume Highway Seymour Precinct (Seymour) Track Slew Investigation Area G Track Slew Investigation Area H Beaconsfield Parade, Glenrowan	Potential habitat. Species recorded in the rail reserve between Glenrowan and Wangaratta.
Large-flower crane's-bill*	FFG Act	Barry Road Overbridge (Dallas) Hume Highway Overbridge (Craigieburn).	Recorded at Barry Road, plus potential habitat, see notes below.
Buloke	FFG Act	Seymour-Avenel Road Overbridge (Seymour)	Recorded at site, in conjunction with Grey box grassy woodland in two sites. See notes below.
Tough scurf-pea (*Cullen tenax*)	FFG Act	McIntyre Road (Sunshine)	Potential habitat in recorded grassland patch.

**individuals were not in flower during survey, but highly likely to be large-flowered crane's-bill*

Targeted surveys for threatened flora species undertaken during flowering times did not identify any FFG Act-listed orchid species within the project areas (KBR 2020b).

4.3.1 Nationally listed flora species

Habitat for EPBC Act listed flora species was located in investigation areas that contain native grassland habitat that is contiguous with larger patches of grassland extending outside of the investigation areas.

Around Melbourne, grassland habitat has been severely depleted and several grassland-dependent flora species are now endangered. Habitat within the investigation areas for these species is generally limited to where remnant grassland vegetation has been recorded. This is restricted to three investigation areas, McIntyre Road Overbridge (Sunshine), Hume Highway Overbridge (Craigieburn) (both south of Beveridge) and Track Slew Investigation Area C (north of Beveridge).

The grassland patch at McIntyre Road (Sunshine) is considered to be part of a larger grassland that extends into the adjacent biosite (located in private land). The adjacent biosite contains a large population of the endangered spiny rice-flower. The species was recorded immediately north (outside) of the investigation area during a targeted survey within the rail reserve and these individuals are considered to be part of the population. These spiny rice flower individuals were found more than 100 m outside of the McIntyre Road Overbridge (Sunshine) Investigation Area and are not in danger of direct or indirect impacts (Appendix D, Map 1). It should be noted that the project area was extended following field assessment (see Appendix A). This location has potential grassland habitat, including for spiny rice-flower that has not been assessed.

The grassland located at Hume Highway Overbridge (Craigieburn) has been subject to grazing. However, assessor knowledge of the site considers the area to provide native grassland habitat. Records for the endangered matted flax-lily occur near this area and the site is considered to provide suitable habitat.

Matted flax-lily habitat is also considered to be present at Track Slew Investigation Area C, where patches of grassland were found interspersed amongst exotic pasture. The area is a transition zone between grassland from the volcanic plain, into foothill forests and woodlands in the sedimentary hills. This is similar habitat in the nearby South Morang/Mernda/Whittlesea area, where large populations of the species exist. The grassland in this area is also considered to be consistent with the habitat requirements for swamp everlasting and swamp fireweed. Part of the recorded grassland appears to be regularly inundated, and several species of daisy were recorded within the patch. Matted flax-lily, swamp everlasting and swamp fireweed were not recorded in the Investigation Areas.

Several unidentified orchids (not flowering) have been recorded within the rail reserve in central Victoria, from Broadford to Mangalore. It is not expected that these species are EPBC Act-listed flora and the desktop assessment did not identify any species with potential to occur. However, the presence of potential spider-orchid (*Caladenia* spp.) leaf (see Appendix H) indicated suitable habitat for orchid species. The EPBC Act listed crimson spider-orchid (*Caladenia concolor*) was identified in the EnSym results (Appendix I) as having modelled habitat. A subsequent review of the habitat requirements for the species is similar to habitats at Seymour-Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour) (north of Beveridge).

Targeted surveys for threatened flora species undertaken during flowering times did not identify any EPBC Act-listed orchid species within the project areas (KBR 2020b).

Euroa guinea-flower is confined to the Euroa-Mansfield area, occurring on shallow sandy loams in woodland (FoV 2019), and is known to occur in the rail reserve between Longwood and Euroa, approximately 40 km north of the investigation areas at Seymour. Seymour-Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour) Investigation Areas provide similar habitat to that present at the rail reserve, where the population is present (pers. obs.). The species was not

identified during the current survey. It was also not identified during targeted flora surveys completed during the flowering time (September to November 2019), despite the species being observed flowering at another nearby site outside the corridor and project areas at the same time (KBR 2020b).

4.3.2 Victorian listed flora species

Two FFG Act-listed flora species were recorded within investigation areas (records are identified in Appendix D):

- large-flower crane's-bill, considered endangered in Victoria, was recorded (though individuals were not in flower during survey) within the Barry Road Overbridge (Dallas) Investigation Area (south of Beveridge), and
- buloke, considered endangered in Victoria, was recorded at Seymour-Avenel Road Overbridge (Seymour) (north of Beveridge).

Habitat for Victorian listed species was also present for tough scurf-pea (*Cullen tenax*) and purple diuris (*Diuris punctata*). Other listed species, narrow goodenia and small milkwort, were also identified as having potential habitat within the investigation areas (WSP/PB 2016). However, following field surveys, suitable habitat was not considered to be present, primarily due to poor habitat quality and habitat modification where the species had potential to occur.

Potential large-flower crane's-bill individuals were located within the fenced Coolaroo Station Metro network protected flora site within the Barry Road Overbridge (Dallas) Investigation Area. This species could not be confirmed during field survey as the individuals had finished flowering. The species is known to occur within the adjacent Maribyrnong Valley – Barry Road Grassland Remnant and the leaf-shape and the location within the fenced MTM biosite area indicates it is likely to be large-flower crane's-bill. The species can be confirmed through targeted surveys during April (season dependent). However, this area has been excluded from the project area following a change in design option and these individuals are no longer predicted to be impacted.

Two immature buloke were identified within the Seymour-Avenel Road Overbridge (Seymour) Investigation Area. It is likely that these individuals will be impacted by the works at Seymour-Avenel Road Overbridge (Seymour). These individuals appear to be isolated from larger buloke populations, which are known to occur further north within the rail corridor on more fertile soil (KBR 2008).

Purple diuris habitat has been identified at Beaconsfield Parade Overbridge (Glenrowan) Investigation Area, with some potential habitat at Seymour-Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour). The species is known from the rail corridor further north of the Beaconsfield Parade Overbridge (Glenrowan) Investigation Area, in grassy woodland habitat. High quality grassy woodland habitat has been recorded to the eastern end of the investigation area, which was considered to provide potential habitat for the species. This area has been excluded from the Beaconsfield Parade Overbridge (Glenrowan) Project Area.

4.3.3 Targeted spiny rice-flower survey

Habitat characteristics

The western section of the rail corridor adjacent to the Sunshine North industrial area (south of Beveridge) was severely degraded and largely devoid of native vegetation. There was an abundance of illegally dumped rubbish and mounds of spoil and significant areas of soil disturbance (see Figure 8). Multiple scheduled noxious weeds were present, which included artichoke thistle, African boxthorn, fennel (*Foeniculum vulgare*), Chilean needle-grass and serrated tussock.

The eastern section of the rail corridor was also degraded with several noxious weeds present. The northern end of the survey area had areas of Plains grassland dominant by kangaroo grass (*Themeda triandra*) present, which was considered suitable habitat for spiny rice-flower. The southern end was disturbed with piles of spoil dominated by exotic vegetation. This section of the investigation area is adjacent to the privately-owned Solomon Heights Grassland. There appears to be no management regime to the northern end of the survey area, although areas adjacent to the rail corridor to the south had been burned within the last 6 months.

Figure 8 Western section of the rail corridor within the McIntyre Road (Sunshine) Investigation Area

Survey results

A total of nine spiny rice-flower plants were identified within the rail corridor during the survey (see Appendix D). These individuals were all located north of the McIntyre Road (Sunshine) Investigation Area.

The individuals were all located within a patch of plains grassland dominated by kangaroo grass, representing one of the only few patches of native vegetation within the survey area. The patch appeared to be slashed as part of the rail corridor management regime.

The individuals are located adjacent to the Solomon Heights Grassland, where multiple records of the species are located. All nine individuals were in flower as verified in Figure 8, below.

Figure 9 Flowering spiny rice-flower recorded north of the McIntyre Road (Sunshine) Investigation Area

4.3.4 Vegetation quality assessment

A total of 189 habitat zones were assessed. The results of the vegetation quality assessments, using the habitat hectares method (DSE 2004b), including Large Trees in patch, have been mapped and included in Appendix D. The Habitat Zone data and the results of the assessment for each site are found in Appendix E.

A total of 36.465 ha of native vegetation have been identified within the investigation areas (north and south of Beveridge), comprising 16 different EVCs. A list of these EVCs and their applicable Large Tree benchmark size are provided in Table 12. Refer to Table 29 in Section 6 for EVCs predicted to be impacted for each project area.

Table 12 Ecological vegetation classes recorded in Investigation Areas and the large tree benchmark

Bioregion	EVC name	EVC code	Bioregional conservation significance	Large old tree benchmark (cm)	Area (ha)
Victorian Volcanic Plain	Plains grassland	132	Endangered	N/A	1.605
	Plains grassy woodland	55	Endangered	80	0.335
	Creekline grassy woodland	68	Endangered	70	0.092
	Swampy riparian woodland	83	Endangered	70	0.600
Central Victorian Uplands	Plains grassy woodland	55	Endangered	80	9.850
	Box-ironbark forest	61	Vulnerable	70	10.740
	Grassy woodland	175	Endangered	70	2.768
	Valley grassy forest	47	Vulnerable	70	0.049
	Plains grassy wetland	125	Endangered	N/A	0.091

Bioregion	EVC name	EVC code	Bioregional conservation significance	Large old tree benchmark (cm)	Area (ha)
Victorian Riverina	Plains grassy woodland	55	Endangered	80	0.982
	Creekline grassy woodland	68	Endangered	70	1.030
	Grassy woodland	175	Endangered	80	0.029
	Riverine grassy woodland	295	Endangered	80	0.901
	Floodplain riparian woodland	56	Vulnerable	80	5.304
Northern Inland Slopes	Plains woodland	175	Endangered	70	2.070
	Grassy woodland	175	Endangered	80	0.019

The investigation areas within the Melbourne metropolitan area, south of Beveridge are located within the Victorian volcanic plain bioregion. One investigation area located north of Beveridge, Track Slew C Investigation Area, also occurs within the Victorian volcanic plain bioregion. These areas are dominated by grasslands and grassy woodlands. The grassland areas are predominately located within the investigation areas to the west of Melbourne. Further north, the grasslands begin to grade into grassy woodlands. Historic rail maintenance of the rail reserves generally has removed and controlled the trees, which often leaves derived native grasslands.

From Wandong to Seymour (north of Beveridge), the investigation areas occur mainly on the low-lying and undulating hills of the Central Victorian Uplands bioregion, near the transition to the flatter plains of the Victorian Riverina bioregion. The vegetation within the investigation areas therefore often represents a natural transition zone between the hills and the plains, where different tree species and communities dominate.

Through the Wandong to Tallarook areas (north of Beveridge), Plains grassy woodland occupies the low-lying areas, particularly along minor drainage lines, with Grassy woodland present in the low rises and hilly areas. If larger waterways and creeks were present, Creekline grassy woodland, or as is the case with the Murray River, Riverine grassy woodland, would occupy the landscape between waterway and open plain or floodplain.

Through drier areas, notably north of Seymour, the low hills and rises were characterised by Box-ironbark forest, which often contained a similar suite of species to the nearby Plains grassy woodland EVC, although it was typically taller and displayed more 'forest' characteristics.

The Northern Inland Slopes bioregion intersected with two investigation areas, Beaconsfield Parade Overbridge (Glenrowan) and a small section of Murray Valley Highway Overbridge (Barnawartha North), (although no native patches or scattered trees where recorded in this bioregion at Barnawartha).

4.3.5 Scattered trees

A total of 303 scattered trees were recorded within and immediately adjacent to the investigation areas (north and south of Beveridge), 36 of these are located south of Beveridge and 267 located north of Beveridge. This includes trees adjacent to the investigation areas were also recorded, where there was potential for the root zones to extend into the Investigation Area, based on a visual estimation of the Tree Protection Zone (DELWP 2018). These scattered trees are summarised in Appendix F.

4.3.6 Planted native vegetation

Planted native vegetation was observed throughout the investigation areas, including on the embankments of road bridges within the Metropolitan sites south of Beveridge, such as Keilor Park Drive Overbridge (Keilor East), Barry Road Overbridge (Dallas) and Pascoe Vale Road Overbridge (Glenroy), and bridges in regional towns, north of Beveridge, including Anderson Street Overbridge (Euroa) and Benalla Station Approach Road Overbridge (Benalla).

The vegetation present in these plantings included native grasses and rushes, mainly common tussock-grass (*Poa labillardieri*) and spiny mat-rush (*Lomandra longifolia*), plus native overstorey species, including spotted gum (*Corymbia maculata*) and Yellow box.

Planted native vegetation was not recorded during the assessment.

5 Fauna

This section discusses the fauna species and habitat for threatened fauna species recorded and observed during Stage 1 (December 2017 and February 2018) and Stage 2 (June 2019) field surveys at each investigation area. This includes the following values, which are discussed further below:

- Potential habitat for 16 threatened species listed under the EPBC Act or the FFG Act
- Potential habitat for seven threatened fish species listed under the EPBC Act or the FFG Act
- Three broad habitat types that provide habitat for threatened fauna species, including woodlands, grasslands and waterways.

Targeted fauna surveys have also been completed for two grassland-dependent species, golden sun moth and striped legless lizard.

5.1 GENERAL

Fauna species opportunistically observed within the investigation areas were generally common bird species through metropolitan and rural landscapes. Commonly observed species included the indigenous species little raven (*Corvus mellori*), magpie (*Gymnorhina tibicen*), galah (*Eolophus roseicapilla*), noisy minor (*Manorina melanocephala*), rainbow lorikeet (*Trichoglossus moluccanus*), sulphur-crested cockatoo (*Cacatua galerita*), welcome swallow (*Hirundo neoxena*) and the exotic species European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), common myna (*Acridotheres tristis*), rock dove (*Columba livia*) and spotted turtle-dove (*Streptopelia chinensis*).

Other terrestrial fauna species were also recorded occasionally through the investigation areas, including an echidna (*Tachyglossus aculeatus*) at Short Street Overbridge (Broadford); a swamp wallaby (*Wallabia bicolor*) at Track Slew Investigation Area C, as well as several garden skinks (*Lampropholis guichenoti*), rabbits (*Oryctolagus cuniculus*) and foxes (*Vulpes vulpes*).

An assessment of habitat, see below, was conducted to inform the likelihood of presence for species identified during the desktop assessments.

5.2 THREATENED FAUNA SPECIES

No threatened fauna species were recorded or observed during the ecological investigations. Species considered to have potential to occur based on previous records and the presence, quality and connectivity of habitat, are considered further below.

Additionally, during the Stage 1 assessment in 2017/18, a targeted survey was completed for the golden sun moth. A further assessment and check of tile grids for the striped legless lizard (WSP/PB 2016) was also completed.

5.2.1 Growling grass frog

Waterway and grassland habitat suitable for the growling grass frog (*Litoria raniformis*) was limited within the investigation areas. As noted above, the investigation areas were primarily around road bridges and, particularly around Melbourne, did not contain aquatic or foraging habitat, including in close proximity to

waterways, which provide likely habitat, for instance Moonee Ponds Creek and the Maribyrnong River, as they occur in deep ravines that contain unsuitable habitat between the waterway and the sites where project activities are proposed.

Three sites have been identified as containing potential habitat for this species:

North of Beveridge:

- Track Slew Investigation Area C, where remnant grassland has been recorded and which is in close proximity to the upper reaches of the Merri Creek at Wallan.

South of Beveridge:

- Calder Freeway Precinct (Keilor East) investigation which area extends close to Steele Creek and an adjacent wetland
- Hume Highway Overbridge (Craigieburn) investigation area which occurs near Malcolm Creek, a tributary to the Merri Creek

Each of these three locations have been identified as potential habitat supporting the species due to suitable resources being available, including potential grassland foraging habitat in close proximity to aquatic habitat, namely creeks and wetlands. Track Slew Investigation Area C and Hume Highway Overbridge (Craigieburn) are located in close proximity to the Merri Creek, where the species has a significant meta-population (Heard *et al.* 2010).

5.2.2 Brush-tailed phascogale and squirrel glider

The brush-tailed phascogale (*Phascogale tapoatafa*) and squirrel glider (*Petaurus norfolcensis*) are arboreal mammals that primarily occupy forests and woodlands in Victoria. The brush-tailed phascogale is considered Vulnerable and the squirrel glider is considered Endangered in Victoria, with both being listed as threatened under the FFG Act.

Both species occur in similar regions through northern Victoria, with brush-tailed phascogale generally occurring in dry foothill forests with sparse understorey (DSE 2003a) and squirrel glider preferring dry forests and woodland, particularly along watercourses with a substantial understorey, mainly of wattles, present (DSE 2003b).

Brush-tailed phascogales occupy large home ranges with numerous den sites (DSE 2003). Females occupy home ranges of 30-60 ha in size that do not overlap, while males forage over areas greater than 100 ha, which overlap extensively with both females and other males

Squirrel gliders occupy small to moderate home ranges, which contain numerous den sites (DSE 2003a). The species is known to occupy linear corridors around Euroa (approximately 45 km north of Hume Freeway, Seymour). Throughout this well-connected network of habitat, the average home range size ranges of 1.3–2.8 ha (DSE 2003a).

Both species are considered to have potential to occur at several locations, all north of Beveridge, Marchbanks Road (Broadford), Hume Freeway Tallarook Precinct (Tallarook), Seymour-Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour). These sites contain areas with intact woodland that is connected to other habitats and woodland corridors in the landscape, and also contain large and hollow-bearing trees, which may be used as den sites. Other sites considered to contain suitable habitat for the species are Track Slew Investigation Area D, Track Slew Investigation Area I, Beaconsfield Parade Overbridge (Glenrowan) and Murray River Underbridge (Albury).

Brush-tailed phascogale and squirrel glider favour areas that have large old trees with hollows and logs present, as well as a complex understory. Continuous habitat areas are favourable, as are connectivity to other habitats within the landscape.

5.2.3 Woodland birds

The VTWBC is a listed threatened ecological community under the FFG Act. The community is a suite of woodland bird species that are considered to occur in similar habitats, mainly on the drier slopes and plains of the Great Dividing Range. Species within the group that are considered to have potential to occur are apostlebird, barking owl, bush stone-curlew, diamond firetail, grey-crowned babbler, ground cuckoo-shrike, hooded robin, painted honeyeater, powerful owl, regent honeyeater, speckled warbler, swift parrot and turquoise parrot.

These birds favour habitat that has large old trees with hollows, as well as a complex understory including logs in the matrix. Many of the species rely on hollows for breeding and roosting. Suitable feed tree species for parrots and honeyeaters include red box (*Eucalyptus polyanthemos*), yellow box, grey box and river red gum.

Most regional sites between Tallarook and Mangalore are considered to contain suitable habitat, in addition to the sites at Broadford, Murray River Bridge and Wangaratta (Appendix D), with no woodland bird habitat identified south of Beveridge. Many of these sites comprise large trees and are connected to other woodland habitats in the surrounding landscape.

The vegetation at the regional sites that are considered appropriate for woodland birds, include large old trees with suitable hollows for nesting and roosting, and appropriate feed trees for parrots and honeyeaters, (such as red box, yellow box, grey box and river red gum). The understory is generally complex, with a diversity and high cover of shrubs, with often high cover of litter.

The Beaconsfield Parade Overbridge (Glenrowan) Investigation Area has Box-ironbark forest in the vicinity, as well as being close to the Chiltern-Mt Pilot National Park and the Warby Ranges. This neighbouring high-quality habitat indicates that woodland birds are more likely to be in the area and utilising the habitat available in the investigation area. The habitat in the investigation area may not support large permanent populations, but it is likely to act as a dispersal corridor for the birds in the listed community.

Hume Highway Tallarook Precinct (Tallarook) Track Slew Investigation Area D, Seymour-Avenel Road Overbridge (Seymour), Track Slew Investigation Area G, Hume Highway Seymour Precinct (Seymour) and Track Slew Investigation Area H have disused road reserve adjacent to rail reserve, which has created bands of vegetation 50-100 m wide through an otherwise highly modified landscape.

The habitat in the investigation areas is part of a band of vegetation that is considered to primarily function as a dispersal corridor for many woodland bird species. It is considered likely that woodland species utilise these habitats, including within the investigation areas, for dispersal through the landscape.

5.2.4 Threatened fishes

Seven threatened fish species have been recorded at the Murray River in the vicinity of the Murray River Underbridge (Albury), and within 5 km of Wangaratta.

