STAR OF THE SOUTH

Victorian Environment Effects Statement

Chapter 8 – Onshore ecology

Chapter 8 Onshore ecology

8.1 Introduction

This chapter summarises the existing conditions related to onshore ecology and assesses the impacts and risks associated with the construction, operation and decommissioning of works in Victoria associated with the Star of the South Offshore Wind Farm Project (works in Victoria). The chapter describes how impacts will be avoided, minimised or managed.

Ecology

Refers to native flora (plants) and fauna (animals) and their supporting environments

This chapter is based on the impact assessment presented in *Technical Report G – Onshore Ecology.* This chapter covers Victorian legislated onshore ecological aspects only. Commonwealth legislated onshore ecology aspects are covered in the Commonwealth Environmental Impact Statement.

8.2 Assessment scope

The study objective for Victorian regulated onshore ecology is to assess and avoid, minimise or offset potential adverse effects on native vegetation, habitats, listed threatened species and ecological communities, migratory species, and other protected flora and fauna. This includes avoiding impacts within the more ecologically significant areas of McLoughlins Beach-Seaspray Coastal Reserve (noting this area is largely avoided through boring underneath at the shore crossing) and Woodside Bushland Reserve H28.

All detailed technical methodologies and assessment on onshore ecology can be found in *Technical Report G – Onshore Ecology*.

8.2.1 Victorian matters

The EES scoping requirements issued by the Victorian Minister for Planning include a set of evaluation objectives that identify the desired outcomes to be achieved in managing the potential impacts of works in Victoria during construction, operation and decommissioning. The following EES evaluation objective is relevant to onshore ecology:

To avoid, and where avoidance is not possible, minimise, potential adverse effects on protected native vegetation and listed threatened species and their habitat and listed ecological communities, in both onshore and offshore environments, as well as address offset requirements consistent with state policies.

Further information about the EES scoping requirements is listed in *Attachment IV – EES Scoping Requirements Checklist*.

8.3 Evaluation framework

8.3.1 Key legislation, policy, guidelines and standards

Table 8-1 lists the key legislation, policy, guidelines and standards relevant to onshore ecology in Victoria. Refer to *Chapter 5 – Victorian Legislative Framework* for further details.

Table 8-1 Key legislation, policy, guidelines and standards

Type	Applicable legislation, policy, guideline or standard
Victorian legislation	*Flora and Fauna Guarantee Act 1988*
	Wildlife Act 1975
	Planning and Environment Act 1987
	Catchment and Land Protection Act 1994
	Water Act 1989
	Crown Land (Reserve) Act 1978
	Guidelines for the removal, destruction or lopping of native vegetation (DEECA 2025)
Local government	Wellington Planning Scheme

8.3.2 Assessment criteria

To assess the works in Victoria, predicted impacts and risks are compared to criteria that set required environmental performance outcomes (refer *to Chapter 6 – Assessment Framework*). The criteria for onshore ecology are derived from legislation and policy, relevant standards and guidelines, stakeholder feedback and industry best practice.

The assessment criteria are defined as where impacts on onshore ecology could impact on Victorian legislated ecological values that include:

- Native vegetation with impacts based on:
  - Ecological vegetation class extent
  - Large trees
  - Endangered ecological vegetation classes
  - Department of Energy, Environment and Climate Action (DEECA) mapped wetlands.
- Named waterways
- Threatened flora species listed under the *FFG Act*

- Terrestrial fauna species listed under the FFG Act
- Connectivity (number of threatened terrestrial fauna species affected by habitat fragmentation).

8.4 Methods

The purpose of the onshore ecology impact assessment was to assess the potential onshore ecology impacts and risks of works in Victoria.

Impacts refer to the consequences of planned project actions, which are given a rating determined by combining the magnitude of the impact and the sensitivity of the receptor.

Risks are an unexpected (accidental) event and are determined by combining the likelihood of an event occurring and the consequences that would result if the event were to occur.

The technical chapters consider **key impacts and risks** with a residual consequence rating of moderate to severe. **Other impacts and risks** are those with a residual consequence rating of negligible to minor.

Refer to *Chapter 6 – Assessment Framework* for more detail on how impact and risk ratings are derived.

The assessment was achieved by undertaking the following key tasks:

- Defining a study area which includes the onshore project area where direct impacts could occur plus a 15-metre buffer to allow for the assessment of indirect impacts (refer to Figure 8-1 and Figure 8-2). It is not intended to clear the 15-metre buffer area (indirect impacts). However, it has been included in figures for impacted native vegetation to provide a conservative worse case assessment.
- Reviewing national, state and local legislation relevant to the protection of onshore ecology
- Characterising existing conditions and identifying sensitive assets, values and uses (including through field surveys and consultation)
- Reviewing the *Chapter 4 - Victorian Works Project Description* to determine the location, type, timing, extent, intensity, and duration of potential interactions with sensitive receptors
- Defining the maximum design scenario(s) based on project design envelope parameters that provide the basis for impact assessment. This is defined further in *Technical Report G – Onshore Ecology*

- Undertaking a proportional assessment of risks and impacts, based on the outcomes of the initial assessment of issues and consultation insights, to examine the potential severity, extent and duration of identified issues
- Evaluating predicted outcomes against performance benchmarks and assessment criteria derived from applicable legislation, policy and standards
- Identifying mitigation measures where necessary to address potentially significant environmental impacts
- Evaluating residual environmental impacts and risks against assessment criteria, taking into account the proposed mitigation measures and likely effectiveness.

Figure 8-1 Onshore project area and study area

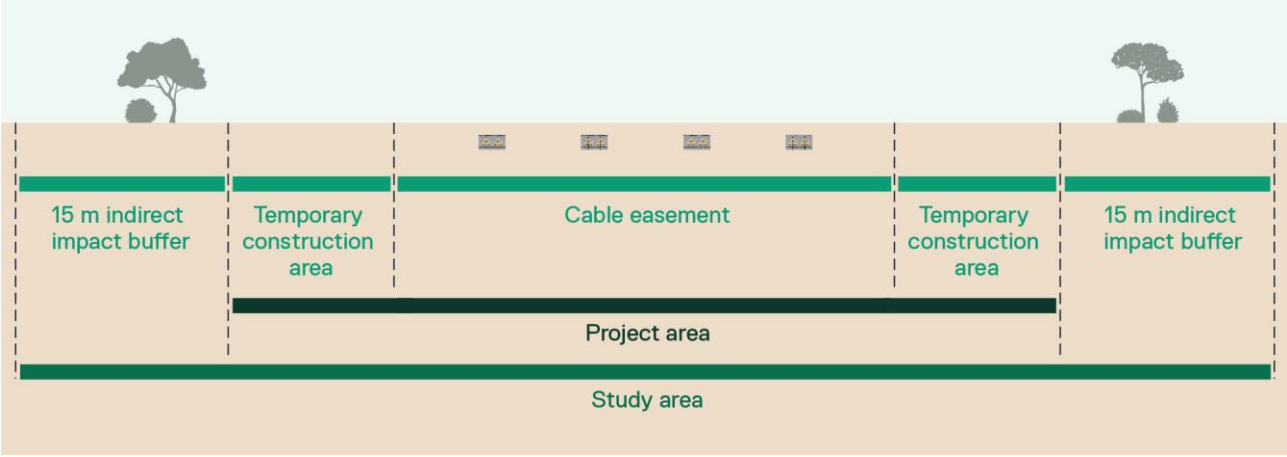
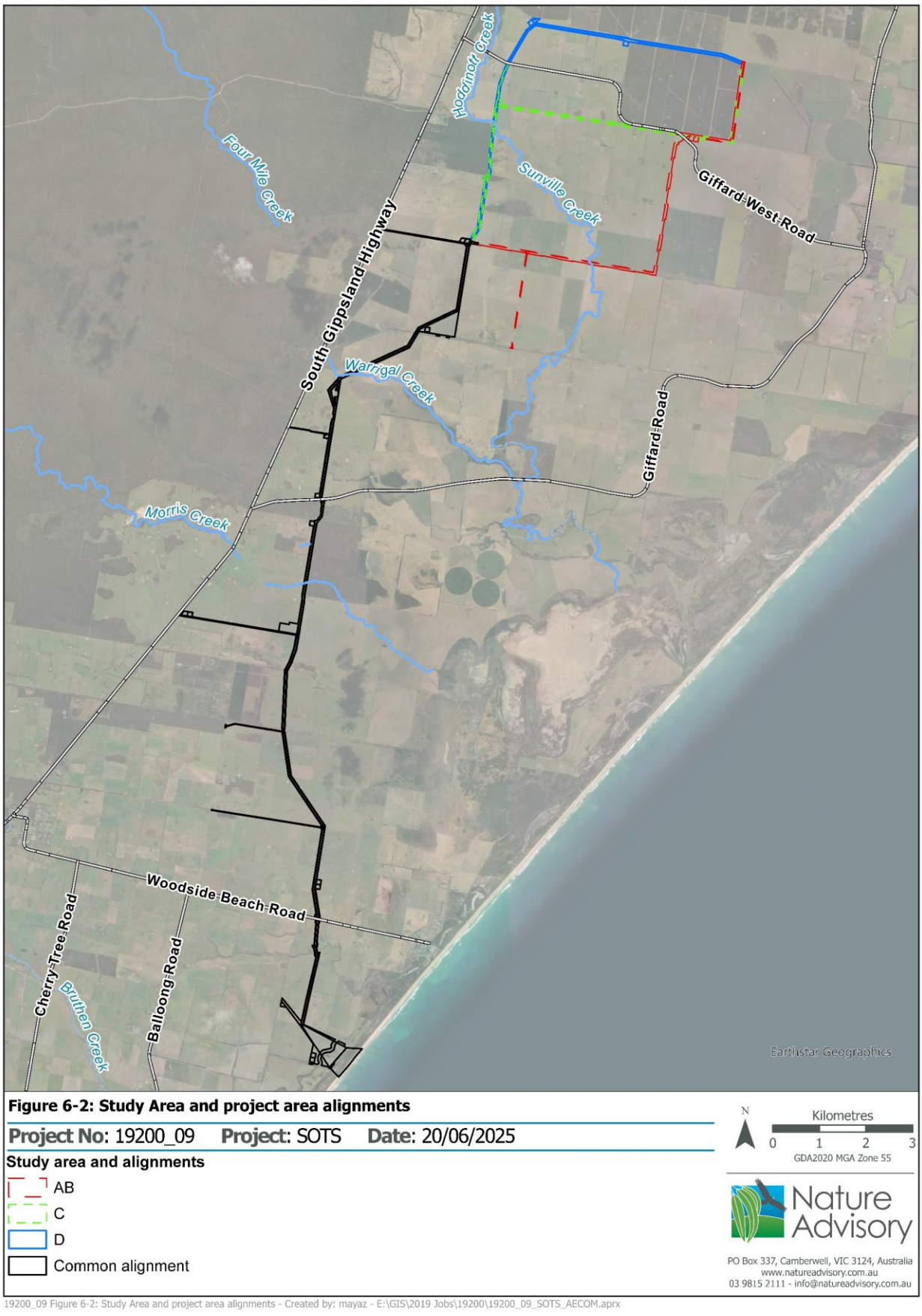


Figure 8-2 Study area and alignments



8.5 Existing environment

This section describes the existing conditions within the study area as they relate to Victorian legislated onshore ecology. The study area is defined as the onshore project area boundary plus a 15-metre buffer for assessment of indirect impacts. This section provides a description of the following existing environment elements:

- Landscape description
- Native vegetation
- Trees
- Wetlands
- Threatened communities
- Threatened flora
- Threatened fauna
- Groundwater dependent ecosystems
- Conservation reserves and environmental overlays
- Weeds and pests.