The species recorded within proximity of the Murray River include flat-headed galaxias (*Galaxias rostratus*), Macquarie perch (*Macquaria australisica*), Murray cod (*Maccullochella peelii*), Murray river rainbow fish (*Melantaenia fluviatilis*), Murray spiny crayfish (*Euastacus armatus*) and trout cod (*Maccullochella macquariensis*).

The works are in NSW and will be delivered under the A2I project. Works in Victoria are limited to provision of a temporary construction laydown and rail access via hi-rail machinery. The A2I scope includes modifications to the existing rail bridge structure, with no physical works in the waterway or riverbanks.

Murray cod and trout cod have been recorded in the nearby Ovens River. One Mile Creek, traverses through the Wangaratta Precinct (Wangaratta) Investigation Area, which flows into the Ovens River further north. However, One Mile Creek, within the investigation area, is generally of poor quality, with concrete bridge abutment lining the waterway. The habitat for the threatened species recorded nearby is unlikely to occur within this waterway, due to its shallow and ephemeral nature, with both Murray cod and trout cod requiring deeper waterways. Threatened fish species are not likely to occur within the Wangaratta Precinct (Wangaratta) Investigation Area.

5.2.5 Golden sun moth

Habitat assessment

WSP/PB (2016) identified six sites as habitat for golden sun moth south of Beveridge (Section 2.1.3). Following the field assessment, five of these sites were not considered for further targeted survey. The majority of potential habitat sites are present near vehicle access points to the rail reserve and are high activity areas that lack suitable tussock-grass species and have been subject to soil disturbance. As such habitat at most sites are not likely to suit the species, with any areas of suitable habitat limited to small, narrow and isolated pockets located behinds factories and residential areas.

The field assessment at Stage 1 identified that suitable areas are likely to be located further away from the level crossings and bridges, which are high activity areas. Overall, most of the sites had unsuitable habitat due to:

- Lack of grassland habitat in regional Victorian sites, north of Beveridge, including Seymour-Avenel Road Overbridge (Seymour) and Hume Highway, Tallarook, which were primarily of woodland vegetation.
- Lack of suitable grass species in metropolitan Melbourne sites, south of Beveridge, where sites were dominated by exotic pasture and stoloniferous 'creeping' grasses, including kikuyu (*Pennisetum clandestinum*), couch, brown-top bent, paspalum, Yorkshire fog and phalaris.
- High cover of herbaceous weed species, such as blanket weed, artichoke thistle, cat's ear and ribwort
- Previous disturbance. Numerous sites, particularly in metropolitan Melbourne, have been subject to disturbance, including from rail construction and maintenance, including sites with artificial substrates (ballast, crushed rock or fill), or from illegal rubbish dumping.

During 2017 and 2018 targeted surveys, two discrete sites, within the Tullamarine Freeway Precinct (Strathmore Heights) Investigation Area, were considered to have suitable habitat. Although these sites have been subject to previous disturbance and are generally dominated by Chilean needle-grass, both have potential habitat and were identified for further targeted surveys.

Following further design development, Stage 2 surveys identified additional habitat in discrete, and generally isolated, locations within the Investigation Areas, which are all located south of Beveridge. Habitat, either as optimal wallaby-grass and spear-grass dominated grassland patches, or as potentially suitable exotic *Nassella* grasslands, where identified at the following locations:

- On the edges of the McIntyre Road Overbridge (Sunshine) Investigation Area bordering Solomon Heights Grassland/Maribyrnong River Edge biosite
- Calder Freeway Investigation Area, at the northern extent near Steele Creek
- Track Slew A Investigation Area, including large areas of exotic *Nassella*-dominated grasslands
- Barry Road Overbridge (Dallas) Investigation Area, where the Investigation Area borders the grassland biosite

- Hume Highway Overbridge (Craigieburn), at the northern end of the Investigation Area near Malcolm Creek.

Stage 1 Golden sun moth survey

Tullamarine Freeway Precinct (Strathmore Heights) - Site 1 Melrose Drive, Airport West

Site 1 consists of an area of 0.42 ha of low-quality Plains grassland surrounded by a larger area of grassland degraded by an access track, structures and past soil disturbance. The central part of the site is dominated by wallaby grass with approximately 45 per cent cover, surrounded by areas of lower cover of the native grass. The exotic Chilean needle-grass was scattered on site at approximately 10 per cent cover, amongst other exotic grassy weed and herb cover totalling approximately 20 per cent cover. No tree or shrub cover was present, and no buildings or other structures were located within the site. The site is flat with a central longitudinal minor depression and no rocky areas present. The soil is clayey and of volcanic origin. Bare ground comprises approximately 10% cover and the site is regularly mown using a tractor mounted slasher which produces a dense layer of organic litter at approximately 25 per cent cover.

The site is adjacent to more highly degraded grassland on all boundaries, which has an unsuitable species mix for golden sun moth. The Melrose Drive and Tullamarine Freeway bridges over the rail reserve to the east of the site, and the Westfield Drive Bridge to the west, are characterised by bare ground, concrete ramparts and walkways that result in extensive breaks in the vegetation within the rail reserve, isolating the site from other habitat areas. Disturbance from a swale drain located towards the northern boundary of the rail reserve and other rail infrastructure has encouraged areas of disturbed weedy grassland that increase degradation to higher quality areas of the site.

Tullamarine Freeway Precinct (Strathmore Heights) - Site 2 Gowanbray Drive, Airport West

Site 2 comprises a 0.27 ha slightly elevated long narrow area of highly degraded grassland backing on to residential housing and grading towards Moonee Ponds Creek to the north. Rocky areas are not present, and the soil characteristics are similar to the nearby Site 1. Site 2 is dominated by the exotic spear grasses Chilean needle-grass and serrated tussock at approximately 60 per cent cover with scattered native wallaby grass at less than 5 per cent cover. The site is surrounded by areas dominated by exotic grasses, including phalaris, paspalum and exotic non-grassy weeds. One residential property has extended their garden into the rail reserve, including fruit trees and prickly pear (*Opuntia* spp.), however this area has been excluded from the survey site. No buildings are present within the site, however residential paling fences and adjacent garden trees shade the boundary of the rail reserve and has been excluded from the survey site. Bare ground comprises approximately 2 per cent cover and this site is also mown occasionally, with slashed material left on site resulting in a dense layer of mown grass thatch and organic litter of approximately 25 per cent cover.

The site is adjacent to areas dominated by weedy herbs which are unsuitable for golden sun moth habitat. The Tullamarine Freeway bridges towards Melbourne and deeply incised channel of the Moonee Ponds Creek and Rail Bridge to the north create large breaks in the rail reserve vegetation.

Survey conditions

Appropriate golden sun moth flying conditions (DEWHA 2009) coincided with the selected survey dates during December 2017 and January 2018 and moths were observed flying at reference sites to the north and west of Melbourne from late November 2017 until 18 January 2018.

Meandering traverse surveys were completed on four occasions in appropriate weather conditions by two ecologists experienced in the identification of golden sun moth on 22 December 2017, and 5 January, 11 January and 17 January 2018 between the hours of 10.00 am and 2.00 pm Australian Eastern Daylight-Saving Time (EDST). Each survey occurred at least two days since the last period of rainfall. Ground

conditions were dry for each survey. Table 13 summarises the prevailing weather conditions on each day of survey at each site.

Table 13 Recorded weather conditions* for targeted golden sun moth surveys at Tullamarine Freeway Precinct (Strathmore Heights)

Date	Survey site	Start time	End time	Cloud cover (%)	Wind speed (km/h) and direction	Temperature (°C)
22 December 2017	Site 1	10.19 am 11.30 am	10.39 am 11.50 am	5	5 SSE 6 ENE	20.5 22.3
	Site 2	10.50 am 11.10 am	11.10 am 11.25 am	5	6 SSE 9 NNE	21.5 22
5 January 2018	Site 1	11.40 am 12.47 pm	12.01 pm 1.10 pm	0	9 SE 15 SE	22 25.7
	Site 2	12.05 pm 12.23 pm	12.21 pm 12.39 pm	0	11 SE 12 SE	23.4 24
11 January 2018	Site 1	12.05 pm 12.40 pm	12.40 pm 1.01 pm	5	8-24 NNE 8-20 N	30.4 30.7
	Site 2	1.06 pm 1.22 pm	1.21 pm 1.40 pm	5	8-24 NNE 19 NNE	31.4 32.3
17 January 2018	Site 1	11.06 am 11.27 am	11.27 am 11.47 am	0	7 E 11 NW	21.4 23.9
	Site 2	11.55 am 12.14 pm	12.12 pm 12.33 pm	0	9 SE 9 SE	24.3 25.4
18 January 2018	-	12.00 noon	-	-	15 N	33.1

Note: * Wind speed and direction were recorded at the time of survey from the nearest Bureau of Meteorology station (Tullamarine Airport). Statistics for 18 January weather conditions was sourced from Bureau of Meteorology (26 February 2018).

The data recorded in Table 13 and 14 acknowledges a discrepancy in the records of golden sun moth flying at reference sites, whereby there were no other known observations of golden sun moth flying at reference sites on 17 January 2018, when the final KBR survey took place. However, flying was observed on 18 January 2018, in warmer but windier weather conditions. As the targeted surveys were completed in the latter half of the flying season, it was particularly important to take advantage of suitable weather conditions.

GSM Reference Areas

KBR obtained information on the commencement of the 2017-8 GSM flying season from the GSM survey distribution list (Biosis) and by consulting past records of GSM sightings and locations included in the VBA (DELWP 2017). Table 14 indicates GSM flying at reference areas on the survey dates.

Table 14 Recorded golden sun moth flying at reference sites

Date	Recorded flying	Location/s
22 December 2017	Yes	North Laverton, Little River, Epping
5 January 2018	Yes	Little River

Date	Recorded flying	Location/s
11 January 2018	Yes	Little River, Epping
17 January 2018	No*	-
18 January 2018	Yes	Epping

Note: * Recorded flying on 18 January 2018

Information obtained from the golden sun moth survey distribution list (Biosis 2017) and online VBA database (DELWP 2017) indicated that the first golden sun moth known to be flying in the Melbourne region in the 2017-8 season were observed on 29 November 2017 at Craigieburn, approximately 11 km north east of the investigation area. The latest reported golden sun moth flights were at 18 January 2018 at Epping, which is located approximately 12 km north east of the investigation area. Flying males were also observed at Laverton North, located approximately 12 km south west of the site, plus at Little River, located approximately 40 km south west, during the survey period.

Survey results

Desktop investigation found the nearest recent records of golden sun moth to the current targeted survey sites are located adjacent to Merlynston Creek in Seabrook Reserve, Broadmeadows approximately 5 km in a north easterly direction from the current survey sites and were observed during the 2015-6 GSM flying season (DELWP 2015). Seabrook Reserve was investigated as the most local reference site for the current golden sun moth surveys; however it had been recently mown in mid-January and no golden sun moth were observed flying. The reserve is isolated from the rail corridor, by high density residential development and an industrial estate.

For the targeted survey completed at Tullamarine Freeway, a total of 6:16 person-hours were spent surveying Site 1 and 4:32 person-hours were spent surveying Site 2. Table 15 summarises the survey results and survey effort. Appendix H indicates the location of Site 1 and 2 GSM survey areas (TF_HZ01 and TF_HZ03, respectively) located at the Tullamarine Freeway Precinct (Strathmore Heights).

Table 15 Golden sun moth survey results and survey effort at Tullamarine Freeway Precinct (Strathmore Heights)

Date	Survey site	Number of GSM observed	Person hours
22 December 2017	Site 1	0	1:20
	Site 2	0	1:10
5 January 2018	Site 1	0	1:28
	Site 2	0	1:04
11 January 2018	Site 1	0	1:52
	Site 2	0	1:06
17 January 2018	Site 1	0	1:22
	Site 2	0	1:12
Totals	**Site 1**	0	**6:16**
	Site 2	0	**4:32**

Golden sun moth activity was recorded as flying at reference sites within the Melbourne region, however no sightings of the moth were recorded within the Tullamarine Freeway sites. Habitat suitability across Site 1 is generally consistent but low-quality remnant native grassland, consisting of short (mown) wallaby grass dominated vegetation, but is surrounded by areas of tall dense exotic annual grasses. Tall dense

grasses are unfavourable habitat, due to the presence of thatch and the absence or reduction of inter-tussock spaces. Similarly, Site 2 is comprised of exotic spear-grasses of consistently low quality, surrounded by areas dominated by exotic spear-grasses (*Nassella* spp.), non-spear-grasses and weedy herbs which constitute unfavourable habitat due to the height of the grasses, high tussock and thatch density and absence of inter-tussock spaces.

5.2.6 Striped legless lizard

Habitat assessment

As identified for other fauna species, habitat for striped legless lizard within the investigation areas was limited to scattered and isolated patches. The rail reserve and surrounding areas generally present a modified environment of an existing rail line in suburban Melbourne. In most instances the surface rock and natural layer has been removed or ballast and other materials has been spread over areas.

The habitat that is generally identified for the species, is away from the rail formation on the edges of the areas surveyed, with more optimal habitat occurring in adjacent lands.

Habitat for the species has been identified in several discrete locations within the investigation areas. These locations generally occur where the rail corridor occurs near a larger patch of grassland or habitat, or where the investigation area extends outside of the rail reserve.

Three locations were identified as potential or marginal habitat for the species. A tile survey for the species was completed during Stage 1 at the following locations:

- Calder Freeway Precinct (Keilor East) Investigation Area, two sites east and west of the bridge
- Tullamarine Freeway Precinct (Strathmore Heights) Investigation Area.

Following the Stage 1 assessment, an increase or change in investigation area due to design changes, extents for the Stage 2 ecological surveys resulted in the following additional locations being identified as containing suitable habitat for the species:

North of Beveridge:

- A derived grassland area at Marchbanks Road Overbridge (Broadford)
- A derived grassland patch within Track Slew Investigation Area G.

The two habitat locations mapped north of Beveridge have been excised from the project area and will not be impacted.

South of Beveridge:

- On the edges of the McIntyre Road Overbridge (Sunshine) Investigation Area bordering Solomon Heights Grassland/Maribyrnong River Edge biosite
- Calder Freeway Precinct (Keilor East) Investigation Area, at the northern extent near Steele Creek
- Barry Road Overbridge (Dallas) Investigation Area, where the investigation area borders the grassland biosite
- Hume Highway Overbridge (Craigieburn), at the northern end of the investigation area near Malcolm Creek

Stage 1 Targeted survey

Artificial shelter in the form of roof tiles were laid in grid formation at four sites (Table 16) which comprised suitable striped legless-lizard habitat, and for which there were recent records within relatively close proximity to the study sites (Appendix H).

All tile grids were installed on 7 September 2016 by WSP/PB (2016). Given that the area of potential habitat along the rail corridor is narrow and linear, the maximum number of tiles able to be installed at each site was 50. Some sites received less than 50 tiles due to narrow site dimension constraints. This is noted to be below the optimal tile grid layout and recommended 50 tiles per grid (DSEWPAC 2011).

Tiles were checked in the Stage 1 survey during the detailed ecological assessment on 19 December 2017. Table 16 provides a summary of findings of the survey.

Table 16 Striped legless lizard tile location description

Site	Number of tiles	Habitat description (WSP/PB 2016)	Current Assessment
Calder Freeway (West)	25	Predominately exotic vegetation. Thick infestations of Chilean needle-grass and Artichoke Thistle, along with planted vegetation. Closest recent record approximately 3.5 kilometres to the west (Keilor Downs).	No species were recorded using the tiles During Stage 1, it was determined that habitat and connectivity was poor. Tiles were checked once. However, no further visits were completed. This site is not considered habitat for the species.
Calder Freeway (East)	50	Cracking soils with some surface rock present within a narrow (~10m wide) rail corridor. Areas of highly modified remnant grassland present along with a suite of weeds. Closest recent record approximately 3.5 kilometres to the west (Keilor Downs).	No striped legless lizards were recorded. A garden skink was observed under a tile. During Stage 1, it was determined that habitat and connectivity was poor. Tiles were checked once. However, no further visits were completed. This site is not considered habitat for the species.
Tullamarine Freeway	50	Modified Chilean Needle-grass dominated grassland, with a patch of plains grassland dominated by Wallaby-grasses. Some sections inundated at the time of laying tiles and occupied by semi-aquatic vegetation. Recent nearby records (~1.5 km) to the south-west of the site. Moderate connectivity to other areas of suitable habitat in the region.	The tiles at this site were damaged by a slasher. All tiles were not suitable artificial shelter. No searches were able to be completed. Tiles recommended to be re-laid in June/July.

No striped legless lizard was found during the tile check, with only one reptile species, garden skink (*Lampropholis guichenoti*), recorded at the Calder Freeway site on the east tile grid. There was also no evidence of use of the tiles by striped legless lizard.

The current status of the tile survey from WSP/PB (2016) was not considered suitable to inform the presence of the species and inform the project impact. It is recommended that the survey be updated to reflect the current status of the project impact to identified habitat for Striped Legless Lizard.

5.2.7 Habitat

Woodland habitats

Woodland habitat has been observed at most regional Victorian sites, north of Beveridge. These are indicated in Appendix D as patches of mapped woodland type EVCs.

Woodland habitats provide the greatest area of habitat for fauna species within the assessed investigation areas. Woodland habitat is considered to have higher quality where there is good connectivity with other woodland patches over the landscape, as they provide habitat corridors through the fragmented landscape. Sites that provide woodland habitat as part of a wider corridor, include:

- Murray River Underbridge (Albury
- Beaconsfield Parade Overbridge (Glenrowan)
- Wangaratta Station (Wangaratta), along One Mile Creek
- Track Slew Investigation Areas E, G and H
- Seymour-Avenel Road Overbridge (Seymour)
- Hume Highway Precinct (Seymour)
- Hume Highway Precinct (Tallarook)
- Marchbanks Road Overbridge (Broadford)

These sites are generally located outside of regional town centres and are contiguous with other patches of woodland or forest habitats along road reserves, the rail reserve, or along drainage lines and nearby waterways. These sites are likely to provide habitat for fauna moving through the landscape, including birds and arboreal mammals; however, it is noted that the rail and associated bridge are potential barriers to movement, particularly for arboreal mammals. Table 5.5 provides a summary of the woodland habitat present at each of the sites.

Table 17 Description of woodland habitat at Investigation Areas

Site	Area (ha)	Habitat description
Marchbanks Road Overbridge (Broadford)	3.421 ha	The site consisted of moderate quality woodland habitat spread over five patches that are intersected by the road and rail line. Some of these patches contain a high number of large trees, predominately river red gums. The understorey was dominated by exotic grasses, mainly phalaris and large patches of blackberry.
Hume Highway Tallarook Precinct (Tallarook)	4.368 ha	The woodland habitat is predominately in three patches divided by the Hume Highway and the rail line. The vegetation in the rail reserve is contiguous with woodland habitat in adjacent road reserves. On the Tallarook side of the bridge, the habitat is contiguous with a large patch of habitat within a reserve around an oval. The habitat contains only occasional large trees, however, there is generally a native dominated shrubby understorey, with occasional logs and dense litter.
Track Slew Investigation Area D	0.302 ha	The habitat in this location is contiguous with that described above for Hume Highway Tallarook Precinct (Tallarook), particularly on the western side, adjacent to the vegetation surrounding the sports oval. However, vegetation is partially contained within a cutting and tree and tall shrub vegetation has been removed under the powerlines. Hence, less tree cover is present in these locations. There is also minimal logs and litter on the ground.
Track Slew Investigation Area E	6.872 ha	The woodland habitat extends along the rail reserve as two large linear strips of vegetation within an agricultural landscape This is located immediately south of the Goulburn River. The habitat consists of river red gum dominated woodland on a riverine/floodplain location. Several very large river red gums were present, including several with hollows. The understorey through this area is predominately weedy, consisting primarily of pasture grasses, with only few native species. There are also minimal logs, occurring only occasionally.