8.5.1 Landscape description

The works in Victoria are located within the coast of central Gippsland across two distinct landscapes:

- Coastal and near-coastal areas
- Plains and lowland plains.

Coastal and near-coastal landscapes are comprised of dunes, which separate the beachfront from the inland environments. The plains and lowland plains landscapes consist of low elevation plains, interspersed with ephemeral waterways.

Both landscape types are generally considered to be altered from an ecological, pre-settlement perspective due to the historic and current day agricultural land uses.

Ephemeral waterway

Watercourses that are typically dry or have very limited flow for most of the year

8.5.2 Native vegetation

In Victoria, planning schemes define native vegetation as 'plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses.' The Victorian *Guidelines for the removal, destruction or lopping of native vegetation* (the Guidelines) further classify native vegetation as either a 'patch' or a 'scattered tree.' This section discusses native vegetation classified as a patch. Further discussion on native vegetation classified as a scattered tree is detailed in Section 8.5.3.

Native vegetation across the works in Victoria is highly fragmented. The most intact native vegetation is associated with the conservation reserves along the coastline (McLoughlins Beach-Seaspray Coastal Reserve) and a former native forest timber production plot (Woodside H28 Bushland Reserve) (refer to Figure 7-2 in *Technical Report G – Onshore Ecology*). Smaller pockets of native vegetation are also scattered throughout the largely agricultural landscape and are typically associated with ephemeral waterways, roadside vegetation and scattered trees. Planted vegetation exists along an unnamed waterway (UFI:42806331), and along various fence lines throughout the study area.

Vegetation types based on ecological vegetation class classifications recorded within the onshore project study area for each alignment option are summarised in Table 8-2.

Further details of extent of native vegetation within the study area can be found in *Technical Report G – Onshore Ecology*.

Table 8-2 Total native ecological vegetation types within the study area

Ecological vegetation class	Ecological vegetation class number	Bioregional Conservation Status	Pre mitigation extent impacted within study area (hectares) #		
			Common alignment & option AB	Common alignment & option C	Common alignment & option D
Mapped Wetland	74	Endangered	0.003	0.003	0.003
Coast Banksia Woodland#	2	Vulnerable	0.02	0.02	0.02
Damp Sands Herb-rich Woodland	3	Vulnerable	0.63	0.63	0.63
Estuarine Wetland	10	Least Concern	0.94	0.94	0.94
Lowland Forest	16	Vulnerable	1.06	1.59	1.03
Heathy Woodland	48	Least Concern	-	3.95	-
Swamp Scrub	53	Endangered	1.37	1.35	1.35
Plains Grassy Forest	151	Vulnerable	12.77	17.81	17.93
Coastal Dune Scrub	160	Depleted	0.1	0.1	0.1
Riparian Scrub	191	Vulnerable	1.74	1.31	1.31
Lowland Forest/Heathy Woodland Mosaic	698	Vulnerable	3.90	1.96	1.96
Total area – ecological vegetation class			**22.53**	**29.67**	**25.26**
Total area – study area			**438.7**	**423.2**	**418.4**

excludes area of McLoughlins Beach–Seaspray Coastal Reserve avoided through boring of shore crossing area

The predominant ecological vegetation classes within the study area are Plains Grassy Forest and Lowland Forest / Heathy Woodland Mosaic. Examples of these vegetation types are described in Table 8-3, Table 8-4 and Table 8-5 below.

Table 8-3 Plains Grassy Forest

Ecological vegetation class description	Condition	Example
Open forest to 20 m tall, often above a heathy shrub layer and a diverse grassy, sedgy and herbaceous ground layer. Occurs on lowland plains and old river terraces made up of gravelly, sandy clays.	Plains Grassy Forest of varying quality was widespread across the study area and was characterised by a canopy of mixed Eucalypt species. High-quality Plains Grassy Forest was generally characterised by greater densities/lengths of large trees and logs, while poorer quality examples of the ecological vegetation classes generally lacked these features.	

Table 8-4 Lowland Forest

Ecological vegetation class description	Condition	Example
Eucalypt forest to 20 m tall on relatively fertile, moderately well-drained soils in areas of relatively high rainfall. Characterised by the diversity of life forms and species in the understorey including a range of shrubs, grasses and herbs.	Lowland Forest typically consisted of a mix of Eucalyptus species in the canopy layer and shrub and grass species in the understorey.	

Table 8-5 Heathy Woodland

Ecological vegetation class description	Condition	Example
Eucalypt-dominated low woodland to 10 m tall lacking a secondary tree layer and generally supporting a diverse array of narrow leaved shrubs except where frequent fire has reduced this to a dense cover of bracken.	Moderate-quality areas were absent of large trees, with lower recruitment of woody species. Low-quality areas were represented by managed strips of the ecological vegetation class with no overstorey or logs and low understorey diversity. Understorey throughout the study area included relatively high cover of shrubs.	

8.5.3 Trees

Scattered tree

A tree in isolation of other native vegetation

This assessment considers only native trees, as defined by the Guidelines. The Guidelines classify trees by their size (small or large trees) and by their location (occurring in patches of native vegetation or being scattered) (refer to Figure 7-3 in *Technical Report G – Onshore Ecology*). The Guidelines require individual assessment of small and large scattered trees and large trees in patches. Within the study area across the three alignment options, the numbers of trees recorded range from 200 to 347 scattered trees and 115 to 149 large trees in patches. The number of trees within the onshore project study area for each alignment option is provided in Table 8-6. A list of species recorded within the study area is shown in Table 8-7. For the purposes of assessing fauna habitat, all large trees identified were assumed to contain hollows.