Site	Area (ha)	Habitat description
Seymour Avenel Road Overbridge (Seymour) Hume Highway Seymour Precinct (Seymour) Track Slew Investigation Area G Track Slew Investigation Area H	14.804 ha	The woodland in this location is considered to be of high quality to qualify as the EPBC Act listed GBGW. This community extends along the corridor between Seymour and Mangalore on both sides of the reserve, which also extends into the adjacent road reserves on the east and west. Although a two lane road and rail tracks are present, the combined road and rail reserves provide an approximately 100 m wide woodland corridor that extends through the landscape. On the west side, past maintenance for the (now redundant) powerlines resulted in removal of large trees and shrubs, however, there is high diversity in the understorey. On the east side, only a small amount of the community extends into the rail reserve, however, this habitat (primarily with the adjacent road reserve) provides good quality woodland habitat.
Beaconsfield Parade Overbridge (Glenrowan)	1.15 ha	At the western and eastern end of the investigation area, there are patches of woodland, with the patch at the eastern end, considered to be the EPBC Act listed WBYBBRGGW. This patch contains all three overstorey species including some large trees. The understorey is sparse and there is a high cover of leaf litter and twigs, with the occasional log. A drain also runs through the site, containing some semi-aquatic sedges and rushes. The woodland at the western end of the investigation area is of lower quality, with past management of (now redundant) powerline removing the tree layer in the rail reserve, except for the outside of the reserve. There are large trees in adjacent private land and road reserve. This site has some diversity of native understorey, however, there is high cover of high threat weeds, including blackberry and African lovegrass.
Wangaratta Precinct (Wangaratta)	1.026 ha	The investigation area is largely devoid of native vegetation as it is associated with the station. However, the western end of the investigation area crosses One Mile Creek. A reserve is present along the Creek, running north-south through Wangaratta. The reserve contains several large river red gums that occur along the waterway, with several on-line wetlands. The waterway corridor provides a habitat corridor through the town.
Murray River Underbridge (Albury)	1.501 ha	The investigation area is located adjacent to the Murray River. On the Victorian side a reserve extends along the bank upstream and downstream of the investigation area. There are several large river red gums within the site and in the surrounding area. Although the majority of the understorey is weedy, predominately phalaris and spear thistle, there are patches of native understorey. A marshy wetland is also present on the north side of the investigation area that extends into the rail reserve.

Regional Victorian sites, north of Beveridge, close to town centres often contain woodland habitat, but generally, these are more isolated, compared to the sites above. These include Short Street Overbridge (Broadford), Hamilton Street Overbridge (Broadford), Broadford Road Overbridge (Wandong), Wangaratta Precinct (Wangaratta) and Benalla Station Approach Road Overbridge (Benalla). These sites are likely to be used by more common fauna species typical of fragmented landscapes.

Grasslands

Grassland habitats found throughout the investigation areas were predominately in metropolitan areas and were generally of low quality. This was reflected in the low number of recorded patches of plains grassland EVC recorded.

The investigation areas with grassland habitats had often been used for maintenance access and storage of material, including ballast to stabilise the tracks, and old ballast stockpiles. They generally lacked important features, such as tussock cover, surface rocks and cracking clays. These areas were dominated by species that are not typically suitable habitat for threatened fauna, including phalaris, brown-top bent, kikuyu and herbaceous weeds such as blanket weed and wireweed.

Some scattered native grasslands contained a mainly native understory along with natural surface layers and rocks. Some of these patches were considered to be the EPBC Act-listed NTG. These locations include:

Sites north of Beveridge:

- Track Slew C, between the rail and Merri Creek

Sites south of Beveridge:

- On the edges of the rail reserve at McIntyre Road Overbridge (Sunshine), adjacent to the Solomon Heights/Maribyrnong River Edge biosite
- At the northern end of Hume Highway Overbridge (Craigieburn)
- A small patch at Keilor Park Drive Overbridge (Keilor East)
- At Barry Road Overbridge (Dallas), where the investigation area adjoins the grassland reserve

These locations are also considered to provide habitat for threatened fauna, notably striped legless lizard and golden sun moth, and where near waterways, growling grass frog. This is due to the presence of typical habitat features including suitable grass species (wallaby-grasses, spear-grasses and kangaroo grass), with inter-tussock spaces, potential for soil cracks and natural surface rock.

Two sites within the regional areas, north of Beveridge, Track Slew G and Marchbanks Road Overbridge (Broadford), contained an isolated area of derived grassland. Trees had been removed from these areas; however, a native grassy dominated understorey still persists, comprised of kangaroo grass and wallaby-grass. Although isolated, these habitats are considered to be provide habitat for golden sun moth and striped legless lizard, which have been recently recorded around the Broadford region.

Several exotic grasslands, dominated by stipoid grasses, particularly *Nassella* spp. are also known to provide habitat for threatened fauna, particularly golden sun moth, and occasionally, striped legless lizard. Larger patches of exotic grasslands that were considered to provide potential habitat include the following locations south of Beveridge:

- Calder Freeway Precinct (Keilor East), at the northern section of the investigation area near the Western Ring Road
- Tullamarine Freeway Precinct (Strathmore Heights)
- Several large patches along Track Slew A, particularly east of the Moonee Ponds Creek bridge
- At Barry Road Overbridge (Dallas), where the investigation area adjoins the grassland reserve.

Waterways

Only three named waterways intersect with the investigation areas. Each of these is described below.

Sunday Creek

A tributary to the Sunday Creek was present within the Short Street Overbridge (Broadford) Investigation Area (north of Beveridge), with Sunday Creek occurring immediately adjacent to the western end of the investigation area.

The tributary to Sunday Creek flows from south to north through the investigation area, with Sunday Creek being a tributary of the Goulburn River.

The waterway is ephemeral, flowing adjacent to a new residential area from which it receives stormwater runoff. The waterway has a shallow and narrow channel, with no flow at the time of assessment. It comprised a few small and stagnant pools, with dark colours and evidences of detergents or oils on top of the water.

As the waterway is ephemeral there was a high amount of vegetation both within the channel and along the bank. Within the channel there was a high cover of couch (*Cynodon dactylon*), with some clumps of slender knotweed (*Persercaria decipiens*). Along the banks there is a high cover of phalaris, with an overstorey of river red gums.

The waterway at Sunday Creek, approximately 20 m west of the investigation area, appeared to have been subject to some bank stability works. The vegetation around the rail bridge had been removed and the bank filled with rock. Within the rail reserve, there was a wide pool, however, the water was turbid, with no in stream vegetation or debris. However, further up and downstream, where no works have occurred, the waterway is narrower, with river red gum woodland occurring along the riparian zone.

The waterway includes a vegetated corridor through the residential areas of Broadford with some larger remnant patches, including immediately north of the investigation area, where a larger patch of grassy woodland is present. The habitat values along the creek within the investigation area are limited, compared to the vegetated areas outside the reserve, with the waterway diverted under the rail via a culvert and minimal canopy cover and trees. The waterway north and south of the investigation area, however, is likely to provide a reasonable habitat corridor through Broadford, predominately for birds.

One Mile Creek

One Mile Creek intersects with the Wangaratta Precinct (Wangaratta) Investigation Area (north of Beveridge). The creek flows in a north south direction through residential areas of Wangaratta and is located at the western end of the investigation area.

The One Mile Creek reserve includes a walking path and is utilised as a public reserve with a shared user path on the western side of the creek. On the eastern side of the creek, south of the bridge, the area contains a patch of native vegetation, with higher density of indigenous trees and shrubs. On the north of the bridge, on the eastern side of the waterway, the bank area above the channel contains less vegetation, generally consistent of exotic grasses with high river red gum leaf litter.

The waterway is a low order waterway, with a low-flow shallow channel and bank, and pools of still and sometimes stagnant water. The channel located within the investigation area included high cover of in-stream vegetation, dominated by slender knotweed and common reed (*Phragmites australis*), with some littler from surrounding river red gums, including leaves and branches. Branches and logs are common in the channel.

The banks on either side include fringing aquatic and semi-aquatic vegetation, mainly slender knotweed, with some water plantain (*Allisma plantago-aquatica*), with mainly exotic lawn grass on the western (walking path) side. On the eastern side, indigenous shrubs, some of which appear planted, dominant the area, with little ground cover vegetation, and high amounts of leaf litter.

The waterway almost entirely flows within the town of Wangaratta and is used as a recreation reserve. However, the waterway does contain several large river red gums and some large pools with good cover of in-stream and fringing vegetation. However, the riparian zone is of limited width (20-30 m) and is bordered by housing.

The waterway is linked to the larger Ovens River and is likely to provide suitable habitat for several wetland bird species, including egrets and herons. Further upstream various common frog species were heard, which are also likely to utilise the waterway habitat within the investigation area. However, as the

majority of the reserve is mown grass, above the channel, there is limited habitat availability other than large trees and the channel.

Murray River

The Murray River Bridge Investigation Area includes the Murray River. The Murray River, including the channel, bank and riparian vegetation up to the high-water mark, is located within New South Wales. The assessment therefore concentrates on the Victorian riparian vegetation and bank.

The waterway is likely to provide suitable habitat for a variety of fishes, including several nationally listed species, such as the Murray cod (*Maccullochella peelii*). The riparian vegetation will also likely provide habitat for several bird species, with the vegetation part of a larger patch of river red gum woodland along the river.

The Murray River is a highly significant landscape feature. The area at the top of the bank where the river intersects the investigation area includes a public reserve and walking path. To the north of the bridge the bank and area above the bank has been cleared of vegetation and provides public access to the waterway. The bank in this location is predominately exotic grass, kikuyu and paspalum, with the herbaceous weed cat's ear. One large river red gum is adjacent to the investigation area, north of the bridge.

To the south of the bridge, the bank is steeper and contains a denser cover of river red gums and exotic and native shrubs. The understorey is still predominately weedy, containing a dense cover of kikuyu, phalaris and paspalum.

6 Impact assessment

The following provides an assessment of the potential impacts to the recorded ecological values within the project areas. Impact assessment, legislative constraints and requirements for ecological values are based on impacts within the project area for Enhancement Sites and the defined impact area for Track Slews. These areas are indicated in Appendix A, Appendix D (for vegetation communities and threatened flora species) and Appendix H (for threatened species habitat).

Sections of the investigation areas that contain significant ecological values have been excised from the project areas, where possible, to minimise the environmental impact of the project. All habitat within the project areas has been assumed to be impacted as a conservative approach, however it is expected that during detailed design and construction opportunities will be identified to further minimise impacts.

6.1 PROJECT IMPACTS

The project will have potential impacts to native flora and fauna, including listed threatened species and communities primarily through the removal of vegetation.

Enhancement Sites

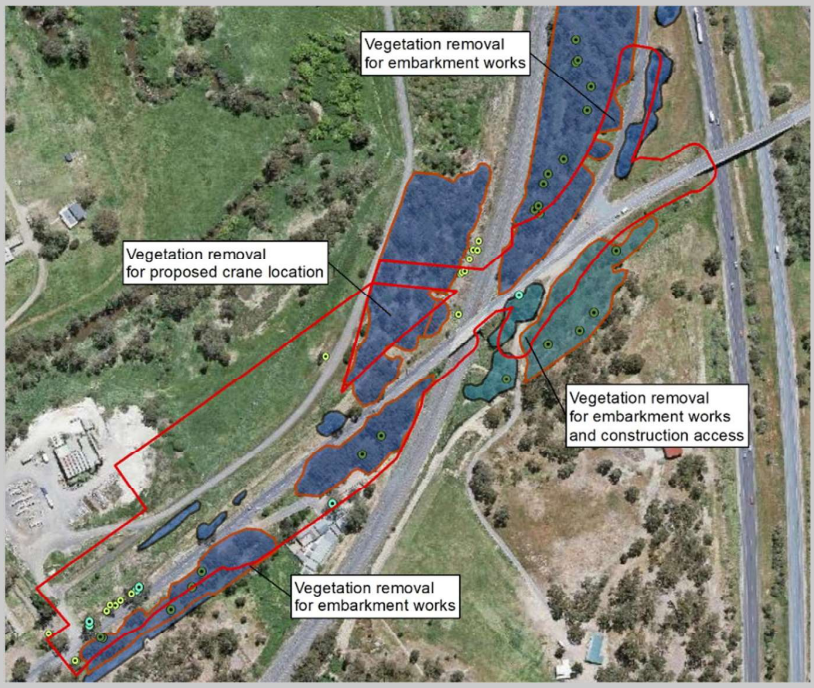
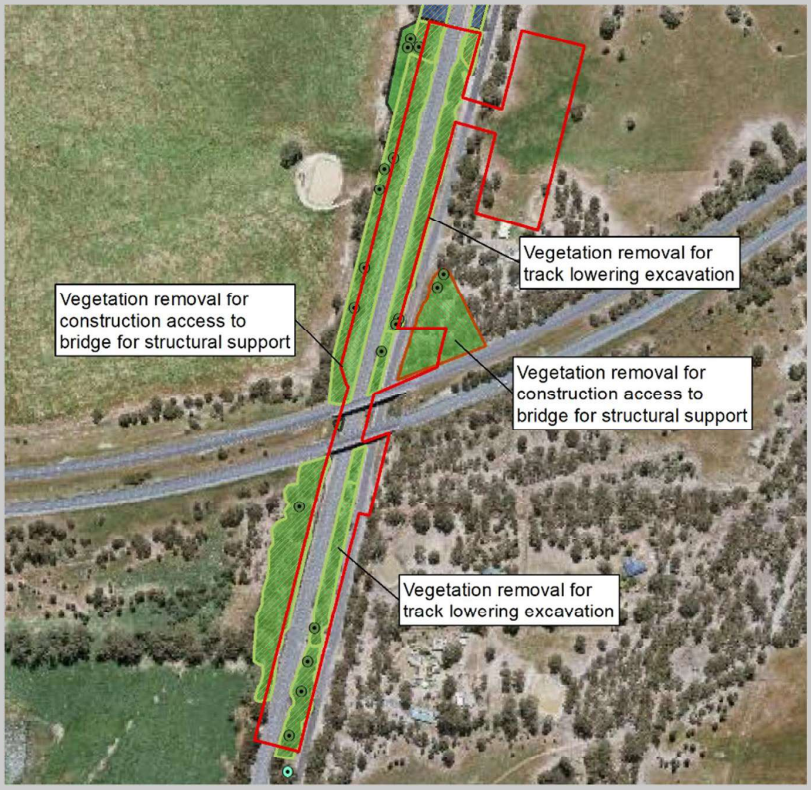
Impacts will vary between each project area and between the design solutions to achieve the required clearance. Most impacts will be associated with bridge replacements and track lowering sites; construction activities for these design solutions are provided in Section 1.2.1. Examples of a bridge replacement and track lowering is provided in Table 18 below.

Vegetation impacts associated with Track Slews to provide horizontal clearance will be minimal. For Track Slew E (south of Seymour), a waiver will be requested due to the minimal size of the slew. Additionally, for Track Slews D, H and I, all works will be completed via hi-rail and no vegetation removal will be required. Some vegetation removal will be required to allow for machinery to access the extents of the slew, however, all other works will be confined to the formation and access tracks.

Track Slew F, being located within the Seymour rail yards, does not contain any native vegetation or habitat, and therefore, no impacts will occur.

The greatest impact associated with the Track Slew works is Track Slew C, located at Wallan (north of Seymour) which requires the reconstruction of the formation to provide the required horizontal clearance. These works have been sited to widen the formation to the west, toward the V/Line track and Wallan Station. This is due to the NTG and habitat for threatened species identified in the east side rail reserve.

Table 18 Typical impact for design solutions

Design Solution	Example of impact
BRIDGE REPLACEMENT	
Bridge replacement will require vegetation removal along the road alignment for: • Re-alignment of bridge (if no road closure is planned) or replace existing bridge (if bridge closure is planned) • Construction of new batters, embankments or retaining walls (vegetation loss depending on the height and width of the batter or retaining wall) Additional vegetation removal may be required for construction access, laydown and site compounds	
TRACK LOWER	
Track lowering will require vegetation removal along the existing rail line, and potentially adjacent land, for: • Lowering track to the design depth and to allow for track works and drainage construction • Relocation of services and utilities that currently exist under the track • Installation of drainage solution (either open channel or pipes) to a suitable outlet. Additional vegetation removal may be required for construction access, laydown and site compounds	

Signal gantries have potential for small and isolated impacts to native vegetation and habitat, predominately relating to access and footings for new gantry structures.

Overall the loss of vegetation and habitat for biodiversity will result in:

- Loss in extent of vegetation and habitat
- Potential fragmentation and isolation of habitats
- Loss of large trees that provide important nesting, roosting and feeding resources.

The impact for biodiversity values is further assessed below for threatened ecological communities, flora and fauna and native vegetation, based on the following applicable legislation and policies:

- Matters of national environmental significance (listed under the EPBC Act)
- EE Act, including assessment of impacts to FFG Act species as an Environmental Effects Statement (EES) referral trigger
- Guidelines for the removal, destruction and lopping of native vegetation (under the P&E Act).

6.2 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

6.2.1 Significant impact assessment

The assessment of impacts to MNES was based on the defined project areas determined through an assessment against the significant impact guidelines 1.1 policy document (DoE 2013). Where relevant, species specific impact and referral guidelines, such as the *Significant impact guidelines for the critically endangered golden sun moth* (DEWHA 2009), were also considered in the impact assessment.

In consideration of the recorded habitat and potential habitat recorded within the project areas, the impact guidelines for either vulnerable or endangered and critically endangered species and community conservation listing are discussed below. Where species specific referral or impact guidelines exist, these species are discussed separately.

Woodland bird species habitat has been identified as present within several project areas. The habitat was identified as primarily functioning as a movement corridor through the landscape, as these species are generally mobile and moving between larger woodland areas that can sustain populations of the species.

These habitat areas have potential to support species such as the critically endangered swift parrot and regent honeyeater and the vulnerable painted honeyeater. However, the use of this habitat is likely to be sporadic and occasional and therefore, the impacts are unlikely to be relevant to ‘a population’, which is the criteria for a significant impact. Hence, impacts are not likely to be significant for these species.

Critically endangered and endangered communities

The follow ecological matters of national environmental significance (MNES) have been recorded within the project areas:

- 3.543 ha of GBGW has been recorded within the project areas of Seymour-Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour), north of Beveridge. This vegetation community is EPBC listed and as such impact from construction may be considered significant.
- 0.392 ha of NTG was recorded within the project areas at McIntyre Road Overbridge (Sunshine) and Hume Highway Overbridge (Craigieburn), south of Beveridge.

Refer to Table 19 for details of the significant impact assessment for the threatened ecological communities, based on the significant impact guidelines for critically endangered and endangered ecological communities (DoE 2013).

Table 19 Significant impact guidelines and assessment for TECs

Potential impact criteria (DoEE 2013)	Impact assessment – GBGW	Impact assessment – NTG	Impact assessment – WBYBBRGGW
Reduce the extent of an ecological community	A total of 17.675 ha of the community has been recorded in the investigation area. Through re-design and avoiding the community where possible, an impact of 3.543 ha within the project area is predicted. Impacts to this community could not be avoided at the following locations: • Seymour-Avenel Road Overbridge (Seymour) • Hume Highway Seymour Precinct (Seymour) Based on modelled extent of the community of 343,641 ha remaining in Victoria (TSSC 2010), this impact would be a reduction in extent by 0.001%. Although the reduction in extent represents a small portion of the remaining community in Victoria, the loss in hectares is considered a potentially significant reduction in extent.	A total of 0.849 ha of the community has been recorded in six investigation areas. Several areas have since been identified as no-go zones for the project, which has limited the current design and construction impacts to 0.392 ha within the project area. Impacts are predicted at the following locations, which are noted to be south of Beveridge: • Hume Highway Overbridge (Craigieburn) • McIntyre Road Overbridge (Sunshine) The impact is likely to be considered a reduction in extent of the community, which is considered to comprise 0.007% of the remaining community (TSSC 2008) and is a potentially significant impact.	The current design and resultant reduction in the project area for Beaconsfield Parade Overbridge (Glenrowan) would result in no impact to the community, consequently no further assessment of impact has been undertaken. Patches BP_HZ02 and BP_HZ03 must be identified as no-go zones for construction.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	The current design and construction impacts are likely to remove sections of vegetation that abut the road bridge at Seymour-Avenel Road Overbridge (Seymour) and the rail line at Hume Highway Seymour Precinct (Seymour) (see Appendix D). The two sites are part of the same patch in the landscape and the separate removal within the overall patch is expected to increase the existing fragmentation of the community between the rail and road. This impact is considered significant to the patch of the community, and maybe considered significant to the remaining extent of the community.	Patches recorded on site are small and isolated, or impacts are proposed to the edge of the community, which extends into adjacent areas (that are not being impacted). Impacts are not expected to fragment or increase fragmentation of the community.	
Adversely affect habitat critical to the survival of an ecological community	The loss of sections of the community will also result in the loss of the habitat required to support the community	Generally, the recorded patches are small and isolated remnants, and is not considered to be critical to the survival of the community.	

Potential impact criteria (DoEE 2013)	Impact assessment – GBGW	Impact assessment – NTG	Impact assessment – WBYBBRGGW
	in areas at Seymour-Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour).		
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	Abiotic factors are not predicted to be impacted by the design or works.	Aside from removal of some the community and reduction in extent, indirect impacts are not expected to adjacent grasslands or retained grasslands.	
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	The management of the community is not expected to result in a change in species composition under the current design.	Aside from removal of the community extent, no change in management or works will impact any grasslands.	
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: • assisting invasive species, that are harmful to the listed ecological community, to become established, or • causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or • interfere with the recovery of an ecological community	Potential impacts such as the inadvertent assistance of invasive species, pollutants and sediment mobilisation associated with construction works will be managed using industry best practice methods.	There is potential for works to import weeds into the grassland or the immediate vicinity. However, it is noted that the grasslands are already surrounded by several high threat weeds. It is recommended that environmental controls, including weed control, be implemented during works. No other impacts are expected from the project.	