Further details of trees and species within the study area can be found in *Technical Report G – Onshore Ecology.*

Table 8-6 Number of native canopy trees in the study area

	Common alignment & option AB			Common alignment & option C			Common alignment & option D		
	Large tree in patch	Large scattered tree*	Small scattered tree	Large tree in patch	Large scattered tree*	Small scattered tree	Large tree in patch	Large scattered tree*	Small scattered tree
Number of trees	115	150	50	149	238	109	126	183	47

* Trees identified through aerial photographs are assumed to be large scattered trees

Table 8-7 Native canopy tree species in the study area#

Species	*Common name*
Eucalyptus angophoroides	Apple-top Box
Eucalyptus bosistoana	Coast Grey-box
Eucalyptus bridgesiana	Apple box
Eucalyptus bridgesiana s.s.	But But
Eucalyptus consideniana	Yertchuk
Eucalyptus croajingolensis	Gippsland Peppermint
Eucalyptus macrorhyncha	Red Stringybark
Eucalyptus melliodora	Yellow Box
Eucalyptus muelleriana	Yellow Stringybark
Eucalyptus obliqua	Messmate stringybark
Eucalyptus ovata	Swamp Gum
Eucalyptus sp.	N/A
Eucalyptus viminalis	Manna Gum
Eucalyptus viminalis subsp. pryoriana	Gippsland Manna Gum
Eucalyptus viminalis subsp. viminalis	Manna Gum

8.5.4 Wetlands

8.5.4.1 Ramsar wetlands

Ramsar wetlands are wetlands of international importance designated under the Ramsar Convention. Ramsar wetlands are protected for their important habitat for international migratory shorebirds. The Corner Inlet Ramsar site is the closest Ramsar wetland to the works in Victoria. The wetland is located at the mouth of the Bruthen Creek estuary. Unnamed waterway (UFI:42806331), an ephemeral watercourse, feeds into Bruthen Creek infrequently.

8.5.4.2 Modelled wetlands

Review of modelled wetlands through the Victorian Department of Energy, Environment and Climate Action's Current Wetlands Map identified one mapped wetland (ID 83488) within the study area. The mapped wetland is located on private farmland used for beef grazing.

8.5.5 FFG Act listed communities

No threatened communities listed under the FFG Act were recorded within the study area. FFG Act threatened communities are therefore not discussed further in this chapter.

8.5.6 FFG Act listed threatened and protected flora

Targeted surveys were undertaken for 27 FFG Act listed threatened and protected flora species which, from desktop review were known and considered likely or possibly occurring within the study area. Survey finding summaries are provided in Section 8.6.1.3.

Following targeted surveys, a review of likelihood of occurrence was undertaken. Seven FFG listed threatened flora species were either recorded in the study area or are considered likely or possible to occur, as listed in Table 8-8. While targeted surveys cannot guarantee absence of a species, it is unlikely that any of the 20 remaining threatened species surveyed for are present.

Threatened species

A species recognised as being at risk of extinction in the wild.

Protected flora

Flora species not necessarily at risk of extinction, but subject to the same protections as threatened species.

Table 8-8 FFG Act listed threatened flora species recorded or possibly occurring in the study area

Scientific name	Common name	Status	Likelihood
Coronidium gunnianum	Pale Swamp Everlasting	Critically endangered	Recorded
Eucalyptus bosistoana	Coast Grey-box	Endangered	Recorded
Oxalis rubens	Dune Wood-sorrel	Endangered	Recorded
Prasophyllum spicatum	Dense Leek-orchid	Critically endangered	Possible
Pterostylis grandiflora	Cobra Greenhood	Endangered	Possible
Thelymitra matthewsii	Spiral-leaved Sun-orchid	Endangered	Possible

A further nine species listed as protected under the FFG Act were also recorded, as listed in Table 8-9.

Table 8-9 FFG Act generally protected species recorded as occurring in the study area

Scientific name	Common name
Caladenia carnea	Pink Lady Fingers
Caladenia latifolia	Pink Fingers
Chiloglottis valida	Common Bird-orchid
Corybas incurvus	Slaty Helmet-orchid
Microtis unifolia	Common Onion-orchid
Diuris pardina	Leopard Orchid
Pterostylis nutans	Nodding Greenhood
Thelymitra ixioides	Dotted Sun-orchid
Thelymitra media	Tall Sun-orchid

8.5.7 FFG Act listed threatened fauna

Based on a review of desktop information, general field surveys and targeted species surveys, the likelihood of occurrence of threatened fauna within the study area has been assessed.

8.5.7.1 FFG Act listed threatened birds

Field surveys recorded two listed threatened bird species within the study area. Based on potential habitat, the ecological assessment identified nine FFG Act listed threatened birds as either present, likely or possibly occurring within the study area (refer to figures within Section 8 of *Technical Report G – Onshore Ecology*). The majority of habitat identified for the threatened birds related to fly over and foraging habitats. A summary of the likelihood of occurrence is provided in Table 8-10.

Table 8-10 Likelihood of FFG Act listed threatened birds within the study area

Scientific name	Common name	FFG Act listing	Likelihood of occurrence
Falco subniger	Black Falcon	cr	Possible flying over and foraging from time to time
Calamanthus pyrrhopygius	Chestnut-rumped Heathwren	vu	Recorded in the general area, possible in very limited areas of suitable habitat
Callocephalon fimbriatum	Gang-gang Cockatoo	en	Recorded, suitable breeding habitat exists in the works in Victoria
Hieraaetus morphnoides	Little Eagle	vu	Likely to fly over and forage from time to time
Ninox strenua	Powerful Owl	vu	Likely to occur in suitable habitat in footprint from time to time, no breeding habitat in study area
Neophema chrysogaster	Orange-bellied Parrot	cr	Possible. Occurrence and abundance in the study area is likely to be low and sporadic. Habitat represents a small proportion of available habitat
Lathamus discolor	Swift Parrot	cr	Likely at times in the very limited areas of potential habitat within the works in Victoria
Haliaeetus leucogaster	White-bellied Sea-Eagle	en	Likely to fly over, no foraging habitat
Hirundapus caudacutus	White-throated Needletail	vu	Likely to fly over and forage

Notes FFG Act = threatened species status under the FFG Act (cr = critically endangered; en = endangered; vu = vulnerable).

8.5.7.2 FFG Act listed threatened mammals

Field surveys did not record any FFG listed threatened mammals within the study area. Based on potential habitat, the ecological assessment identified three FFG Act listed threatened mammals as likely or possibly occurring within the study area (refer to Figure 8-9 in *Technical Report G – Onshore Ecology*). Habitat identified for the threatened mammals was either recorded as foraging or of limited quality or disconnected from known distributions. A summary of the likelihood of occurrence is provided in Table 8-11.

Table 8-11 Likelihood of FFG Act listed threatened mammals within the study area

Scientific name	Common name	FFG Act listing	Likelihood of occurrence
Pteropus poliocephalus	Grey-headed Flying-Fox	vu	Likely to forage within suitable habitat
Pseudomys novaehollandiae	New Holland Mouse	en	Possible due to lack of records, lack of habitat, and known distribution
Sminthopsis leucopus	White-footed Dunnart	vu	Possible but habitat disconnected from known distribution

Notes FFG = threatened species status under the FFG Act (cr = critically endangered; en = endangered; vu = vulnerable).

8.5.7.3 FFG Act listed threatened reptiles

Field surveys recorded two FFG Act listed threatened reptile species within the study area (refer to Figure 8-10 in *Technical Report G – Onshore Ecology*). No other threatened reptile species were assessed as likely or possibly occurring in the study area. Habitat for the threatened reptiles is associated with waterways and woodlands. A summary of the likelihood of occurrence is provided in Table 8-12.

Table 8-12 Likelihood of FFG Act listed threatened reptiles within the study area

Scientific name	Common name	FFG Act listing	Likelihood of occurrence
Varanus varius	Lace Monitor	en	Recorded
Pseudemoia rawlinsoni	Glossy Grass Skink	en	Recorded

Notes FFG = threatened species status under the FFG Act (cr = critically endangered; en = endangered; vu = vulnerable).

8.5.7.4 FFG Act listed threatened frogs

Field surveys did not record any FFG listed threatened frogs within the study area. Based on potential habitat, the ecological assessment identified two FFG Act listed threatened frogs as assumed present and likely occurring within the study area (refer to Figure 8-11 in *Technical Report G – Onshore Ecology*). The habitat type identified for the threatened frog is associated with water bodies located next to woodland or coastal scrub and where extensive native vegetation remains in gullies and low points in the landscape. A summary of the likelihood of occurrence is provided in Table 8-13.

Table 8-13 Likelihood of FFG Act listed threatened frogs within the study area

Scientific name	Common name	FFG Act listing	Likelihood of occurrence
Pseudophryne semimarmorata	Southern Toadlet	en	Likely where extensive native vegetation remains in gullies and low points in the landscape in or adjacent to areas of forest/woodland
Uperoleia martini	Martin's Toadlet	en	Assumed present in all areas of potential habitat

Notes FFG = threatened species status under the FFG Act (cr = critically endangered; en = endangered; vu = vulnerable).

8.5.7.5 FFG Act listed threatened fish

Field surveys did not record any FFG listed threatened fish within the study area. Based on potential habitat, the ecological assessment identified one FFG Act listed threatened fish as possibly occurring within the study area (refer to Figure 8-12 in *Technical Report G – Onshore Ecology*). Habitat identified for the Australian Mudfish was identified in waterways with permanent or seasonal water flows. A summary of the likelihood of occurrence is provided in Table 8-14.

Table 8-14 Likelihood of FFG Act listed threatened fish within the study area

Scientific name	Common name	FFG Act listing	Likelihood of occurrence
Neochanna cleaver	Australian Mudfish	en	Possible. Suitable habitat in Bruthen Creek, but not detected during survey.

Notes FFG = threatened species status under the FFG Act (cr = critically endangered; en = endangered; vu = vulnerable).

8.5.8 Groundwater dependent ecosystems

Groundwater dependent ecosystems are natural ecosystems that require access to groundwater to meet some or all the water requirements to sustain species and ecological processes. Groundwater dependent ecosystems are classified into terrestrial, aquatic and subterranean types based on how they interact with groundwater (Table 8-15).

Table 8-15 Groundwater dependent ecosystems types

Groundwater dependent ecosystem	Description
Terrestrial	Vegetation communities that rely on groundwater accessed through their root systems
Aquatic	Associated with springs, streams and lakes that receive groundwater discharge
Subterranean	Exist entirely below ground and support specialised organisms adapted to life in groundwater environments

A desktop assessment and field survey identified ten ecological vegetation classes that are defined as groundwater dependent ecosystems within the study area (refer to Figure 7-4 in *Technical Report G – Onshore Ecology*). A summary of these ecological vegetation classes and their level of dependency (high, medium or low) on groundwater for survival is detailed in Table 8-16.