In consideration of the significant impact guidelines and the above assessment it is likely that the impact to the recorded NTG and GBGW communities within the defined project areas (Appendix D), would be considered significant. This is due to the expected reduction in extent and fragmentation, particularly at Seymour-Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour) for GBGW. It is therefore recommended the project be referred to the Commonwealth Environment Minister.

The modified design option at Beaconsfield Parade Overbridge (Glenrowan) enables avoidance of all patches of WBYBBRGGW. As such, this TEC would not be impacted by the project.

6.2.2 Critically endangered and endangered species

The significant impact assessment for critically endangered and endangered species is considered below. In completing the assessment, consideration needs to be given to the term 'population'. The policy provides guidance on the definition (DoE 2013):

> *A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:*

- a geographically distinct regional population, or collection of local populations, or
- a population, or collection of local populations, that occurs within a particular bioregion.

Three species, the matted flax-lily, swift parrot and regent honeyeater have been considered below for a significant impact assessment (Table 20).

The defined project areas for sites associated with other critically endangered species have been avoided by reducing project area extents that exclude known threatened flora and fauna habitat.

Spiny rice-flower was recorded outside the project area during the targeted assessment at McIntyre Road Overbridge (Sunshine) (south of Beveridge). However, the project area was extended into adjacent private land following the field surveys, which has not been subject to a targeted survey. This area is potential habitat for spiny rice-flower and additional surveys will need to be completed to determine presence and impact within the unassessed portion of the project area. A significant impact assessment will need to be completed if EPBC Act-listed species are found in the expanded project area.

Table 20 Significant impact assessment for critically endangered and endangered species

Significant impact criteria	Matted flax-lily	Swift parrot and regent honeyeater
Lead to a long-term decrease in the size of a population	Based on the surveys completed to date, there is potential presence of the species at Hume Highway Overbridge (Craigieburn), located south of Beveridge. No populations were recorded during the assessment, however there is potential for a small population to be present. This significant impact assessment may change based on the results of the targeted survey. Potential habitat at Track Slew Investigation Area C, north of Beveridge, will be protected as a 'no-go zone'.	There is potential habitat for these listed species, corresponding with the woodland bird habitat. The habitat is likely to be limited to occasional foraging and dispersal habitat for these species. The impacts are unlikely to result in long-term decline to each species, due to the localised impacts occurring in areas that are not considered to be important of any population for the species foraging and breeding.
Reduce the area of occupancy of the species	The patches of habitat are small and discrete. The reduction in area of occupancy at either habitat location is not likely to be significant.	The loss of woodland habitat is localised to sections of dispersal habitat. It is unlikely this habitat

Significant impact criteria	Matted flax-lily	Swift parrot and regent honeyeater
		would be occupied by either species.
Fragment an existing population into two or more populations	The recorded habitat is small and isolated occurring adjacent to an existing rail corridor. Fragmentation is unlikely.	It is not considered that a population of either species is present. Both species are able to move through the landscape and extent of loss is not expected to fragment or prevent individuals moving between breeding and foraging habitat.
Adversely affect habitat critical to the survival of a species	The patches of habitat are small and discrete. The impacts at either habitat locations are not likely to be significant.	It is not considered that the habitat present or impacts will adversely affect critical habitat.
Disrupt the breeding cycle of a population	Aside from removal of potential individuals, the impact is not likely to impact the breeding cycle of a population.	These impacts are unlikely to impact the species breeding sites or populations.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Aside from removal of potential individuals, this impact is not likely.	This impact is unlikely as impacts are unlikely to prevent dispersal.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	The surrounding areas are high in weed cover. It is unlikely that the works will result in an increase in weeds within the habitat. However, weed hygiene controls should be employed during works.	Hygiene controls should be employed to mitigate this potential impact. This impact is unlikely.
Introduce disease that may cause the species to decline	Hygiene controls should be employed to mitigate this potential impact. This impact is unlikely.	Hygiene controls should be employed to mitigate this potential impact. This impact is unlikely.
Interfere with the recovery of the species.	As potential impacts are likely to only small number of individuals or habitat, this impact is unlikely.	As potential impacts are limited to potential dispersal habitat and unlikely to interfere with the species recovery.

There is potential for significant impacts to the matted flax-lily, if the species is present at the identified habitat in the Hume Highway Overbridge (Craigieburn) (south of Beveridge). Further targeted survey is recommended to determine the presence of any individuals at the site to confirm the impact for the species (if this site is developed subject to a decision on the intermodal terminal). The potential habitat at Track Slew Investigation Area C (north of Beveridge), will be protected as a no-go zone during works. As such, there is unlikely to be a significant impact on the species at this site.

The impacts to the critically endangered swift parrot and regent honeyeater are unlikely to be considered significant. Although the species use of the site has not been confirmed, it is most likely that the habitat is used as a habitat corridor to move through the landscape. Both species have the ability to move through a fragmented landscape, particularly swift parrot, however, dispersal and movement through the landscape and provision of foraging habitat is important for the species. The project related impacts are considered to be a minor portion of the overall habitat corridor in the landscape; therefore the impacts are unlikely to be considered significant.

6.2.3 Vulnerable species

The significant impact assessment for vulnerable species is considered below. In completing the assessment, consideration needs to be given to the term 'important population'. The policy provides guidance on the definition (DoE 2013):

An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source population, either for breeding or dispersal
- a population that is necessary for maintaining genetic diversity, and/or
- a population that is near the edge of the species range

Two vulnerable flora species, crimson spider-orchid and Euroa guinea-flower, are considered to have potential to occur within the project area north of Beveridge. The assessment against significant impacts based on current survey results, is provided below (Table 21).

One EPBC Act-listed vulnerable fauna species, painted honeyeater, has potential habitat associated with mapped woodland bird habitat at Seymour-Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour), north of Beveridge. Potential habitat within woodland at Beaconsfield Parade Overbridge (Glenrowan) has been avoided, and therefore the species is not expected to be impacted at this location.

Two other flora species, swamp fireweed and swamp everlasting, listed as vulnerable under the EPBC Act, have potential habitat recorded in the investigation area at Track Slew C (north of Beveridge). However, the potential habitat locations have been identified as a no-go zone for the works at Track Slew C and will be avoided. Therefore, no significant impact to the species will occur.

Table 21 Significant impact assessment for vulnerable species

Significant impact criteria (DoE 2013)	Crimson spider-orchid	Euroa guinea-flower	Painted honeyeater
Lead to a long-term decrease in the size of an important population of a species	There is potential presence of the species at Hume Highway Seymour Precinct (Seymour). No populations were recorded during the assessment, however there is potential for individuals to be present. This is unlikely to be considered an important population.	There is potential habitat for the species at Hume Highway Seymour and Seymour-Avenel Road Overbridge (Seymour). No individuals were recorded, and it is unlikely that an important population exists.	There is potential habitat for these listed species, corresponding with the woodland bird habitat. The habitat is likely to be limited to occasional foraging and dispersal habitat for these species. It is unlikely that an important population is present that will be impacted.
Reduce the area of occupancy of an important population	The patches of habitat are isolated and unlikely to support an important population. This impact is unlikely.	The project areas are unlikely to support an important population. This impact is unlikely.	The loss of woodland habitat is localised to sections of dispersal habitat. It is unlikely this habitat would be occupied by an

Significant impact criteria (DoE 2013)	Crimson spider-orchid	Euroa guinea-flower	Painted honeyeater
			important population of painted honeyeater.
Fragment an existing important population into two or more populations	The recorded habitat is isolated, occurring adjacent to an existing rail corridor. This impact is unlikely.	The recorded habitat occurs within an existing rail corridor. This impact is unlikely.	The loss of woodland habitat is localised to sections of dispersal habitat. It is unlikely potential habitat impacts would fragment an existing population.
Adversely affect habitat critical to the survival of a species	These small isolated areas are unlikely to be critical to the survival of the species. This impact is unlikely.	These small isolated areas are unlikely to be critical to the survival of the species. This impact is unlikely.	It is not considered that the habitat present or impacts will adversely affect critical habitat.
Disrupt the breeding cycle of an important population	This impact is unlikely, as an important population is unlikely.	This impact is unlikely, as an important population is unlikely.	This impact is unlikely, as an important population is unlikely.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Neither the availability nor quality of habitat will be altered to the extent that the species would be likely to decline. This impact is unlikely.	Neither the availability nor quality of habitat will be altered to the extent that the species would be likely to decline. This impact is unlikely.	Neither the availability nor quality of habitat will be altered to the extent that the species would be likely to decline. This impact is unlikely.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The surrounding areas are high in weed cover. With standard weed hygiene controls this impact is unlikely.	Hygiene controls should be employed to mitigate this potential impact. This impact is unlikely.	Hygiene controls should be employed to mitigate this potential impact. This impact is unlikely.
Introduce disease that may cause the species to decline	With standard disease hygiene controls this impact is unlikely.	Hygiene controls should be employed to mitigate this potential impact. This impact is unlikely.	Hygiene controls should be employed to mitigate this potential impact. This impact is unlikely.
Interfere substantially with the recovery of the species.	These small isolated areas are unlikely to be of importance to the recovery of the species. This impact is unlikely.	These small isolated areas are unlikely to be of importance to the recovery of the species. This impact is unlikely.	The habitat is potential dispersal habitat, which loss of will not likely interfere with the recovery of the species.

Some habitat for the Euroa guinea-flower has been recorded within and adjacent to the project areas north of Seymour. The majority of higher quality habitat observed outside of the project areas for Track Slews G and I that will not be impacted by work. Where impacts are likely, the species has not been recorded previously. It is therefore unlikely that an important population for the species exists that would trigger a significant impact.

6.2.4 Golden sun moth

The significant impact guidelines for golden sun moth considers there is a possibility of a significant impact on the species if an action may lead to the loss, degradation or fragmentation of golden sun moth habitat at sites south of Beveridge including, but not limited to, the following impact thresholds:

- Clearing of grassland or grassy woodland, including soil cultivation
- Modification of habitat, including changes to shading, hydrology, wind patterns or species composition
- Management practices, including changes in fire regime, slashing, mowing, and increases or decreases in grazing intensity
- Weed introduction
- Application of chemicals, such as herbicides and fertilisers.

Under the significant impact guidelines for the golden sun moth, the size and connectivity of suitable habitat are key indicators of what constitutes a significant impact (DEWHA 2009). The guidelines and current survey findings are summarised in Table 22.

Table 22 Significant impact guidelines and current survey findings for golden sun moth

Ecological impact	Impact threshold	Notes from guidelines	Current survey findings
Large or contiguous habitat area (>10 ha)	Habitat loss, degradation or fragmentation >0.5 ha	The area of habitat is a similar or connected area within which the golden sun moth is found during surveys or known from records. The function of the area may include feeding, breeding, dispersal.	Not applicable. All potential habitat areas recorded are less than 10 ha
Small or fragmented habitat area (<10 ha)	Any habitat loss, degradation or fragmentation	Small areas of habitat are more likely to suffer significant impacts from loss, degradation and fragmentation than larger areas. The limited dispersal ability of the moth means habitat areas separated by >200 m are effectively isolated and should be considered separate habitat areas. Extremely small, isolated and degraded habitat patches (e.g. <0.25 ha) may support populations of golden sun moth but are unlikely to contribute to the overall ecological health of the species.	Tullamarine Freeway (targeted survey location) The identified potential sites are less degraded by unsuitable weedy grasses and herbs than the surrounding area. Sites 1 and 2 are regularly slashed and inter-tussock spaces are covered by a dense layer of organic litter comprised of cut grass which renders the habitat less suitable. Site 1 (0.42 ha) – see above description Site 2 (0.27 ha) is narrow, subject to shading, is long and rank grass, has a dense layer of organic litter and is dominated by exotic spear-grasses which decrease the suitability of the potential habitat. Potential habitat locations (no targeted surveys conducted) There is potential for habitat that may contain populations of the species to be impacted. This is

Ecological impact	Impact threshold	Notes from guidelines	Current survey findings
			more likely to occur at Barry Road Overbridge (Dallas), where several records are present in an adjacent biosite. Impacts to the habitat at Barry Road Overbridge (Dallas) are potentially a significant impact. There is reduced potential at the other locations, which are more isolated. Many of these areas are considered to be small and isolated (<0.25 ha), which as noted in the policy, does not contribute to the overall ecological health of the species. Impacts to these small areas are not likely to be significant.
Habitat connectivity	Fragmentation of a population due to the introduction of a barrier to dispersal	Barriers to dispersal include breaks in habitat of >200 m, structures that prohibit movement.	The recorded potential habitat has poor existing connectivity. Barriers to dispersal currently exist in the form of the existing operational rail tracks and major road overpasses. Surrounding areas are highly developed for residential housing and industrial uses and do not represent habitat for the moth. Potential habitat areas are located on the edges of larger potential habitat areas or inn areas that are largely isolated. Therefore, this impact is unlikely.

During the targeted survey for the golden sun moth in within the Tullamarine Freeway Precinct (Strathmore Heights) Investigation Area no individuals were observed. The survey results suggest that the species is absent from the site.

Other potential habitat areas recorded in the project areas have not been subject to targeted surveys. However these patches are considered too small (<0.25 ha) and isolated, and therefore are unlikely to contribute to the overall health of the species (DEWHA 2009). These include McIntyre Road Overbridge (Sunshine), Keilor Park Drive Overbridge (Keilor East) and Hume Highway Overbridge (Craigieburn) south of Beveridge, and Track Slew G and Marchbanks Road Overbridge (Broadford) north of Beveridge. Additionally, these areas are also to be considered to be low quality habitat. Due to the small size and low quality of the habitat the project is not considered to have a significant impact to the species at these locations.

The habitat at Barry Road Overbridge (Dallas), south of Beveridge, is considered low quality grassland habitat, consisting mainly of exotic grasses, including Chilean needle-grass. However, as the species is known to use Chilean needle-grass and the habitat is located immediately adjacent to higher quality habitat with previous records, the impact to this habitat is potentially significant as a loss of a small and fragmented habitat area. If sites south of Beveridge are constructed, further targeted surveys are recommended to confirm the presence of the species and, if necessary, complete a revised impact assessment.

6.2.5 Striped legless lizard

All potential habitat for striped legless lizard has been identified south of Beveridge. As limited targeted survey has occurred and there are potential impacts to habitat that is considered the EPBC Act-listed community NTG, further assessment may be required if the sites south of Beveridge are constructed.

The following policy (DSEWPAC 2011) considerations should be taken into account:

> *The following factors need to be considered in determining whether a site is not likely to support an important population under the provisions of the EPBC Act:*

- Sites less than 0.5 hectares
- Small isolated areas of habitat which are currently under pressure or are likely to experience long-term pressures (for example sites located within urban settings, such as adjacent to factories or in residential subdivisions).
- Small sites which support marginal or low quality habitat (for example dominated by high threat weeds).

The majority of grassland patches recorded within the project areas, including those considered to be of NTG quality, are less than 0.5 ha in size. The habitat available within the project areas are generally small and isolated.

However, sites such as Barry Road Overbridge (Dallas), Hume Highway Overbridge (Craigieburn) and McIntyre Road Overbridge (Sunshine) have large areas of potential habitat adjacent and may therefore contain an important population. The habitat within Tullamarine Freeway Precinct (Strathmore Heights) is less likely to contain an important population as the site is considered to be isolated (bordered by rail, roads and factories) and of low quality.

Important populations are considered when assessing against significant impacts on a vulnerable species. Under the referral guidelines for the species (DSEWPAC 2011), an important population of striped legless lizard is one that meets at least one of the following:

- key source population, either for breeding or dispersal
- a population that is necessary for maintaining genetic diversity, and/or
- a population that is near the edge of the species range.

The presence of a population will need to be determined through survey at the following sites south of Beveridge that contain potential habitat should these sites be constructed:

- McIntyre Road Overbridge (Sunshine) bordering Solomon Heights Grassland/Maribyrnong River Edge biosite
- Tullamarine Freeway Precinct (Strathmore Heights) (replacing damaged tile grid)
- Barry Road Overbridge (Dallas), where impacts are proposed in the grassland biosite south of the road
- Hume Highway Overbridge (Craigieburn), near Malcolm Creek.

An assessment of the significant impact has been made below (Table 23), assuming presence of the species, until such time as the presence or absence can be confirmed.

Table 23 Significant impact assessment for striped legless lizard

Significant impact criteria (DoE 2013)	Impact assessment
Lead to a long-term decrease in the size of an important population of a species	Habitat present in the project areas are generally small, less than 0.5 ha and an important population is unlikely to be present. Important populations may be present at sites were the habitat is contiguous with large habitat in adjacent land. Impacts to these areas, McIntyre Road (Sunshine), Barry Road Overbridge (Dallas) and Hume Highway Overbridge (Craigieburn), may result in a significant impact.
Reduce the area of occupancy of an important population	As noted above, only three sites would be considered to have potentially important populations. There is potential for occupancy to be reduced through impacts, which could be significant.
Fragment an existing important population into two or more populations	As the habitat is located along an active rail line, these works are not proposing to fragment populations.
Adversely affect habitat critical to the survival of a species	No additional impacts, other than direct removal of habitat, would occur that is critical to the species survival.
Disrupt the breeding cycle of an important population	As the habitat potentially impacted is likely to be on the edge of an important population, if present, impacts would unlikely affect the breeding cycle.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No additional impacts, other than direct removal of habitat, would occur that is critical to the species survival.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The implementation of standard environmental management measures, including pathogen, pest and weed management will mitigate any potential impacts.
Introduce disease that may cause the species to decline	The implementation of standard environmental management measures, including pathogen, pest and weed management will mitigate any potential impacts.
Interfere substantially with the recovery of the species.	Based on the existing habitat quality and the location and nature of the proposed works, they are unlikely to interfere with the recovery of the species.

Further targeted survey work would be required to determine whether the species is present within the project areas that have potential to be part of a wider and important population and the significance of any potential habitat, including at McIntyre Road Overbridge (Sunshine), Barry Road Overbridge (Dallas) and Hume Highway Overbridge (Craigieburn).

6.2.6 Growling grass frog

The significant impact assessment for the species considers the species significant impact guidelines (DEWHA 2009), in addition to the overall guidance on significant impacts (DoE 2013). All potential impacts to habitat at sites north of Beveridge have been avoided. If sites south of Beveridge are constructed further assessment may be required.

The significant impact thresholds provided in DEWHA (2009) and assessment in relation to the current project is provided in Table 24. The impact assessment for the current project, in accordance with the policy (DEWHA 2009) needs to consider the ecology of the species and the definition of an important population. DEWHA (2009) provide the following definition of an important population:

Much of the habitat for the growling grass frog has been isolated or fragmented, restricting the opportunity for important population processes such dispersal and colonisation. As such, any viable population is considered to be an important population for the persistence and recovery of the growling grass frog. For this species, a viable population is one which is not isolated from other populations or water bodies, such that it has the opportunity to interact with other nearby populations or has the ability to establish new populations when water bodies fill and become available. Interaction with nearby populations and colonisation of newly available water bodies occurs via the dispersal of individual frogs across suitable movement habitat.

However, targeted surveys have not been able to be completed for the species. Therefore, the current assessment is based on the assumed presence of the species and consideration of the 'connectivity' of individuals with other known populations and habitat corridors. Further surveys will be required to confirm the significance of the impact to the species, including a determination of an important population.

Table 24 Significant impact assessment for growling grass frog

Ecological impact	Impact threshold	Impact assessment
Habitat degradation in an area supporting an important population	Permanent removal or degradation of terrestrial habitat (for example between ponds, drainage lines or other temporary/permanent habitat) within 200 metres of a water body in temperate regions, or 350 metres of a water body in semi-arid regions, that results in the loss of dispersal or overwintering opportunities for an important population. Alteration of aquatic vegetation diversity or structure that leads to a decrease in habitat quality. Alteration to wetland hydrology, diversity and structure (for example any changes to timing, duration or frequency of flood events) that leads to a decrease in habitat quality. Introduction of predatory fish and/or disease agents.	<u>Merri Creek</u> Impacts to potential habitat identified at Track Slew Investigation Area C, Wallan, have been avoided as the habitat has been identified as a no-go zone during construction. There are potential impacts to terrestrial habitat at Hume Highway Overbridge (Craigieburn). The habitat is close to Malcolm Creek, which flows into the Merri Creek approximately 600 m downstream. The Merri Creek is a known habitat corridor for the species and provides individuals with connectivity for this important meta-population. There is potential for some terrestrial habitat degradation at Hume Highway Overbridge (Craigieburn). Further surveys would be required to determine if the population along Merri Creek extends into Malcolm Creek. <u>Steele Creek</u> Terrestrial habitat for the species was identified at Calder Freeway, immediately adjacent to Steele Creek and an adjacent wetland. No aquatic habitat is predicted to be impacted. Several records are nearby, although these are generally associated with Maribyrnong River and Moonee Ponds Creek. Due to low number of records and isolated locations near Freeways and rail reserve, it is likely that Steele Creek at this location does not contain an important population and a significant impact is unlikely. However, further surveys are recommended to determine the presence of the species.