Table 8-16 Groundwater dependent ecosystems within the study area

Ecological vegetation class type	Level of dependency on groundwater for survival		
	High	Medium	Low
Coast Banksia Woodland	*X*		
Damp Sands Herb-rich Woodland			*X*
Estuarine Wetland	*X*		
Heathy Woodland		*X*	
Lowland Forest			X
Plains Grassy Forest			X
Riparian Scrub	*X*		
Swamp Scrub	*X*		
Coastal Dune Scrub	*X*		
Lowland Forest/Heathy Woodland Mosaic			X

8.5.9 Conservation reserves and environmental overlays

Conservation reserves and environmental overlays are established to provide statutory controls to limit the use and development of land designated for conservation. Discrete areas of land designated for conservation via reserves managed by Parks Victoria and environmental overlays within the Wellington Planning Scheme intersect the study area (refer to Figure 7-5 in *Technical Report G – Onshore Ecology*). A summary of the conservation reserves and environmental overlays within the study area is provided inTable 8-17 Table 8-18 and Table 8-18 below.

Table 8-17 Conservation reserves within the study area

Conservation reserve	Ecological vegetation class	Area (hectares)
McLoughlins Beach–Seaspray Coastal Reserve	*Coast Banksia Woodland*	0.02
Woodside H28 Bushland Reserve	*Riparian Scrub*	0.006
Woodside H28 Bushland Reserve	*Plains Grassy Forest*	0.23
Total		**0.26**

Table 8-18 Environmental overlays within the study area

Environmental overlay	Description
Environmental Significance Overlay	The area covered by Environmental Significance Overlay is cleared farmland (Farming Zone). Native vegetation in this area is limited to the estuarine wetland that occurs along unnamed waterway UFI 42824679.

8.5.10 Weeds and pests

The vegetation and habitat assessments recorded weed species within the study area including nine declared noxious weeds listed under the *Catchment and Land Protection Act 1994* (CaLP Act) and four 'weeds of national significance'. A summary of the weeds recorded in the study area is presented in Table 8-19.

Table 8-19 Weed species within the study area

Scientific name	Common name	CaLP Act status	Weeds of national significance
Asparagus asparagoides	Bridal Creeper	Regionally prohibited	Listed
Cirsium vulgare	Spear Thistle	Regionally controlled	-
Eragrostis curvula	African Love-grass	Regionally controlled	-
Lycium ferocissimum	African Boxthorn	Regionally controlled	Listed
Oxalis pes-caprae	Soursob	Regionally controlled	-
Rosa rubiginosa	Briar Rose	Regionally controlled	-
Rubus fruticosus spp. agg.	Blackberry	Regionally controlled	Listed
Senecio jacobaea	Ragwort	Regionally controlled	-
Ulex europaeus	Gorse	Regionally controlled	Listed

Pest species recorded in the study area during fauna surveys included six pest species listed under the CaLP Act. A summary of the pests recorded is presented in Table 8-20. No pest fish or species listed as 'noxious aquatic species' under the *Fisheries Act 1995* were recorded.

Table 8-20 Pest species within the study area

Scientific name	Common name	CaLP Act status
Felis catus	Feral cat	Established (on Crown land only)
Canis lupus	Domestic/feral dog	Established
Oryctolagus cuniculus	European rabbit	Established
Mus musculus	House mouse	Established
Vulpes vulpes	Red fox	Established
Rusa unicolor	Sambar deer	Established

8.6 Construction impacts

This section discusses the impacts and risks associated with the construction works in Victoria that relate to onshore ecology and the respective receptor groups.

For the purposes of impact assessment, the spatial area assessed includes a 15-metre buffer on either side of the alignment where no works are contemplated, but is conservatively included to understand the worst-case scenario from any indirect impacts. The assessment excludes the McLoughlins Beach–Seaspray Coastal Reserve due to the area being avoided through boring of shore crossing area.

8.6.1 Key impacts

8.6.1.1 Highly sensitive native vegetation (FFM-I001) and less sensitive native vegetation (FFM-I002)

Potential impact

Direct and indirect impacts to native vegetation will occur during site preparation activities to establish construction areas. Direct impacts are caused by the physical removal or pruning of native vegetation within the onshore project area. Indirect impacts are caused by excavation or compaction in the vicinity of native vegetation root zones which could affect the health of native vegetation.

Impacts to highly sensitive native vegetation (FFM-I001) relate to impacts to ecological vegetation classes listed as endangered, high quality or high strategic biodiversity value. Impacts to less sensitive native vegetation (FFM-I002) relate to impacts to ecological vegetation classes that are not listed as endangered, high quality or high strategic biodiversity value.

Impacts to native vegetation were split into two categories (FFM-I001 and FFM-I002) to highlight the importance of high quality native vegetation.

The impacts related to native vegetation (listed in Table 8-2) is considered localised and long-term and rated as major.

Mitigation

To avoid and minimise impacts to native vegetation, transmission alignment options with increased levels of vegetation were discounted and the proposed transmission alignment is in areas without native vegetation where possible. Where works in Victoria intersect high value native vegetation, the Star of the South has sought to:

- Reduce the construction footprint
- Implement trenchless construction techniques to install underground cables
- Implement no-go zones to avoid native vegetation (refer to Figure 14-1 in *Technical Report G – Onshore Ecology*).

This has resulted in a reduction of between 33 to 46 per cent in the impact to native vegetation depending on the option. Star of the South will seek to further reduce impacts to native vegetation, as far as reasonably practicable, through ongoing design refinement including:

- During detailed design, Star of the South will seek to further reduce impacts to native vegetation as far as reasonably practicable and confirm any additional trenchless crossing sites (FFM-M001)
- Develop further no-go zones to reduce impacts to native vegetation by delineating and preventing specific construction activities within areas of native vegetation (FFM-M005).