Ecological impact	Impact threshold	Impact assessment
Isolation and fragmentation of populations	Net reduction in the number and/or diversity of water bodies available to an important population. Removal or alteration of available terrestrial or aquatic habitat corridors (including alteration of connectivity during flood events). Construction of physical barriers to movement between water bodies, such as roads or buildings.	The habitat present that is being assessed for significant impacts to the species, is at Hume Highway Overbridge (Craigieburn) and Calder Freeway Precinct (Keilor East). These are considered to be on the edges of potential important populations. The removal of terrestrial habitat at Hume Highway Overbridge (Craigieburn) and Calder Freeway Precinct (Keilor East) is not likely to be a barrier to movement or further isolate or fragment a population, if present, as there is other nearby aquatic habitat available for dispersal.

The meta-population present at the Merri Creek is a known important population for the species. As the impact guidelines note habitat degradation, including terrestrial habitat surrounding water bodies, as being significant, impacts to habitat at Hume Highway Overbridge (Craigieburn) (south of Beveridge) maybe considered significant if the area is found to be part of the meta-population along the Merri Creek. Further targeted surveys would be required along Malcolm Creek to confirm the presence of the species if the sites south of Beveridge are constructed.

6.3 ENVIRONMENT EFFECTS ACT 1978

The following provides an assessment against the *Ministerial guidelines for assessment environmental effects under the Environment Effects Act 1978* (DSE 2006) to determine whether the project should be referred to the Minister for Planning, who will then determine whether an Environment Effects Statement (EES) is required. The following is relevant to the ecological triggers included in the Ministerial guidelines (DSE 2006).

6.3.1 Ecological referral criteria

Guidelines to determine whether a referral to the Minister is required include the following individual criteria relevant to ecological values in the Project Areas (DSE 2006):

- potential clearing of 10 ha or more of native vegetation from an area that is an endangered EVC or is of very high conservation significance
- potential long-term loss of a significant proportion (1 to 5 per cent) of known remaining habitat or population of a threatened species within Victoria.

Other individual referral criteria are contained within the guidelines that are not considered relevant to an ecological assessment, such as greenhouse gas emissions, and this report makes no assessment against these triggers.

Additional referral criteria are present in the referral guidelines, where a combination of impact criteria may require a referral. Relevant criteria to the projects' potential ecological impacts include:

- potential clearing of 10 ha or more of native vegetation
- matters listed under the FFG Act:
  - potential loss of a significant area of a listed ecological community; or
  - potential loss of genetically important population of and endangered or threatened species, including the loss or fragmentation of habitats; or

- potential loss of critical habitat; or
- potential significant effects on habitat values of a wetland supporting migratory bird species.

6.3.2 Loss of native vegetation

The individual referral trigger of 'potential clearing of 10 ha or more of native vegetation from an area that is an endangered EVC or is of very high conservation significance' has not specifically been met for the Tottenham to Albury (or T2A – Stage 1) component of the project. However, it is noted that the impact is close to the 10 ha amount and a whole-of-project assessment that includes impacts from overhead lines must be considered.

From the habitat hectare assessment, the potential impacts (in area) that may occur for EVCs within the project areas are detailed in Section 4.3.4. Following ecological assessments, the project has re-considered options to minimise and avoid impacts to significant ecological values, in particular the recorded extensive areas of nationally and Victorian listed TECs. This impact reduction has occurred at sites that were found to have significant vegetation and habitat, notably Barry Road Overbridge (Dallas) and Beaconsfield Parade Overbridge (Glenrowan).

Additionally, designs and proposed construction methodologies at Seymour-Avenel Road Overbridge (Seymour) and Marchbanks Road Overbridge (Broadford), have significantly altered the project boundaries to reduce the vegetation impacts. Further consultation was also completed with the designers and construction planners to identify where TECs and potential habitat for threatened flora and fauna could be identified as no-go zones. The proposed impact to EVCs for the project is presented in Table 25.

Table 25 Potential impacts to EVCs in the project areas

Bioregional conservation significance	Estimated impact – north and south of Beveridge	Estimate impact south of Beveridge	Estimated impact north of Beveridge
Endangered	9.123 ha.	1.092 ha	8.031 ha
Vulnerable	4.79 ha	0.00 ha	4.79 ha
Total	13.913 ha.	1.092 ha	12.821 ha

6.3.3 Impacts to matters listed under the *Flora and Fauna Guarantee Act 1988*

Additional referral triggers include impacts to matters listed under the FFG Act. Three FFG Act-listed items, buloke, VTWBC and Western (basalt) plains grassland community have been recorded within the project areas. Targeted surveys for threatened flora species did not identify any further threatened flora species in the project area (KBR 2020b).

Potential habitat has also been identified for several other fauna species, including barking owl, brush-tailed phascogale and squirrel glider.

As per the Ministerial Guidelines (DSE 2006) the referral triggers to these matters include significant impacts to a population or critical habitat. Minor impacts, to a small number of individuals or small and discrete areas of non-critical habitat, are not considered to meet the EES referral trigger.

Threatened ecological communities

The predicted impact on the listed ecological communities is provided in Table 26.

Table 26 Potential impacts for FFG Act listed threatened ecological communities

FFG Act listed matters	Location (north or south of Beveridge)	Total area recorded (ha)	Estimated impact – Project Area (ha)	Estimated impact
VTWBC	North	35.122 ha	7.501 ha	Although there are extensive patches of woodland scattered throughout Victoria, this amount may be considered a significant area of the TEC and should be considered in the combination referral triggers.
Western (basalt) plains grassland community	South	0.849 ha	0.392 ha	This proposed impact to the community is relatively minor and not considered to meet the EE Act referral triggers.

Victorian temperate woodland bird community

Through avoid and minimisation measures implemented to date, the proposed impact has been significantly reduced to a proposed 7.501 ha direct impact to the community. It is noted that this is a combined figure, which occurs primarily across five Project Areas:

- 0.675 ha at Short Street Overbridge (Broadford), including 2 large trees
- 1.221 ha at Marchbanks Road Overbridge (Broadford), including 7 large trees
- 1.898 ha at Hume Highway Tallarook Precinct (Tallarook), including 10 large trees
- 1.707 ha at Seymour-Avenel Road Overbridge (Seymour), including 6 large trees
- 1.994 ha at Hume Highway Seymour Precinct (Seymour), including 7 large trees.

There are some minor impacts at Signal Gantry's 18 and 19, however, these comprise a very small amount (0.006 ha), which would not significantly impact the bird community at those locations.

Impacts at Marchbanks Road Overbridge (Broadford) and Short Street Overbridge (Broadford) are closer to activity areas around Broadford. The patches are more suited to mobile birds of the community that readily move through a patchily connected landscape.

The community recorded at Hume Highway Tallarook Precinct (Tallarook), Seymour-Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour) are located within a greater network of woodland habitat that occurs surrounding Seymour, including known important bird habitat areas in Puckapunyal, Mangalore and Avenel (BirdLife 2019). The loss of the community at these locations is likely to increase distances between the remaining woodland habitats in the immediate area. This will affect some of the bird species at various levels, with larger, mobile birds likely to be unperturbed by the increased distance, however, smaller species may be unwilling or exposed to predation and become isolated from other habitat areas.

A review of the woodland bird species included in the community, including those listed individually as threatened species, indicates that woodland bird habitat is becoming increasingly fragmented, particularly with losses of large and mature trees that provide the significant habitat value for foraging, nesting and roosting, and changing of soil and litter properties affecting ground-foragers (Ingerswen and Tzaros 2011). It is noted that 32 large trees are contained in the mapped community within the five project areas that are likely to be impacted. Additionally, several of these trees at Hume Highway Tallarook Precinct (Tallarook), Seymour-Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour), are hollow-bearing (Appendix H).

In consideration of the size of the impact, the number of large trees loss and the increasing loss and fragmentation of temperate woodland bird habitat in Victoria, the impact is considered to be a significant area of the community. Based on the predicted loss of 7.501 ha and the habitat features being lost within the project area, this referral criteria is considered to be met for the VTWBC. Triggering these criteria is taken into account when considering whether the project should be referred under the EE Act, as part of a combination criteria for the 'potential loss of a significant area of a listed ecological community' (DSE 2006).

Threatened flora species

The predicted impact on the listed threatened flora species that have been recorded or have potential to occur in the project areas is provided in Table 27.

Based on the surveys completed to date and the predicted impacts to mainly small and isolated habitat, the impacts to FFG Act listed flora species are not considered to be to a significant proportion of the remaining population, to an important population or to habitat that is critical for the species. Therefore, impacts are not currently considered to meet the individual or combination EES referral triggers for FFG flora.

Table 27 Potential impacts for FFG Act listed threatened flora

FFG Act listed matter	Project Area	Location (north or south of Beveridge)	Predicted impact
Matted Flax-lily	0.11 ha of potential habitat at Hume Highway, Craigieburn	South	The species was not recorded during the assessment and habitat is small (0.11 ha). The impact is not currently considered significant; however, targeted surveys are required to confirm presence.
Swamp everlasting	Potential habitat at Track Slew Investigation Area C avoided by reducing project area.	North	No impact.
Swamp fireweed	Potential habitat at Track Slew Investigation Area C avoided by reducing project area.	North	No impact.
Spiny Rice-flower	Recorded individuals recorded north of the project area. Potential habitat recorded at McIntyre Road Overbridge (Sunshine) (to be assessed)	South	No impacts to recorded individuals within the rail reserve north of McIntyre Road. Further survey is required to determine presence of the species within section of the project area at McIntyre Road Overbridge (Sunshine) not assessed.
Euroa Guinea-flower	1.99 ha of potential habitat identified at Hume Highway Seymour Precinct (Seymour)	North	The species is not known to occur in the project area and has not been recorded from previous surveys. No species were observed during flora surveys in 2019 (KBR 2020b).
Crimson spider-orchid	Potential habitat identified at the following project areas:	North	The species is not known to occur in the project areas and has not been recorded from previous surveys.

FFG Act listed matter	Project Area	Location (north or south of Beveridge)	Predicted impact
	• 1.71 ha at Seymour-Avenel Road Overbridge (Seymour) • 1.99 ha Hume Highway Seymour Precinct (Seymour)		No species were observed during targeted flora surveys in 2019 (KBR 2020b).
Purple diuris	Potential habitat identified at the following project areas: • 1.71 ha at Seymour-Avenel Road Overbridge (Seymour) • 1.99 ha Hume Highway Seymour Precinct (Seymour)	North	The species is not known to occur in the project areas and has not been recorded from previous surveys. No species were observed during targeted flora surveys in 2019 (KBR 2020b).
Large-flower crane's-bill	Individuals recorded near Barry Road Overbridge (Dallas) have been avoided by reducing the project area. 0.11 ha of potential habitat at Hume Highway Overbridge (Craigieburn)	South	No impact within the Barry Road Overbridge (Broadmeadows). The species was not recorded during the assessment at Hume Highway Overbridge (Craigieburn), and potential habitat is small (0.11 ha). The impact is not currently considered significant; however, targeted surveys are required to confirm presence.
Buloke	2 individuals recorded in Seymour-Avenel Road Overbridge (Seymour).	North	Loss of individuals is not considered to be a significant impact.
Tough scurf-pea	Potential habitat recorded at McIntyre Road Overbridge (Seymour) (including area that is to be assessed)	South	The species was not recorded in potential habitat during assessment. The impact is not currently considered significant. Further survey is required to determine presence of the species within section of the project area at McIntyre Road Overbridge (Sunshine) not assessed.

Threatened fauna species

The predicted impact on the listed threatened flora species that have been recorded or have potential to occur in the project areas is provided in Table 28.

Table 28 Potential impacts for FFG Act listed threatened fauna

FFG Act listed matter	Project area	Location (north or south of Beveridge)	Predicted impact
GRASSLAND-DEPENDENT SPECIES			
Striped legless lizard	Potential habitat recorded at: • 0.28 ha at McIntyre Road Overbridge (Sunshine) • 0.007 ha at Calder Freeway Precinct (Keilor East) • 0.55 ha Barry Road Overbridge (Dallas) • 0.11 ha at Hume Highway Overbridge (Craigieburn)	South	No individuals were recorded during the limited targeted survey. Potential habitat is considered small and isolated, which is not considered to be significant for the species. Further survey is required to determine presence of the species.
Golden sun moth	Potential habitat recorded at: • 0.28 ha at McIntyre Road Overbridge (Sunshine) • 0.007 ha at Calder Freeway Precinct (Keilor East) • 0.55 ha Barry Road Overbridge (Dallas) • 0.11 ha at Hume Highway Overbridge (Craigieburn)	South	Potential habitat is considered small and isolated, which is not considered to be significant for the species. Further survey is required to determine presence of the species.
Growling grass frog	Potential habitat recorded at: • 0.03 ha at Calder Freeway Precinct (Keilor East) • 0.11 ha at Hume Highway Overbridge (Craigieburn)	South	Potential habitat is considered to be small and isolated terrestrial habitat, which is not likely to impact frog movement. Impacts are not considered significant; however, further survey is required to determine the presence of the species.
WOODLAND-DEPENDENT SPECIES			
Brush-tailed phascogale	Potential habitat identified at the following project areas: • 1.9 ha at Hume Highway Tallarook Precinct (Tallarook) • 1.71 ha at Seymour-Avenel Road Overbridge (Seymour) • 1.99 ha at Hume Highway Seymour Precinct (Seymour)	North	Potential habitat is part of a wider woodland network. The project areas contain suitable habitat connected to other habitat areas. Several old and hollow-bearing trees will be impacted, which may be suitable den sites. Individual phascogales have large home ranges that extend to 60 ha for females and 100 ha for males. Although part of a wider woodland network, the home range extent requirements indicate that the impact will be at most to a small number of individuals. Therefore, impacts are not considered to be

FFG Act listed matter	Project area	Location (north or south of Beveridge)	Predicted impact
			significant for the species and the habitat is not considered critical for survival of a population.
Squirrel glider	Potential habitat identified at the following project areas: • 1.9 ha at Hume Highway Tallarook Precinct (Tallarook) • 1.71 ha at Seymour-Avenel Road Overbridge (Seymour) • 1.99 ha at Hume Highway Seymour Precinct (Seymour)	North	Potential habitat is part of a wider woodland network. The project areas contain suitable habitat connected to other habitat areas. Several old and hollow-bearing trees will be impacted, which may be suitable den sites. The species is known to occur at reasonably high densities in well-connected woodland habitat, including through road reserves. A local population may utilise this habitat and could be impacted by the project, including loss of den sites and fragmenting habitat. This has potential to be significant for a local population of the species. The squirrel glider may be impacted by the operation of double-stacked freight trains. However, as night-time train frequency is not being increased this impact is not likely to be significant.
Woodland birds*	Potential habitat identified at the following project areas: • 0.675 ha at Short Street Overbridge (Broadford) • 1.221 ha at Marchbanks Road Overbridge (Broadford) • 1.898 ha at Hume Highway Tallarook Precinct (Tallarook), • 1.707 ha at Seymour-Avenel Road Overbridge (Seymour) • 1.994 ha at Hume Highway Seymour Precinct (Seymour)	North	No listed woodland bird species were recorded during 2019 surveys; however, habitat has been identified (see 5.2.3). The habitat is likely to be used as a corridor for species to disperse through the landscape to known important bird habitat areas in the surrounding landscape (BirdLife 2019). Currently impacts have potential to result in loss of foraging areas and restricted movements between habitats, particularly for smaller birds. Impacts are likely to be to individuals or small family groups. The loss of habitat at these locations is not considered to be significant for FFG Act-listed woodland bird species.

FFG Act listed matter	Project area	Location (north or south of Beveridge)	Predicted impact
Barking owl & Powerful owl	Potential habitat identified at the following project areas: • 1.898 ha at Hume Highway Tallarook Precinct (Tallarook) • 1.707 ha at Seymour-Avenel Road Overbridge (Seymour) • 1.994 ha at Hume Highway Seymour Precinct (Seymour)	North	Both species occupy large home ranges that vary depending on the location, size and extent of suitable habitat (primarily hollows) and prey density (DSE 2003b, 2004a). Minimum home ranges for barking owl are ~100 ha, and ~400 ha for powerful owl. These habitat requirements indicate that the impacts at each project area are likely to be only be within a single pairs' home range. Therefore, the impacts are not considered significant for the remaining population of the species or to critical habitat.
AQUATIC FAUNA			
Fishes	Potential habitat (including at the Murray River) has been avoided by reducing scope of impacts and the project areas.	North	No impact.

**Includes only birds of the Victorian temperate woodland bird community that are also individually listed as threatened under the Flora and Fauna Guarantee Act 1988*

For the grassland-dependent species, the predicted impacts are mainly to small and isolated areas of habitat. Therefore, these impacts to FFG Act-listed fauna species are not considered to be to a significant proportion of the remaining population, to an important population or to habitat that is critical for the species. Therefore, impacts are not currently considered to meet the individual or combination EES referral triggers for FFG Act-listed matters.

Impacts to woodland habitat is likely to impact several woodland-dependent species. Impacts to the FFG Act-listed squirrel glider have the potential to be significant. The species is known to inhabit linear habitats along road reserves in nearby Euroa (DSE 2003a), which is similar habitat quality and type to that observed in the relevant project areas (pers. obs.). As there are numerous hollow-bearing trees in the project areas, there is potential for a local population to be present that could be significantly impacted.

Other woodland species occupy larger home ranges, including the brush-tailed phascogale, powerful owl and barking owl. Due to their ecological requirements it is unlikely that impacts will be to a significant proportion of the remaining population, to an important population or to habitat that is critical for the species. Therefore, impacts are not currently considered to meet the individual or combination EES referral triggers for FFG Act-listed matters.

Similarly, for FFG Act listed woodland birds, the habitat is considered to be used as a habitat corridor between extensive habitat areas that are known important habitat locations (BirdLife 2019). Therefore, impacts are not considered be to a significant proportion of the remaining population, to an important population or to habitat that is critical for the species. The impacts are not considered to meet the individual or combination EES referral triggers.

6.4 GUIDELINES FOR REMOVAL OF NATIVE VEGETATION

The current project areas have been developed to minimise and avoid impacts to native vegetation, where possible. Table 29 provides the native vegetation and scattered trees predicted to be impacted within the project areas, including the reduction in impacts from recorded patches and scattered trees.

Avoid and minimisation measures implemented by the project during design development to determine the predicted impact for each project area is provided in Section 7.4.

Table 29 Native vegetation impacts per project area

Project area	Native patch and scattered trees recorded	Native patch and scattered trees impacted
SOUTH OF BEVERIDGE		
McIntyre Road Overbridge (Sunshine)	0.28 ha of plains grassland EVC. 1 scattered tree	0.28 ha of plains grassland EVC. 1 scattered tree
Keilor Park Drive Overbridge (Keilor East)	0.124 ha of plains grassland EVC.	0.124 ha of plains grassland EVC.
Calder Freeway Precinct (Keilor East)	0.288 ha of plains grassland EVC. 6 scattered trees, 1 large scattered tree	0.185 ha of plains grassland EVC. 6 scattered trees, 1 large scattered tree
Westfield Drive Overbridge (Tullamarine)	0.036 ha of plains grassland EVC. 1 scattered tree	0.036 ha of plains grassland EVC. 1 scattered tree
Tullamarine Freeway Precinct (Strathmore Heights)	0.034 ha of plains grassland EVC. 2 scattered trees	0.034 ha of plains grassland EVC. 2 scattered trees
Pascoe Vale Road Overbridge (Glenroy) & Jacana Station Footbridge (Glenroy)	0.049 ha of plains grassy woodland EVC 4 scattered trees	0.049 ha of plains grassy woodland EVC 4 scattered trees
Camp Road Overbridge (Broadmeadows)	0.025 ha of plains grassland EVC.	0.025 ha of plains grassland EVC.
Barry Road Overbridge (Dallas)	0.037 ha of plains grassland EVC. 1 scattered tree	No impact to pains grassland EVC 1 scattered tree
Hume Highway Overbridge (Craigieburn)	0.112 ha of plains grassland EVC. 0.247 ha of plains grassy woodland EVC. 5 scattered trees	0.112 ha of plains grassland EVC. 0.247 ha of plains grassy woodland EVC. **4** scattered trees
NORTH OF BEVERIDGE		
Track Slew Investigation Area C	067 ha of plains grassland EVC 0.6 ha of swampy riparian woodland EVC 6 scattered trees	0.192 ha of swampy riparian woodland EVC **No impact to plains grassland EVC** 5 scattered trees

Project area	Native patch and scattered trees recorded	Native patch and scattered trees impacted
Broadford Road Overbridge (Wandong)	0.049 ha of valley grassy forest EVC	0.049 ha of valley grassy forest EVC
Signal Gantry 15	0.015 ha of plains grassy woodland EVC.	0.015 ha of plains grassy woodland EVC.
Signal Gantry 16	0.015 ha of grassy woodland.	0.015 ha of grassy woodland.
Hamilton Street Overbridge (Broadford)	0.565 ha of grassy woodland EVC. 0.176 ha of plains grassy woodland EVC. 4 scattered trees	0.565 ha of grassy woodland EVC. 0.176 ha of plains grassy woodland EVC. 4 scattered trees
Short Street Overbridge (Broadford)	0.033 ha of grassy woodland EVC. 1.14 ha of plains grassy woodland EVC. 23 scattered trees	0.033 ha of grassy woodland EVC. 0.895 ha of plains grassy woodland EVC. 3 scattered trees
Marchbanks Road Overbridge (Broadford)	0.533 ha of grassy woodland EVC. 3.014 ha of plains grassy woodland EVC. 24 scattered trees	0.182 ha of grassy woodland EVC. 1.558 ha of plains grassy woodland EVC. 13 scattered trees
Signal Gantry 18	0.005 ha of grassy woodland EVC.	0.005 ha of grassy woodland EVC.
Signal Gantry 19	0.001 ha of grassy woodland EVC.	0.001 ha of grassy woodland EVC.
Hume Highway Tallarook Precinct (Tallarook)	1.955 ha of grassy woodland EVC. 0.838 ha of plains grassy woodland EVC.	1.856 ha of grassy woodland EVC. 0.838 ha of plains grassy woodland EVC.
Track Slew Investigation Area D	0.03 ha of grassy woodland EVC	**Native vegetation impacts avoided.**
Seymour-Avenel Road Overbridge (Seymour)	1.556 ha of plains grassy woodland EVC 8.624 ha of box-ironbark forest EVC 3 scattered trees	1.267 ha of plains grassy woodland EVC 2.887 ha of box-ironbark forest EVC 3 scattered trees
Track Slew Investigation Area G	0.5 ha of plains grassy woodland EVC	**Native vegetation impacts avoided.**
Hume Highway Seymour Precinct (Seymour)/ Track Slew Investigation Area H	1.564 ha of plains grassy woodland EVC 2.12 ha of box-ironbark forest EVC	0.106 ha of plains grassy woodland EVC 1.894 ha of box-ironbark forest EVC
Track Slew Investigation Area I	1.632 ha of plains grassy woodland EVC	**Native vegetation impacts avoided.**

Project area	Native patch and scattered trees recorded	Native patch and scattered trees impacted
	0.09 ha of plains grassy wetland EVC	
Anderson Street Overbridge (Euroa)	7 scattered trees	**Native vegetation impacts avoided**
Benalla Station Approach Road Overbridge (Benalla)	0.401 ha of plains grassy woodland EVC 82 scattered trees	0.09 ha of plains grassy woodland EVC 11 scattered trees
Beaconsfield Parade Overbridge (Glenrowan)	1.151 ha of plains woodland EVC 54 scattered trees	0.216 ha of plains woodland EVC. 8 scattered trees
Wangaratta Station Precinct (Wangaratta)	0.024 ha plains grassy woodland 1.03 ha of creekline grassy woodland 13 scattered trees	0.024 ha plains grassy woodland 0.247 ha of creekline grassy woodland 10 scattered trees
Murray Valley Highway Overbridge (Barnawartha North)	0.938 ha of plains woodland EVC. 17 scattered trees	0.608 ha of plains woodland EVC. 4 scattered trees
Murray River Underbridge (Albury)	0.901 ha of riverine grassy woodland. 23 scattered trees	0.016 ha of riverine grassy woodland. No scattered trees impacted.

7 Legislative requirements

The following provides an assessment of the legislative requirements identified from the predicted project impact presented in Section 6.

Due to the uncertainty on the location of the intermodal terminal, and whether works south of Beveridge will be required, the summaries of the legislative constraints for individual project areas are separated into sites north of Beveridge (Table 30) and south of Beveridge (Table 31).

Table 30 Individual summary of the legislative constraints for each project area north of Beveridge

Investigation Area Name	Matters of national environmental significance	Ecological referral triggers (DSE 2006)*	Flora and Fauna Guarantee Act 1988	Native vegetation removal guidelines (DELWP 2017)	Catchment and Land Protection Act 1994 (CaLP 1994)
Track Slew Investigation Area C	Patches of NTG and threatened species habitat avoided. No impact to MNES.	0.21 ha of an endangered EVC. Impacts to threatened grassland community and threatened species habitat avoided.	Impacts to Western (basalt) plains grassland community and potential threatened species habitat avoided.	0.21 ha of swampy riparian woodland EVC 5 scattered trees 1 large scattered tree	
Broadford Road Overbridge (Wandong)	None.	0.049 of a vulnerable EVC	None.	0.049 ha of valley grassy forest EVC	None
Signal Gantry 15	None.	0.015 ha of an endangered EVC	Cotton fireweed P Jersey cudweed P Chinese scrub P Black wattle P	0.015 ha of plains grassy woodland EVC.	Blackberry (R) Briar Rose (R)
Signal Gantry 16	None.	0.015 ha of an endangered EVC	Jersey cudweed P	0.015 ha of grassy woodland.	None
Signal Gantry 17	None.	None.	None.	None.	None
Hamilton Street Overbridge (Broadford)	None.	0.741 ha of an endangered EVC	Jersey cudweed P Chinese scrub P Rosemary Grevillea P	0.565 ha of grassy woodland EVC. 0.176 ha of plains grassy woodland EVC. 3 scattered trees 1 large scattered tree	Cape Broom (C) Blackberry (R) Briar Rose (R)
Short Street Overbridge (Broadford)	Small patch of golden sun moth habitat avoided.	0.928 ha of an endangered EVC. Area of listed ecological community impacted not considered a significant portion.	0.675 ha of VTWBC. Rosemary Grevillea P Chinese scrub P Cottony fireweed P Golden wattle P New-Holland daisy P	0.033 ha of grassy woodland EVC. 0.895 ha of plains grassy woodland EVC. 2 scattered trees 1 large scattered tree	Blackberry (C) Spear thistle (C) St John's Wort (C)
Marchbanks Road Overbridge (Broadford)	Small patch of golden sun moth and striped legless lizard habitat avoided.	1.74 ha of an endangered EVC. Area of listed ecological community impacted not considered a significant portion.	1.221 ha of VTWBC. 0.418 ha of brush-tailed phascogale and squirrel glider habitat. Chinese scrub P Cottony fireweed P	0.182 ha of grassy woodland EVC. 1.558 ha of plains grassy woodland EVC. 13 scattered trees 5 large scattered trees	Blackberry (R) Briar Rose (C) Spear thistle (R) Fennel (R)
Signal Gantry 18	None.	0.005 ha of an endangered EVC Area of listed ecological community impacted not considered a significant portion.	0.005 ha of VTWBC.	0.005 ha of grassy woodland EVC.	Blackberry (C)
Signal Gantry 19	None.	0.001 ha of an endangered EVC Area of listed ecological community impacted not considered a significant portion.	0.001 ha of VTWBC.	0.001 ha of grassy woodland EVC.	Spear thistle (R)

Investigation Area Name	Matters of national environmental significance	Ecological referral triggers (DSE 2006)*	Flora and Fauna Guarantee Act 1988	Native vegetation removal guidelines (DELWP 2017)	Catchment and Land Protection Act 1994 (CaLP 1994)
Hume Highway Tallarook Precinct (Tallarook)	None.	2.793 ha of an endangered EVC. Area of listed ecological community impacted maybe considered a significant portion. An important population of a threatened species is not likely to be present, nor is the potential habitat considered critical for the species. Impacts to potential habitat is also not considered a significant portion.	1.898 ha of VTWBC, and potential habitat for brush-tailed phascogale, squirrel glider, barking owl and powerful owl. Golden wattle P Chinese scrub P Lemon beauty-heads P Gold-dust wattle P New-Holland daisy P Sticky everlasting P Clustered everlasting P Cotton fireweed P	1.955 ha of grassy woodland EVC. 0.838 ha of plains grassy woodland EVC.	Blackberry (C) Bridal Creeper (C)
Track Slew Investigation Area D	None.	0.017 ha of an endangered EVC. Area of listed ecological community and threatened species habitat not impacted.	VTWBC avoided. No impact.	0.017 ha of grassy woodland EVC	St John's Wort (C)
Track Slew Investigation Area E	None.	None. Area of listed ecological community not impacted.	VTWBC avoided. No impact.	Native vegetation impacts avoided.	St John's Wort (C)
Track Slew Investigation Area F	None.	None.	None.	None.	None
Seymour Avenel Road Overbridge (Seymour)	7.655 ha of Endangered GBGW. A predicted impact of 1.707 ha through reduced project impact.	1.267 ha of an endangered EVC. 2.887 ha of a vulnerable EVC. Area of listed ecological community impacted maybe considered a significant portion. An important population of a threatened species is not likely to be present, nor is the potential habitat considered critical for the species. Impacts to potential habitat is also not considered a significant portion.	1.707 ha of VTWBC and potential habitat for purple diuris, crimson spider-orchid, brush-tailed phascogale, squirrel glider, powerful owl and barking owl. Two individual buloke impacted. Golden wattle P Chinese scrub P Cinnamon wattle P Gold-dust wattle P New-Holland daisy P Sticky everlasting P Clustered everlasting P	1.267 of plains grassy woodland EVC 2.887 ha of box-ironbark forest EVC	Flax-leaved Broom (C) Onion Grass (C)
Track Slew Investigation Area G	Impacts avoided to endangered GBGW community.	0.257ha of an endangered EVC.	None.	Native vegetation impacts avoided.	Onion Grass (C) St John's Wort (C)
Hume Highway Seymour Precinct (Seymour)/ Track Slew Investigation Area H	6.090 ha of Endangered GBGW present. A predicted impact of 1.837 ha through reduced project impact.	0.106 ha of an endangered EVC 1.894 ha of a vulnerable EVC. Area of listed ecological community impacted maybe considered a significant portion.	1.994 ha of VTWBC, and potential habitat for purple diuris, crimson spider-orchid, Euroa guinea-flower, brush-tailed phascogale, squirrel glider, powerful owl and barking owl. Golden wattle P Chinese scrub P	0.106 of plains grassy woodland EVC 1.894 ha of box-ironbark forest EVC	African boxthorn (C) Onion Grass (C) St John's Wort (C)

Investigation Area Name	Matters of national environmental significance	Ecological referral triggers (DSE 2006)*	Flora and Fauna Guarantee Act 1988	Native vegetation removal guidelines (DELWP 2017)	Catchment and Land Protection Act 1994 (CaLP 1994)
		An important population of a threatened species is not likely to be present, nor is the potential habitat considered critical for the species. Impacts to potential habitat is also not considered a significant portion.	Cinnamon wattle P Gold-dust wattle P New-Holland daisy P Sticky everlasting P		
Track Slew Investigation Area I	Impacts avoided to endangered GBGW community.	No impacts to endangered or vulnerable EVC, or to threatened species and ecological communities.	VTWBC impacts avoided.	Native vegetation impacts avoided.	Onion Grass (C) St John's Wort (C)
Anderson Street Overbridge (Euroa)	None.	None.	None.	Native vegetation impacts avoided	None
Benalla Station Approach Road Overbridge (Benalla)	None.	0.09 ha of an endangered EVC	Chinese scrub P	0.09 ha of plains grassy woodland EVC 11 scattered trees 2 large trees	African lovegrass (C) St John's Wort (C) Spear thistle (R) Paterson's curse (C) Stinkwort (R)
Beaconsfield Parade Overbridge (Glenrowan)	Impacts to the endangered WBYBBRGGW avoided.	0.216 ha of an endangered EVC. Area of listed ecological community and listed species habitat not impacted.	Impacts to Victorian Temperate Woodland Bird Community and potential habitat for purple diuris avoided. Rough wattle P Heath wattle P Golden everlasting P	0.216 ha of plains woodland EVC. 8 scattered trees 2 large scattered trees	African lovegrass (C) Blackberry (C) Great mullein (C) Prickly Pear (C) St John's Wort (C)
Wangaratta Station Precinct (Wangaratta)	None.	0.270 ha of an endangered EVC	None.	0.024 ha plains grassy woodland 0.247 ha of creekline grassy woodland 6 scattered trees 4 large scattered trees	None
Murray Valley Highway Overbridge (Barnawartha North)	None.	0.608 ha of an endangered EVC	None.	0.608 ha of plains woodland EVC. 2 scattered trees 2 large scattered trees	St John's Wort (C) Spear thistle (C) Paterson's curse (C)
Murray River Underbridge (Albury)	None.	0.016 ha of a vulnerable EVC. Area of listed ecological community and listed species habitat not impacted.	Impacts to Victorian Temperate Woodland Bird Community and potential habitat for squirrel glider avoided. Shrubby fireweed P Gold-dust wattle P Varnish wattle P Golden wattle P	0.016 ha of riverine grassy woodland.	St John's Wort (C) Great mullein (C) Spear thistle (R) Paterson's curse (C) Blackberry (C)

C – CaLP Act Regionally Controlled Weeds
R – CaLP Act Restricted Weeds
P – Protected under the FFG Act
L – Listed under the FFG Act
** The site-by-site assessment in this table does not consider the total whole-of-impact for the project. An assessment of combined impacts in relation to EES referral criteria is provided in Section 7.2*

Table 31 Individual summary of the legislative constraints for each project area south of Beveridge

Investigation Area Name	Matters of national environmental significance	Ecological referral triggers (DSE 2006)*	Flora and Fauna Guarantee Act 1988	Native vegetation removal guidelines (DELWP 2017)	Catchment and Land Protection Act 1994 (CaLP 1994)
McIntyre Road Overbridge (Sunshine)	Spiny rice-flower recorded in rail reserve to the north. 0.28 ha of NTG present, which is habitat for striped legless lizard and golden sun moth. These MNES are also known in the adjacent property.	0.28 ha of an endangered EVC. Area of listed ecological community impacted not considered a significant portion. A significant or important population of a threatened species is not likely to be present.	0.28 ha of Western (basalt) plains grassland community, which is also potential habitat for touch scurf-pea, striped legless lizard and golden sun moth. Listed threatened species adjacent.	0.28 ha of plains grassland EVC. 1 scattered tree	Artichoke thistle (C) Chilean needle-grass (R) Fennel (R) Prickly pear (C)
Keilor Park Drive Overbridge (Keilor East)	None.	0.124 ha of an endangered EVC	None.	0.124 ha of plains grassland EVC.	None
Signal gantry 6	None.	None.	None.	None	African boxthorn (C) Artichoke thistle (C) Prickly pear (C)
Calder Freeway Precinct (Keilor East)	NTG patch and potential threatened species habitat to be a no-go zone. No impact to MNES.	0.185 ha of an endangered EVC. Area of listed ecological community impacted not considered a significant portion. A significant or important population of a threatened species is not likely to be present.	Patch of Western (basalt) plains grassland community and threatened species habitat to be protected.	0.185 ha of plains grassland EVC. 6 scattered trees, 1 large scattered tree	Chilean needle-grass (R) Prickly pear (C) Fennel (R) Artichoke thistle (C) Sweet briar (C) Blackberry (C) Serrated tussock (C)
Westfield Drive Overbridge (Tullamarine)	None.	0.036 ha of an endangered EVC	None.	0.036 ha of plains grassland EVC. 1 scattered tree	Fennel (R) Serrated tussock (C) Sweet briar (C) Blackberry (C)
Tullamarine Freeway Precinct (Strathmore Heights)	0.407 ha of potential exotic habitat for golden sun moth. 0.42 ha of potential striped legless lizard habitat.	0.034 ha of an endangered EVC	Impacts to golden sun moth and striped legless lizard, as per MNES.	0.034 ha of plains grassland EVC. 2 scattered trees	Artichoke thistle (C) Fennel (R) Cape broom (C) African boxthorn (C) Chilean needle-grass (R) Serrated tussock (C) Prickly pear (C)
Track Slew Investigation Area A	0.487ha of potential exotic habitat for golden sun moth. Potential growling grass frog habitat at the creek will be avoided.	None.	Impacts to golden sun moth and growling grass frog, as per MNES.	Native vegetation impacts avoided.	Prickly pear (C) Fennel (R)
Belair Avenue Overbridge (Glenroy)	None.	None.	None.	None.	Prickly pear (C) Fennel (R) Chilean needle-grass (R) Artichoke thistle (C)
Pascoe Vale Road Overbridge (Glenroy) & Jacana Station Footbridge (Glenroy)	None.	0.049 ha of an endangered EVC	None.	0.049 ha of plains grassy woodland EVC 4 scattered tree	Fennel (R) Artichoke thistle (C) Cape broom (C) Blackberry (C)

Investigation Area Name	Matters of national environmental significance	Ecological referral triggers (DSE 2006)*	Flora and Fauna Guarantee Act 1988	Native vegetation removal guidelines (DELWP 2017)	Catchment and Land Protection Act 1994 (CaLP 1994)
Camp Road Overbridge (Broadmeadows)	None.	0.025 ha of an endangered EVC.	None.	0.025 ha of plains grassland EVC.	Artichoke thistle (C) Chilean needle-grass (R)
Riggall Street Overbridge (Broadmeadows)	None.	None.	None.	Native vegetation impacts avoided.	Artichoke thistle (C) Chilean needle-grass (R)
Barry Road Overbridge (Dallas)	Patch of NTG community to be protected. 0.552 ha of potential habitat for golden sun moth and striped legless lizard. Known MNES in adjacent property should be identified during construction and avoided.	None. A significant portion of the adjacent population of a Large-flowered crane's-bill is not likely to be impacted. A significant or important population of other threatened species is not likely to be present.	Impacts to Large-flower crane's-bill and Western (basalt) plains grassland community avoided. 0.552 ha of potential habitat for golden sun moth and striped legless lizard.	1 scattered tree	Blackberry (C) Chilean Needle-grass (R)
Signal Gantry 14	None.	None.	None.	None.	Chilean needle grass (R) African boxthorn (C)
Hume Highway Overbridge (Craigieburn)	0.112 ha of NTG community, which is considered to be potential habitat for golden sun moth, growling grass frog, striped legless lizard and matted flax-lily.	0.359 ha of an endangered EVC. Area of listed ecological community impacted not considered a significant portion. An important population of a threatened species is not likely to be present, nor is the impact considered a significant portion.	0.112 ha of Western (basalt) plains grassland community, which is also potential habitat for Large-flowered crane's-bill, golden sun moth, growling grass frog, striped legless lizard and matted flax-lily. Cotton fireweed P	0.112 ha of plains grassland EVC. 0.247 ha of plains grassy woodland EVC. 4 scattered trees	Bridal creeper (R) Blackberry (C)

C – CaLP Act Regionally Controlled Weeds
R – CaLP Act Restricted Weeds
P – Protected under the FFG Act
L – Listed under the FFG Act
** The site-by-site assessment in this table does not consider the total combined impact for the project. An assessment of combined impacts in relation to EES referral criteria is provided in Section 7.2.*

7.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

7.1.1 Matters of national environmental significance

The Commonwealth EPBC Act protects MNES including world heritage properties, national heritage places, Ramsar wetlands, commonwealth marine areas, threatened species, ecological communities and migratory species.

The impacts to these species and communities within the project areas are considered further below to determine whether impacts could potentially be 'significant', requiring the project to be referred to the Commonwealth Environment Minister.

North of Beveridge

Predicted significant impacts to MNES are located within two project areas north of Beveridge.

Proposed impacts to the endangered GBGW community are considered significant in accordance with the criteria for critically endangered and endangered communities (DoE 2013). Specifically, the criteria considered met are a reduction in the extent of the community and fragmentation of the community, both expected to occur at Seymour-Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour).

Based on the predicted impacts to the above community, the project is required to be referred to the Commonwealth Environment Minister. As the size of the reduction in extent of GBGW community (3.543 ha) is considered significant, this will likely result in the project being considered a controlled action under the EPBC Act.