By implementing no-no zones, native vegetation within and adjacent to construction areas can be retained. Table 8-21 illustrates impacts to native vegetation after the implementation of no-go zones for the alignment options under consideration.

Table 8-21 Native vegetation impacts in patches (habitat zones)

Ecological vegetation class	Ecological vegetation class number	Bioregional Conservation Status	Post mitigation extent impacted within study area (hectares)		
			Common alignment & option AB	Common alignment & option C	Common alignment & option D
Mapped Wetland	74	Endangered	0	0	0
Coast Banksia Woodland	2	Vulnerable	0.002	0.002	0.002
Damp Sands Herb-rich Woodland	3	Vulnerable	0.103	0.103	0.103
Estuarine Wetland	10	Least Concern	0.885	0.885	0.885
Lowland Forest	16	Vulnerable	0.661	0.885	0.705
Heathy Woodland	48	Least Concern	0	0.223	0
Swamp Scrub	53	Endangered	0.957	0.954	0.954
Plains Grassy Forest	151	Vulnerable	7.036	11.517	11.517
Coastal Dune Scrub	160	Depleted	0.106	0.106	0.106
Riparian Scrub	191	Vulnerable	0.920	0.920	1.258
Lowland Forest/Heathy Woodland Mosaic	698	Vulnerable	4.339	0.547	0
Total			**15.009**	**16.142**	**15.531**

Residual impact

With mitigations in place, up to 16.142 hectares of native vegetation in patches may be impacted by works in Victoria, based on the maximum design scenario. The majority of this vegetation is of medium to low quality, with around one hectare of highly sensitive native vegetation affected in a worst case scenario. Residual impacts related to highly sensitive native vegetation (FFM-I001) are considered localised and long-term and rated as major. Residual impacts related to less sensitive native vegetation makes up the remainder of the potential impact (FFM-I002), and is considered localised and long-term and rated as moderate (refer to Table 8-22).

Following the implementation of FFM-M001 and FFM-M005, it is anticipated that further avoidance can be achieved through detailed design, reducing the total area of native vegetation removal and associated offset obligations required for works in Victoria.

Table 8-22 Residual impacts on native vegetation from construction

Potential impact	Receptor group	Receptor sensitivity	Magnitude	Initial consequence	Mitigations	Residual consequence
Clearance of native vegetation during construction that is endangered EVCs, high quality patches or areas of high Strategic Biodiversity Value.	Native vegetation	High	Medium	Major	FFM-M001 FFM-M005	Major
Clearance of native vegetation during construction not including endangered EVCs, high quality patches and areas of high Strategic Biodiversity Value	Native vegetation	Medium	Medium	Moderate	FFM-M001 FFM-M005	Moderate

8.6.1.2 Loss of large and/or hollow-bearing trees (FFM-I003)

Potential impact

Works in Victoria may have direct and indirect impacts to trees during establishment of construction areas. Direct impacts arise from the physical removal or pruning of trees within the onshore project area and indirect impacts from the excavation or compaction of tree root zones which could affect tree health. The importance of trees, and in particular large trees, is the habitat potential they provide for fauna species through hollows and mature cracked bark. Unmitigated, the impacts related to trees will be localised and long-term and rated as major.

Mitigation

As described in section 8.6.1.1, a range of avoidance measures have been undertaken to reduce impacts to native vegetation (including trees). Table 8-23 details the tree impacts following implementation of mitigations. During detailed design, Star of the South will seek to further reduce impacts to native vegetation as far as reasonably practicable (FFM-M001). Protection of the retained trees through construction will occur through the establishment of no-go zones (FFM-M005). Post construction, revegetation for habitats impacted by temporary construction will be implemented to restore habitat connectivity as far as reasonably practicable (FFM-M013).

Residual impact

Following the avoidance through design measures (FFM-M001) and proposed no-go zones (FFM-M005), of the 265 to 387 of the total large trees assessed across the three alignment options, only 82 to 119 trees have been assessed as impacted by works in Victoria (Table 8-23). Residual impacts related to trees is considered localised and long-term and rated as major (Table 8-24). During the detailed design, Star of the South will seek to further reduce impacts to trees, as far as reasonably practicable (FFM-M001). All residual impacts to trees will be offset in accordance with the Guidelines as detailed in Section 8.11, with identified third-party offset sites within the local area meeting these obligations.

Table 8-23 Summary of impacts to large trees in the study area

	Pre-mitigation			Post mitigation		
	Common alignment & option AB	Common alignment & option C	Common alignment & option D	Common alignment & option AB	Common alignment & option C	Common alignment & option D
Number of trees	265	387	309	82	119	107

Table 8-24 Residual impacts on hollow bearing trees from construction

Potential impact	Receptor group	Receptor sensitivity	Magnitude	Initial consequence	Mitigations	Residual consequence
Clearance of trees within the onshore project area resulting in the direct and indirect loss of trees in patches and scattered trees that provide habitat features for fauna	Hollow dependent fauna (threatened and non-threatened species)	High	Medium	Major	FFM-M001, FFM-M002 FFM-M003, FFM-M004 FFM-M005, FFM-M006 FFM-M011, FFM-M013	Major

8.6.1.3 FFG Act listed threatened fauna (FFM-I004)

Potential impact

Impacts to threatened fauna may result from the removal of habitat during construction.

Potential impacts to FFG Act listed threatened fauna relates to the direct and indirect removal of species habitat, which can have direct impacts to the species through temporary disturbance, fauna injury, mortality and habitat fragmentation. Habitat removal can also fragment, deplete and reduce the quality of suitable habitat for the species.

The ecological assessment identified nine listed threatened birds, three listed mammals, two listed reptiles, two listed frogs and one listed fish species under the FFG Act as possibly, likely or known to occur within the study area. A summary of the species impacted within the study area is provided in Table 8-25. Unmitigated, the impacts related to FFG Act listed threatened fauna is considered localised and short to medium-term and rated as negligible to minor.