Several critically endangered and endangered species (swift parrot and regent honeyeater), and vulnerable species (painted honeyeater, crimson spider-orchid and Euroa guinea-flower) have habitat within the project area. Based on current knowledge of these species and the results of this assessment, impacts to these species are unlikely to be considered significant, as no known populations of any of these species have been previously recorded (DELWP 2019, WSP/PB 2016) and current surveys have not identified any individuals or populations.

South of Beveridge

South of Beveridge, there is a potentially significant impact to a critically endangered community. A reduction in the extent of NTG at McIntyre Road (Sunshine) and Hume Highway Overbridge (Craigieburn) is proposed at these sites, with 0.392 ha of the community predicted to be impacted. The impact is potentially significant as a reduction in extent criteria and should be included in a referral should the works for the project proceed at these sites and the impacts be unavoidable.

A referral under the EPBC Act would also need to consider potentially significant impacts to other matters of national environmental significance, including for critically endangered and endangered species (striped legless lizard, golden sun moth, growling grass frog and matted flax-lily). Following a decision on the intermodal terminal and which sites the project will proceed with, an EPBC referral self-assessment is recommended that considers the results of previous surveys for threatened species.

7.1.2 EPBC Act offsets policy

The following statement is included on the Department website in relation to the offset policy under the EPBC Act (DoEE 2018):

> "*Offsets are measures that compensate for the residual impacts of an action on the environment, after avoidance and mitigation measures are taken. Where appropriate, offsets are considered during the assessment phase of an environmental impact assessment under the EPBC Act. This policy provides transparency around how suitable offsets are determined. The suitability of a proposed offset is considered as part of the decision to approve or not approve a proposed action under the EPBC Act.*"

In the event that the project is a controlled action, offsets for the residual impacts to MNES that have a significant impact, may be required. Offsets would primarily be focused on GBGW, which is the most likely matter to be impacted. Under the offsets policy (DSEWPAC 2012), any offsets will need to be commensurate to the residual impact to the community, at least maintaining the amount of the community in the landscape. Typically, these need to be additional to other legislative requirements, though offsets can be achieved through a state-based offset process, where the offsets clearly result in a neutral or positive conservation outcome.

7.2 ENVIRONMENT EFFECTS ACT 1978

The EE Act provides for assessment of proposed projects that are capable of having a significant effect on the environment. This includes potential impacts to ecological, heritage, cultural and social values. The Act enables the Minister administering the EE Act to decide that an EES should be prepared.

The first step to determine whether a project requires an EES is to determine whether the project should be referred to the Minister for Planning. The Minister will then determine whether an EES is required.

North of Beveridge

The current design proposals and predicted impacts within the project areas is considered to trigger an EES referral, meeting two of the combination referral triggers, which relate to ecology:

- Potential clearing of 10 ha or more of native vegetation, and
- Potential loss of a significant area of a listed ecological community.

The impact to the FFG Act-listed ecological community occurs wholly north of Beveridge, and 12.821 ha of the impact to native vegetation occurs within project areas north of Beveridge (Table 32). This predicted impact to native vegetation exceeds the referral trigger for potential clearing of native vegetation under the combination criteria.

Table 32 Summary of native vegetation impacts north of the intermodal terminal at Beveridge

Bioregional conservation significance	Estimated impact – entire project area	Estimated impact north of Beveridge
Endangered	9.123 ha.	8.031 ha
Vulnerable	4.79 ha	4.79 ha
Total	**13.913 ha.**	**12.821 ha**

Meeting the referral criteria for impacts to the FFG listed ecological community, VTWBC, depends on the loss of a 'significant area' of the listed community (DSE 2006). Currently, the project is proposing to remove 7.501 ha of the FFG Act-listed community. These impacts will occur at five discrete locations, ranging in area from 0.675 ha to 1.994 ha, spread over 25 km between Broadford to north of Seymour. At a regional scale, the loss of the vegetation is not predicted to a significantly impact bird communities, as other suitable woodland habitats and movement corridors exist in the surrounding landscape. Impacts are likely to be more significant at a local scale, where family groups, particularly of smaller insectivorous species, will lose habitat and restrict movement between habitat patches.

However, the total loss is considered a significant area, as the extent of the community has been declining within Victoria and habitat removal is a threat to several listed bird species. Of note within the woodland bird habitat in Victoria, large trees, particularly hollow-bearing, and complex understorey suitable for ground foraging species, have been lost at a greater rate that has impacted more significantly on species that rely on these features (Ingerswen and Tzaros 2011). In total, 32 large trees, including those with hollows are proposed to be impacted, particularly at Hume Highway Tallarook Precinct (Tallarook), Seymour Avenel Road Overbridge (Seymour) and Hume Highway Seymour Precinct (Seymour). These sites also contain complex understorey for foraging including logs, debris and organic litter.

It is recommended to refer the project areas north of Beveridge to the Minister for Planning for assessment, due to impacts to the VTWBC combined with over 10 ha of loss of native vegetation, to determine whether an EES is required under the EE Act.

It is noted that several other matters listed under the FFG Act have potential habitat present within several project areas. In consideration of the surveys completed to date, including WSP/PB (2016) and surveys completed from December 2017-February 2018 and June 2019, in addition to results of the desktop assessment and database searches, it is unlikely that significant or important populations exist within the project areas, which are generally in modified environments immediately adjacent to active transport corridors.

Squirrel glider has been identified in similar habitat to that recorded around Tallarook and Seymour and the species generally occur in higher densities than brush-tailed phascogale and barking owl, within a network of woodland habitats.

South of Beveridge

Impacts south of Beveridge are predominately to plains grassland EVC, which is an endangered EVC, within Project Areas in the west and north of metropolitan Melbourne. However, as native grasslands in this area are small and isolated, the overall impact is a relatively small amount of 1.092 ha (Table 33) in comparison to the impacts north of Beveridge.

Table 33 Native vegetation impacts south of the Intermodal terminal at Beveridge

Bioregional conservation significance	Estimate impact south of Beveridge
Endangered	1.092 ha
Vulnerable	0.00 ha
Total	**1.092 ha**

Many of these patches of vegetation are significant grassland habitats with suitable habitat for several nationally and Victorian threatened species, including matted flax-lily, spiny rice-flower, growling grass frog and striped legless lizard. It is unlikely that significant populations are present at these sites and further contribute to the meeting EES referral triggers. However, targeted surveys would be required for these species to confirm the impact should sites south of Beveridge proceed.

7.3 FLORA AND FAUNA GUARANTEE ACT 1988

The FFG Act identifies and protects threatened native flora and fauna species, populations or ecological communities or their habitats. The FFG Act is administered by the DELWP.

Any impacts to the FFG listed threatened community, VTWBC and buloke, will require a permit to take protected flora under the FFG Act. This permit is issued by DELWP. Further consultation with DELWP is

recommended to understand specific application requirements and/or permit conditions, for impacts to VTWBC and buloke.

A permit to take protected flora will also need to include any protected species impacted by works within public land, including road and rail reserves. These species are listed in Table 30 (north of Beveridge) and Table 31 (south of Beveridge).

Impacts to woodland habitat for the FFG Act listed squirrel glider, brush-tailed phascogale and barking owl, should be minimised, particularly at Hume Freeway Precinct (Tallarook), Seymour-Avenel Road Overbridge (Seymour) and Hume Freeway Seymour Precinct (Seymour). Further consultation with DELWP is recommended in the implement of species-specific management actions that that may be considered to mitigate impacts to individuals, including the use of glider poles and rope bridges.

Additionally, project works should be managed to minimise the potential for threatening processes listed under the FFG Act, including invasion of environmental weeds and blackberry into areas of native vegetation, plus habitat fragmentation. There is potential for habitat fragmentation of the threatened woodland bird community, plus the brush-tailed phascogale and squirrel glider. Mitigation measures may need to be considered for these threatening processes, including:

- Avoiding impacts to large and hollow-bearing trees
- Installation of rope bridges and glider poles to allow for movement of arboreal mammals
- Implementation of best-practice construction hygiene controls to prevent the introduction and spread of blackberry and other environmental weeds.

7.4 PLANNING AND ENVIRONMENT ACT 1987

The *Planning and Environment Act 1987* (P&E Act) outlines the legislative frameworks for planning in Victoria and for the development and administration of planning schemes. It is likely that planning approval will be obtained for the project via a planning scheme amendment.

All planning schemes contain native vegetation provisions at Clause 52.17, which require a planning permit to remove, destroy or lop native vegetation. Where vegetation to be removed is considered to meet native patch or scattered tree definitions (DELWP 2017b) applications are required to meet the requirements of the Guidelines for the removal, destruction and lopping of native vegetation (DELWP 2017b), referred to as the Guidelines. The Guidelines will be required to be met for planning approval, including via a planning scheme amendment and associated Incorporated Document.

The project requirements under the Guidelines are discussed further below.

7.4.1 Planning overlays

A number of planning overlays exist within the Project Areas where conditions exist for the removal of vegetation, they include:

- Schedule 5 of the Public Acquisition Overlay (PAO5).
- Erosion Management Overlay (EMO)
- Schedule 1 to the Vegetation Protection Overlay (VPO1) - Roadside Vegetation Protection.
- Schedule 2 to the Vegetation Protection Overlay (VPO2) - Freeway Environs Protection
- Heritage Overlays:
  - Tree controls apply to Benalla Railway Station (HO60) and Benalla Central Urban Conservation Area (HO26).

Further detail regarding permit triggers for each overlay are provided in the Planning Report (KBR 2020a).

7.4.2 Guidelines for the removal, destruction and lopping of native vegetation

The Guidelines (DELWP 2017b) were introduced into all Victorian Planning Schemes on the 12 December 2017. The Guidelines apply to the removal of native vegetation under Clause 52.17 of planning schemes in Victoria.

Under the Guidelines the project will be considered via a Detailed Assessment pathway, which requires a habitat hectare assessment to be completed on the impacted vegetation. Habitat hectare details are included above in Section 4 and Appendix E. The extent and condition of each of the native patches and scattered trees was submitted to DELWP to determine the project offset requirements.

Planning approval will include requirements for all native vegetation removal to comply with the Guidelines. Compliance with the Guidelines will include a habitat hectares assessment (included in this report), an 'avoid and minimise' statement and the meeting of offset requirements.

Avoid and minimise

At the time of preparing this report, sites north of Beveridge are at a reference design phase, and sites south of Beveridge are at a concept design phase. Avoid and minimisation measures have been implemented by the project following the outcomes of the initial Stage 1 (2017 and 2018) ecological surveys, and then again following Stage 2 (2019). Avoid and minimisation measures implemented to date, include the following:

- Re-consideration of options to select the option with least impact
- Re-design of bridge replacement options to minimise the project area footprint
- Utilisation of existing access tracks
- Identification of no-go zones to avoid impacts to threatened ecological communities and threatened species habitat.

Following the implementation of these measures, the predicted impact has been significantly reduced (Table 34). Further recommendations for avoidance and minimisation for each site is also included in Section 8, which may be incorporated into future project planning and construction method.

Table 34 Predicted impacts for each Ecological vegetation classes

Bioregion	Ecological vegetation class (EVC name)	Bioregional conservation significance	Area (ha) recorded in Investigation Area	Impact Area (ha) within Project Area
South of Beveridge				
Victorian Volcanic Plain	Plains grassland	Endangered	1.33	0.796
	Plains grassy woodland	Endangered	0.335	0.296
	Creekline grassy woodland	Endangered	0.092	0.00
	Swampy riparian woodland	Endangered	0.132	0.018
North of Beveridge				
Victorian Volcanic Plain	Plains grassland	Endangered	0.669	0.009
	Swampy riparian woodland	Endangered	0.603	0.219
Central Victorian Uplands	Plains grassy woodland	Endangered	9.850	3.861
	Box-ironbark forest	Vulnerable	10.740	4.742

Bioregion	Ecological vegetation class (EVC name)	Bioregional conservation significance	Area (ha) recorded in Investigation Area	Impact Area (ha) within Project Area
	Grassy woodland	Endangered	2.768	2.429
	Valley grassy forest	Vulnerable	0.049	0.048
	Plains grassy wetland	Endangered	0.091	0.00
Victorian Riverina	Plains grassy woodland	Endangered	0.982	0.412
	Creekline grassy woodland	Endangered	1.030	0.247
	Grassy woodland	Endangered	0.029	0.033
	Riverine grassy woodland	Endangered	0.901	0.016
	Floodplain riparian woodland	Vulnerable	5.304	0.00
Northern Inland Slopes	Plains woodland	Endangered	2.070	0.824
	Grassy woodland	Endangered	0.019	0.00
		Total	**36.465**	**13.913**

Examples of the aforementioned avoid and minimisation measures and their application for specific Investigation Areas is provided in Table 35. These examples are locations which have been targeted due to the presence of EPBC Act and FFG Act listed threatened ecological communities, threatened species and potential habitat.

Table 35 Avoid and minimise measures implemented to date

Investigation Area Name	Summary of measures	Reduction of impact
Barry Road Overbridge (Dallas)	Patch of NTG and habitat for golden sun moth and striped legless lizard has been identified as a conservation no-go zone.	No impact is proposed for the EPBC Act listed community and impacts to threatened species habitat has been minimised.
Track Slew Investigation Area C	The Investigation Area contains significant grassland vegetation and habitat for threatened species. Construction activities have been limited to the existing hard stand areas on the west of the tracks that require slewing. Vegetation and habitat to the east of the tracks will be identified as a no-go zone.	All impacts to the EPBC Act listed NTG and threatened species habitat has been avoided at this site.
Marchbanks Road Overbridge (Broadford)	Due to the presence of extensive native vegetation, the bridge was re-aligned bridge closer to existing structure to minimise construction footprint.	A total area of 2.058 ha of endangered EVCs have been avoided through re-design.
Seymour-Avenel Road Overbridge (Seymour)	Due to the presence of extensive native vegetation, also considered to be of national environmental significance, the bridge design was re-aligned bridge closer to existing structure. This has significantly reduced the construction footprint. Temporary construction areas have been identified on existing hardstands and in private land.	A significant area of 5.948 ha has been avoided of the nationally threatened grey box grassy woodland ecological community.

Investigation Area Name	Summary of measures	Reduction of impact
Track Slew Investigation Areas E, H and I	Existing stockpile and access locations to be utilised. Work will be confined to the rail formation.	All vegetation within these Investigation Areas will be avoided. This includes the nationally listed grey box grassy woodland and the Victorian listed Victorian temperate woodland bird community.
Hume Highway Seymour Precinct (Seymour)	Construction has generally been limited to the east side of the rail reserve, with minimal construction works on the west side reserve, which contains high quality woodland.	A significant area of 4.253 ha has been avoided to the nationally threatened grey box grassy woodland ecological community.
Beaconsfield Parade (Glenrowan)	Several options have been considered at this site, including track lowering and several bridge over locations. The preferred option is to construct a new bridge immediately west of the existing bridge. Works can be contained within a smaller footprint and construction activities can utilise adjacent cleared areas. This option avoids impacts to patches of vegetation that are considered to be nationally significant.	All impacts to the nationally threatened White box-yellow box-Blakely's red gum have been avoided with the proposed option.

7.4.3 Offset requirements

The extent of native patch vegetation of the current project areas, following protection and avoidance measures implemented to avoid significant vegetation and habitat, was used to run a sample scenario through the EnSym tool to understand the project offset requirements. The results of the scenario test through EnSym is provided in Appendix I.

These results exclude 0.108 ha of a patch (HFC_HZ04) at Hume Highway Overbridge (Craigieburn), which is located in the MSA. The tool assumes habitat compensation will be determined with DELWP separately and will not affect project offset requirements for the remaining vegetation. Habitat compensation requirements include for native vegetation, matted flax-lily, golden sun moth and growling grass frog. However, the NVIM tool identifies impacts and provides compensation requirements based on assumed clearing of the entire parcel. The parcel with habitat compensation is much larger than the Project Area, therefore, some of these habitat compensation requirements may not apply to the small impact within the project area. The final compensation requirements will need to be determined in consultation with DELWP to reflect the project area impact.

The impact area did not include the potential tree canopy loss and any impacts to trees immediately adjacent to the project area, which may have root zone impacts. Therefore, as per DELWP (2018), a buffer to account for canopy loss has been included in the patch impact used within the EnSym tool.

This buffer, used in early phase planning of linear infrastructure projects, ranges from 18 m to 25 m depending on density of large trees adjacent to the impacted area (DELWP 2018). For this project it is considered to be conservative and an overestimate of actual impacts. Prior to finalising the submission of these files to DELWP to gain an official offset report (required for planning approval), the extent of canopy loss would need to be determined and included in the project impact and offset calculation, in accordance with the methods noted in DELWP (2018).

Based on the current impact within the project area and with the addition of a standard buffer to estimate canopy loss (DELWP 2018), with 106 scattered trees, the project would be required to offset impacts to 25.470 ha of native vegetation, which includes 128 large trees. The maximum Location Category of the mapped vegetation was Location 2. Therefore, considering the extent and Location Category, the assessment pathway will be a Detailed Assessment Pathway.

The estimated offset requirement for this vegetation is:

- 12.563 general habitat units
- A minimum strategic biodiversity value score of 0.415
- 128 Large Trees.

The location of these offsets is spread over several catchment areas, including Port Phillip and Westernport catchment management authority (CMA), Goulburn Broken CMA and North East CMA.

Where available, which is likely in the case of only general habitat units, offsets will be sourced via a vegetation offset broker. In consideration of the size and location requirements, existing credits at several sites may need to be sourced. In the unlikely event that insufficient credits are available, any remaining offsets will need to be achieved through creation of new offsets.

In the event of impacts to the remnant patch at Hume Highway Overbridge (Craigieburn), it is recommended consultation be held with DELWP to confirm the habitat compensation requirements. This is due to the patch being location within the MSA, but outside of an identified Precinct Structure Plan.

Throughout all phases of project planning, design and construction opportunities to avoid and minimise impacts will be assessed continually. It is therefore likely that this offset requirement will be further reduced.

7.5 WILDLIFE ACT 1975

The *Wildlife Act 1975* protects all Victorian native fauna, including reptiles, amphibians, mammals and invertebrates listed under the FFG Act. All native fauna are protected on all types of land tenure. The Act is administered by DELWP and a specific application for authorisation is required from DELWP to take or keep wildlife, whether the fauna is alive or dead and includes wildlife parts such as eggs. The Act also provides for the protection of wildlife habitat and a person must not damage, disturb or destroy any habitat for native species.

A wildlife licence may be issued to 'take' wildlife for the purposes of the management, conservation, protection or control of wildlife. For the purposes of project delivery, a wildlife licence should be obtained to for the handling, capture and release of wildlife, including listed species such as brush-tailed phascogale, squirrel glider or listed woodland birds, during pre-construction and construction phases.

In the event that FFG Act listed fauna species are required to be handled during works, it is recommended consultation occur with DELWP to confirm any project-specific requirements, including relocation of individuals of listed FFG Act species, in accordance with a project wildlife licence.

7.6 CATCHMENT AND LAND PROTECTION ACT 1994

The *Catchment and Land Protection Act 1994* (CaLP Act) sets Victoria's objectives for the integrated management and protection of catchments, including control of noxious weeds and pest animals. Under the provisions of the CaLP Act, the landowner is required to control noxious weeds and pest animals on their land.

Key objectives of the CaLP Act in relation to the control of weeds and pest animals are:

- regulated and integrated management of noxious weeds and pest animals
- prohibiting the movement and sale of noxious weeds of all categories anywhere in the state

- addressing weed seeds occurring as contaminants in seed lots or other plant products.

Under Section 20 of the CaLP Act, all landowners, including public authorities and licensees of Crown lands, must, in relation to their land, take all reasonable steps to:

- avoid causing or contributing to land degradation which causes or may cause damage to land of another landowner
- conserve soil
- protect water resources
- eradicate regionally prohibited weeds
- prevent the growth and spread of regionally controlled weeds
- prevent the spread of, and as far as possible eradicate, established pest animals.

Construction works will need to consider the requirements of the CaLP Act, including preventing the growth and spread of regionally controlled weeds and managing potential land degraded through construction, by protecting waterways and controlling sediment and land stability. The applicable noxious weeds to consider for each investigation area are included in Tables 30 and 31.

7.7 WATER ACT 1989

The *Water Act 1989* governs water entitlements and establishes the framework for management of Victoria's water resources. Under the Act, works and activities in, under, on or over the bed and banks of Designated Waterways in Victoria require a permit from the relevant CMA. Designated waterways are named or unnamed, permanent or seasonal, and range in size from a river to a natural depression. Designated waterways are declared under the *Water Act 1989*.

Dependent on the nature of the proposed works, the CMA can exempt an activity from the need to obtain a permit. Consultation with the CMAs is recommended to determine application requirements and/or whether any exemptions are applicable.

Impacts to waterways is predicted to be negligible, due to minimal disturbance to the structures over the waterways. Minor impacts may occur through drainage works to the banks of the waterways. Based on current proposed impacts, works on waterways permits may be required at the following locations:

- Broadford Road Overbridge (Wandong); Dry Creek - Goulburn Broken CMA
- Short Street Overbridge (Broadford) and Marchbanks Road Overbridge (Broadford); Sunday Creek tributary – Goulburn Broken CMA
- Wangaratta Precinct (Wangaratta); One Mile Creek – North East CMA.

Requirements under the *Water Act 1989* should be reviewed as detailed designs are progressed.

8 Mitigation measures

8.1 RECOMMENDED MITIGATION MEASURES

Mitigation measures are recommended in this report to minimise the impact to significant biodiversity values recorded in the investigation areas.

General mitigation measures to protect and minimise impacts to biodiversity will be implemented for the protection of key ecological features, including waterways, larger intact areas of native vegetation, large trees, particularly in the VTWBC recorded sites and measures to maintain connectivity in the landscape. Further consideration of rope bridges and glider poles, to mitigate impacts to the FFG Act-listed squirrel glider and brush-tailed phascogale, is recommended to occur during detailed design.

Construction activities should seek to further reduce ecological impacts through targeting cleared areas, existing laydown and stockpile locations, and existing access tracks. Specific environmental control measures based on a risk-based approach to ecological values should be detailed in Site Environmental Management Plans for works.

Specific mitigation measures for each investigation area are included in Table 36, below. The mitigation measures should be read in conjunction with the mapped ecological features in Appendix D.

Table 36 Summary of mitigation measures for each investigation area

Investigation area name	Summary of recommended mitigation measures
PROJECT AREAS LOCATED SOUTH OF BEVERIDGE	
McIntyre Road Overbridge (Sunshine)	Avoid scattered tree north of McIntyre Road Bridge. Target existing cleared area adjacent to McIntyre Road as stockpile location and access point. Grassland patches and potential habitat is recommended to be avoided, including area that has not yet been assessed. Further construction investigation recommended to avoid impacts to mapped grassland and habitat. Avoid construction activities in the adjacent private land, outside the project area, in areas which contains high quality grassland habitat. Existing access and disturbed areas may be used.
Keilor Park Drive Overbridge (Keilor East)	Minimise impacts to patches of plains grassland that occur south east of the bridge. Target existing stockpile locations and access points on the north side of the bridge.
Signal Gantry 6	No native patch, scattered trees or significant habitat values are present within the investigation area. General environmental mitigation measures will be employed for the works.
Calder Freeway Precinct (Keilor East)	Retain low quality grassland patches on the north side of the rail reserve, located along the fence line on top of a cutting. Where possible, retain low quality grassland patch to the south of the rail reserve.

Investigation area name	Summary of recommended mitigation measures
	Potential habitat and grassland vegetation located at the northern end of the investigation area adjacent to Steele Creek and the associated wetland has been identified as a no-go zone. Target other cleared areas for stockpiling and access.
Westfield Drive Overbridge (Tullamarine)	Retain low quality grassland patches to the north of Westfield Drive Bridge, if possible. Use existing lay down areas east of Westfield Drive Bridge.
Tullamarine Freeway Precinct (Strathmore Heights)	Where possible, minimise impacts to native patch, scattered trees and low quality golden sun moth and striped legless lizard habitat west of Melrose Drive. Utilise existing access tracks and stockpile locations to avoid impacts to the native vegetation patch.
Track Slew Investigation Area A	Works to avoid mapped patches of exotic grassland habitat for golden sun moth, where possible.
Belair Avenue Overbridge (Glenroy)	No native patch, scattered trees or significant habitat values are present within the investigation area. General environmental mitigation measures will be employed for the works.
Pascoe Vale Road Overbridge (Glenroy) & Jacana Station Footbridge (Glenroy)	No native patch, scattered trees or significant habitat values are present within the investigation area. General environmental mitigation measures will be employed for the works.
Camp Road Overbridge (Broadmeadows)	No native patch, scattered trees or significant habitat values are present within the investigation area. General environmental mitigation measures will be employed for the works.
Riggall Street Overbridge (Broadmeadows)	Avoid scattered trees on the north side of the rail reserve. Utilise existing stockpile locations and access points.
Barry Road Overbridge (Dallas)	The project area that borders the biosite on the west side of the rail reserve, south of the Barry Road bridge has been excised from the project area or identified as a no-go zone. The area outside of the investigation area should be nominated as a conservation no-go area to avoid impacts to golden sun moth, NTG and larger-flower crane's-bill.
Signal Gantry 14	No native patch, scattered trees or significant habitat values are present within the investigation area. General environmental mitigation measures will be employed for the works.
Hume Highway Overbridge (Craigieburn)	Where possible minimise impacts at the northern end of the investigation area near Malcolm Creek, where potential NTG and threatened species habitat is present. Utilise existing disturbed areas on the west side of the rail.
PROJECT AREAS LOCATED NORTH OF BEVERIDGE	
Track Slew Investigation Area C	High quality grassland and threatened species habitat to the east of the project area has been avoided. Review further opportunities to retain the large swamp gum in the centre of the project area, where possible.
Broadford Road Overbridge (Wandong)	The investigation area has limited ecological values. General environmental mitigation measures will be employed for the works.

Investigation area name	Summary of recommended mitigation measures
Signal Gantry 15	Utilise existing ballast stockpile location and access point from the adjacent Dry Creek Road. Most of the native vegetation is located along the narrow strip of rail reserves on top of the cutting, well above the signal gantry. It is expected that this vegetation will not be impacted. Works should review opportunities to access and conduct works from the existing rail formation.
Signal Gantry 16	Native vegetation within the investigation area is located well above the signal gantry, which is in a deep cutting. It is expected that this vegetation will not be impacted. Works should be designed to be completed via the rail formation.
Signal Gantry 17	Native vegetation is located to the west and east of the rail reserve outside the investigation area. Contain any works to disturbed ballast areas within the investigation area only. Works should review opportunities to access and conduct works from the existing rail formation.
Hamilton Street Overbridge (Broadford)	Avoid siting construction activities near native vegetation, particularly higher quality vegetation on the north (down) side of the bridge. Utilise existing stockpile locations on the up side of the bridge and around Broadford Station. Utilise existing access points.
Short Street Overbridge (Broadford)	Vegetation and habitat to the south of the bridge along the northern rail reserve has been avoided. Avoid siting construction activities near native vegetation, particularly higher quality vegetation on the down side of the bridge. Review further opportunities to utilise existing stockpile locations on the down side of the bridge around existing access points from adjacent roads, where there is minimal native vegetation and habitat. Revegetate areas of woodland habitat in areas not required for road and rail operations to minimise impact of fragmentation and habitat loss to woodland-dependent fauna.
Marchbanks Road Overbridge (Broadford)	The project area has been revised to minimise impacts to native vegetation, including large river red gums. Temporary construction impacts have been sited on cleared land in adjacent private land. Revegetate areas of woodland habitat in areas not required for road and rail operations to minimise impact of fragmentation and habitat loss to woodland-dependent fauna.
Signal Gantry 18	Where possible, minimise impacts to native patch. Where possible, contain any works to disturbed ballast areas within the Investigation Area only. Utilise existing access points and stockpile areas north east of the investigation area, avoiding tree protection zones.
Signal Gantry 19	Native vegetation is located to the west and east of the rail reserve. Where possible, minimise impacts to native patch. Works should review opportunities to access and conduct works from the existing rail formation.
Hume Highway Tallarook Precinct (Tallarook)	Review options to further reduce impacts to high quality areas, particularly those that are contiguous with adjacent road reserve woodland habitat. Utilise existing cleared areas, particularly the cleared paddocks to the north east of the crossing. Retain large trees, particularly hollow-bearing trees, where possible.

Investigation area name	Summary of recommended mitigation measures
	To the south west of the Hume Highway Bridge, further review options to retain the existing retaining wall. This will protect the adjacent woodland that is located immediately adjacent to the retaining wall.
Track Slew Investigation Area D	The slew has been split between two tracks to contain works within the rail formation. Access has been identified from adjacent road, which also includes existing laydown areas.
Track Slew Investigation Area E	The current method is to complete the slew via hi-rail, due to the small width of the slew. If access is required, the existing access track should be utilised. No impacts to habitat and vegetation will occur at this location.
Track Slew Investigation Area F	No native patch, scattered trees or significant habitat values are present within the investigation area. No mitigation measures are currently proposed.
Seymour Avenel Road Overbridge (Seymour)	The project area has been revised to minimise impacts to native vegetation, including vegetation considered to be the nationally listed ecological community. Temporary construction impacts have been sited on cleared land in adjacent private land. Further construction planning should consider the significance of the vegetation, targeted previously disturbed and modified areas if additional construction areas are required. Construction personnel should also be made aware of the significance of the vegetation during works.
Hume Highway Seymour Precinct (Seymour)	The project area has been revised to minimise impacts to native vegetation, including vegetation considered to be the nationally listed ecological community on the western (down) side rail reserve. Temporary construction impacts have been sited on cleared land in adjacent private land. Existing access points from Seymour-Avenel Road Overbridge (Seymour) should also be utilised. Further construction planning should consider the significance of the vegetation, targeted previously disturbed and modified areas if additional construction areas are required. Construction personnel should also be made aware of the significance of the vegetation during works.
Track Slew Investigation Area H	The narrow slew width at this location will result in works being conducted via hi-rail. No disturbance is required to the adjacent vegetation which is an endangered ecological community. Any access requirements should be via the east (Up) side of the rail tracks, where existing access runs parallel to the tracks.
Track Slew Investigation Area I	The narrow slew width at this location will result in works being conducted via hi-rail. No disturbance is required to the adjacent vegetation which is an endangered ecological community. Any access requirements should be via the east (Up) side of the rail tracks, where existing access runs parallel to the tracks.
Anderson Street Overbridge (Euroa)	Construction planning should review options to retain scattered trees along the rail reserve boundary, west of the bridge. Utilise the existing rail depot on the north side of Euroa station.
Benalla Station Approach Road Overbridge (Benalla)	Review options to retain scattered trees and remnant patch within the project area. Preservation of large trees should be prioritised for works.
Beaconsfield Parade Overbridge (Glenrowan)	Patches of an endangered ecological community at the eastern (down) end of the investigation area. These patches have been excluded from the project area and are

Investigation area name	Summary of recommended mitigation measures
	located approximately 400 m east of the project area; however, should be identified as significant values in the surrounding region to avoid. Construction activities should utilise existing access points and cleared areas for laydown.
Wangaratta Precinct (Wangaratta)	Review options to retain the vegetation along One Mile Creek, west of Green Street. Retain large trees, where possible. Utilise existing disturbed areas within the station precinct for construction activities.
Murray Valley Highway Overbridge (Barnawartha North)	Protect native patch and scattered trees, where possible. Utilise existing stockpile locations and access tracks for construction activities.
Murray River Underbridge (Albury)	Areas of woodland habitat, including large river red gums and associated tree protection zones have been avoided within the project area, which utilises existing access and laydown areas.

9 Conclusion and Recommendations

The majority of project areas have minimal biodiversity value and are located within high activity areas around Melbourne and regional towns. Areas with higher quality vegetation and habitat were found to be in a small number of regional project areas, north of Beveridge, where the vegetation and habitat was contiguous with larger patches, extending into adjacent road reserves, providing linear habitat corridors within the landscape.

Design and construction plans have been modified to avoid significant areas of vegetation and habitat and to minimise impacts where avoidance is not possible. The project has significantly reduced potential impacts to values such as threatened ecological communities and habitat for threatened flora and fauna.

All project works south of Beveridge are on hold until the preferred location of the intermodal terminal is determined. The predicted impact within the project areas north of Beveridge includes significant impacts to a MNES - GBGW community. Although the impact is predicted to occur to only 0.001 per cent of the remaining community within Victoria, it is a significant extent of removal and potential fragmentation of the community within the surrounding landscape. This predicted impact will require the project to be referred to the Commonwealth Environment Minister under the EPBC Act.

A potentially significant area of habitat for the FFG Act-listed VTWBC is predicted to be lost. This community occurs within five Project Areas and the extent of impact (7.501 ha) may be considered a significant area of the remaining habitat for the community in Victoria. It is therefore considered that the impact to community meets the EES referral trigger, as part of a combination criteria for the 'potential loss of a significant area of a listed ecological community' (DSE 2006).

There are predicted impacts to potential habitat for several EPBC Act and FFG Act listed threatened flora and fauna species. Assessments of significance are based on databases searches, and several ecological assessments completed over a three-year period, from 2016 (WSP/PB 2016) to 2019. These assessments provide a reasonable level of confidence in determining that there is unlikely to be a significant impact on any listed flora or fauna species within the project areas. Fundamental to this assessment is that a population or critical habitat is required to be present for the impact to be considered significant under relevant state and commonwealth policy and/or guidelines.

The habitat present has been assessed as not critical, more likely to be part of a habitat corridor, and no records or surveys have identified populations of threatened species within the project areas north of Beveridge. Appropriate management and mitigation actions for FFG Act listed species, brush-tailed phascogale, squirrel glider and barking owl, including potential use of gliding poles and rope bridges will need to be addressed.

For project areas located south of Beveridge, there are potentially significant impacts to the EPBC Act listed ecological community, NTG. This community is also considered to qualify as the FFG Act listed, western (basalt) plains grassland community. Potential habitat for threatened flora and fauna is also scattered across project areas, mostly in isolated locations. These isolated and small habitats for threatened flora and fauna currently indicate that the predicted impact to potential habitat for the species is not considered significant.

Should any sites be constructed south of Beveridge following the selection of the preferred location of the intermodal terminal an EPBC referral self-assessment should be made, which may require further survey to confirm impacts to EPBC Act listed flora and fauna.

9.1 LEGISLATIVE REQUIREMENTS

Based on the current project areas and reference design for each location, the predicted project impacts will require consideration under the following key pieces of legislation:

- Referral, and likely assessment, under the EPBC Act
- An EES referral under the Victorian EE Act, due to meeting combination referral criteria
- A permit to take protected flora, for listed threatened and protected listed species
- A management authorisation under the *Wildlife Act 1975*
- Planning approval for native vegetation removal under several planning schemes, including meeting offset requirements (DELWP 2017b), currently estimated to be:
  - 12.563 general habitat units
  - A minimum strategic biodiversity value score of 0.415
  - 128 Large Trees

The estimated offset obligation is conservative, including tree buffers to account for tree canopy loss within retained areas of dissected patches, and is expected to be reduced further. If the project is restricted to sites north of Beveridge, the proposed impacts still trigger referrals under the EPBC Act and the EE Act, although impacts to several significant ecological values, located south of Beveridge, would be avoided.

However, these preliminary offset calculations exclude predicted impacts for overhead powerline sites, which have been assessed for their ecological impacts in a separate report (KBR 2020c). Once confirmed, impacts for overhead powerlines will need to be included in the offset calculations to determine the overall project offset requirement.

9.2 RECOMMENDATIONS

The following recommendations are made based on the ecological assessments completed that informed this report:

- Further review of works and project areas should be completed to retain significant habitat features, primarily habitat for threatened species, such as large trees.
- Any opportunities to further reduce disturbance within project areas should include prioritisation of existing disturbed areas, utilising existing access tracks and stockpile and laydown locations to minimise impacts to vegetation and habitat
- Impacts to extensive woodland habitats should be minimised through revegetating areas not required for operations or maintenance with indigenous woodland plant species
- Complete further targeted surveys to confirm impact assessment on threatened flora and fauna species, see below.

9.2.1 Further targeted survey

The assessment has noted restrictions on being able to determine presence or absence of threatened species. The assessment of impacts to listed threatened flora and fauna have been conservative and based on the assumption that species are present and there is potential for populations to be present based on the current condition and extent of habitat.

While impacts are unlikely to be significant, there are potential impacts to habitat for individuals of FFG Act listed species, brush-tailed phascogale, squirrel glider and barking owl. It is recommended that

impacts to woodland habitat for each species is mitigated, including through revegetating areas not required for future operations and potential installation of gliding poles and rope bridges to facilitate movement of brush-tailed phascogale and squirrel glider. Target species and communities, with optimal survey periods, are provided below (Table 37).

Table 37 Species and communities recommended for further survey

Species	Survey period	Survey Locations	Completed Surveys*
PROJECT AREAS SOUTH OF BEVERIDGE			
Golden sun moth	During the local flying season, generally November to January	McIntyre Road Overbridge (Sunshine), Calder Freeway Precinct (Keilor East), Track Slew Investigation Area A, Barry Road Overbridge (Dallas), Hume Highway Overbridge (Craigieburn)	South of Beveridge – not required for T2A - Stage 1
Striped legless lizard	Recommended tile surveys, with tiles laid in June/July, with checks occurring over a 6-month period, concentrated	McIntyre Road Overbridge (Sunshine), Calder Freeway Precinct (Keilor East), Barry Road Overbridge (Dallas), Hume Highway Overbridge (Craigieburn)	South of Beveridge – not required for T2A - Stage 1
Growling grass frog	October-December	Calder Freeway Precinct (Keilor East), Hume Highway Overbridge (Craigieburn)	South of Beveridge – not required for T2A - Stage 1
Spiny rice-flower	April-August	McIntyre Road (Sunshine)	South of Beveridge – not required for T2A - Stage 1
Matted flax-lily	November-December	Hume Highway Overbridge (Craigieburn)	South of Beveridge – not required for T2A - Stage 1
Large-flowered crane's-bill	November to December	Hume Highway Overbridge (Craigieburn)	South of Beveridge – not required for T2A - Stage 1
Tough scurf-pea	September-November	McIntyre Road (Sunshine)	South of Beveridge – not required for T2A - Stage 1
NTG	November-December	Hume Highway Overbridge (Craigieburn)	South of Beveridge – not required for T2A - Stage 1
PROJECT AREAS NORTH OF BEVERIDGE			
Euroa guinea-flower	September to November	Seymour Avenel Road Overbridge (Seymour), Hume Highway Seymour Precinct (Seymour)	Completed September - October 2019
Crimson spider-orchid	September-October	Seymour Avenel Road Overbridge (Seymour), Hume Highway Seymour Precinct (Seymour)	Completed September - October 2019
Purple diuris	October-November	Seymour Avenel Road Overbridge (Seymour),	Completed September - October 2019

Species	Survey period	Survey Locations	Completed Surveys*
		Hume Highway Seymour Precinct (Seymour)	
Brush-tailed phascogale	Spring and autumn	Hume Highway Tallarook Precinct (Tallarook), Seymour Avenel Road Overbridge (Seymour), Hume Highway Seymour Precinct, (Seymour)	Nil
Squirrel glider	Spring and autumn	Hume Highway Tallarook Precinct (Tallarook), Seymour Avenel Road Overbridge (Seymour), Hume Highway Seymour Precinct, (Seymour)	Nil
Woodland birds	Generally in spring, September to November. Also during autumn and winter (March to July), where winter flowering trees are present.	Short Street Overbridge (Broadford), Marchbanks Road Overbridge (Broadford), Hume Highway Tallarook Precinct (Tallarook), Seymour-Avenel Road Overbridge (Seymour), Hume Highway Seymour Precinct (Seymour)	Completed July 2019
Regent honeyeater	September to November (conspicuous during breeding season) March to July (conspicuous as large groups gather in winter-flowering eucalypts)	Short Street Overbridge (Broadford), Marchbanks Road Overbridge (Broadford), Hume Highway Tallarook Precinct (Tallarook), Seymour Avenel Road Overbridge (Seymour), Hume Highway Seymour Precinct (Seymour)	Completed July 2019
Swift parrot	March to July	Short Street Overbridge (Broadford), Marchbanks Road Overbridge (Broadford), Hume Highway Tallarook Precinct (Tallarook), Seymour Avenel Road Overbridge (Seymour), Hume Highway Seymour Precinct (Seymour)	Completed July 2019
Barking Owl	April to June	Short Street Overbridge (Broadford), Marchbanks Road Overbridge (Broadford), Hume Highway Tallarook Precinct (Tallarook), Seymour Avenel Road Overbridge (Seymour),	Nil

Species	Survey period	Survey Locations	Completed Surveys*
		Hume Highway Seymour Precinct (Seymour)	

*Results of completed surveys are reported in:

- Inland Rail Phase 2 Tottenham to Illabo Technical & Approvals Consultancy Services, Threatened Flora Survey Report 2-0001-200-EAP-00-RP-0014. (KBR, 2020b)
- Inland Rail Phase 2 Tottenham to Illabo Technical & Approvals Consultancy Services, Overhead Powerline Biodiversity Assessment Report 2-0001-200-EAP-00-RP-0018. (KBR, 2020c)

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