Mitigation

In addition to further avoiding impacts to native vegetation during the detailed design phase (FFM-M001), Star of the South will also develop an environmental line list (FFM-M002) which identifies and documents ecological values at relevant chainages across the onshore project area. The environmental line list will guide contractors in the development of specific management requirements for these values. In support of the environmental line list, Star of the South will prevent construction impacting on retained vegetation and habitat through no-go zones (FFM-M005).

Star of the South will document mitigation measures to minimise disturbance, injury or death of wildlife during construction in a flora and fauna management plan (FFM-M006), including pre-habitat clearing surveys with suitably qualified wildlife specialists to ensure nests and hollows are free from threatened fauna prior to their removal. The detailed and species specific measures within this plan will further minimise disturbance, injury or death of wildlife.

Post construction, revegetation of habitats impacted will be implemented to restore habitat connectivity as far as reasonably practicable (FFM-M013).

Residual impact

Following effective implementation of mitigations residual impacts related to FFG Act listed threatened fauna are considered localised and short to medium-term and rated as negligible to moderate (refer to Table 8-25 and Table 8-26).

Table 8-25 Summary of impacts to FFG Act threatened fauna

Scientific name	Common name	Initial impact	Residual impact			Residual impact
			Option AB	Option C	Option D	
Falco subniger	Black Falcon	Loss of small proportion of potential habitat.	Loss of small proportion of potential habitat.			Minor
Calamanthus pyrrhopygius	Chestnut-rumped Heath-wren	Loss of suitable heathy vegetation habitat	Loss of ~4 ha potential habitat.	Loss of ~3 ha potential habitat.		Minor
Callocephalon fimbriatum	Gang-gang Cockatoo	Loss of potential breeding and foraging habitat	Loss of ~7 ha potential habitat and 32 large trees	Loss of ~9 ha potential habitat and 53 large trees		Minor
Hieraaetus morphnoides	Little Eagle	Loss of open forest and woodland habitat	Loss of ~9 ha potential habitat	Loss of 10.5 ha potential habitat	Loss of ~11.5 ha potential habitat	Negligible
Lathamus discolor	Swift Parrot	Loss of open forest and woodland foraging habitat	Loss of ~6.5 ha potential habitat	Loss of ~8.5 ha potential habitat	Loss of ~9 ha potential habitat	Minor
Neophema chrysogaster	Orange-bellied Parrot	Loss of degraded pasture habitat	Loss of ~25 ha potential degraded pasture habitat			Minor
Ninox strenua	Powerful Owl	Loss of open forest and woodland habitat	Loss of ~8 ha potential habitat	Loss of 10 ha potential habitat	Loss of ~10.5 ha potential habitat	Negligible
Haliaeetus leucogaster	White-bellied Sea-eagle	Loss of coastal habitat	Temporary construction impacts			Minor
Hirundapus caudacutus	White-throated Needletail	Loss of small proportion of habitat	Nil			Negligible
Pteropus poliocephalus	Grey-headed Flying-Fox	Loss of foraging habitat	Loss of ~8 ha potential habitat	Loss of ~10 ha potential habitat	Loss of ~10.5 ha potential habitat	Minor
Pseudomys novaehollandiae	New Holland Mouse	Loss of open forest and woodland habitat	Loss of ~4 ha potential habitat	Loss of ~2.5 ha potential habitat	Loss of ~2 ha potential habitat	Moderate
Sminthopsis leucopus	White-footed Dunnart	Loss of open forest and woodland habitat	Loss of ~8 ha potential habitat	Loss of ~10.5 ha potential habitat	Loss of ~11 ha potential habitat	Minor
Varanus varius	Lace Monitor	Loss of woodland habitat	Loss of ~8 ha potential habitat	Loss of ~10.5 ha potential habitat		Negligible
Pseudemoia rawlinsoni	Glossy Grass Skink	Loss of habitat adjacent to water bodies	Loss of ~2.5 ha potential habitat	Loss of ~2 ha potential habitat		Minor
Pseudophryne semimarmorata	Martin's Toadlet	Loss of habitat adjacent to water bodies	Loss of ~6 ha potential habitat	Loss of ~10 ha potential habitat	Loss of ~10.5 ha potential habitat	Moderate

Scientific name	Common name	Initial impact	Residual impact			Residual impact
			Option AB	Option C	Option D	
Uperoleia martini	Southern Toadlet	Loss of habitat adjacent to water bodies	Loss of ~4 ha potential habitat	Loss of ~2.5 ha potential habitat	Loss of ~2 ha potential habitat	Moderate
Neochanna cleaver	Australian Mudfish	Loss of habitat along unnamed waterway UFI 42824679	Loss of ~6 m potential habitat (unnamed waterway)			Negligible

Table 8-26 Residual construction impacts on FFG Act listed threatened fauna

Potential impact	Receptor group	Receptor sensitivity	Magnitude	Initial consequence	Mitigations	Residual consequence
Clearance of native vegetation impacting FFG listed threatened faun	Habitat for FFG listed threatened fauna (refer to Table 8-25)	Low-high	Negligible-low	Negligible	FFM-M001; FFM-M002; FFM-M003; FFM-M004; FFM-M005; FFM-M006; FFM-M009; FFM-M011; FFM-M012; FFM-M013	Negligible
				Minor		Minor
				Moderate		Moderate

8.6.1.4 FFG Act listed threatened flora (FFM-I005)

Potential impact

The ecological assessment identified seven FFG Act listed threatened flora species as possible, likely or occurring within the study area. Works in Victoria may have direct and indirect impacts to these threatened species during construction. Direct impacts relate to the physical removal of the species within the onshore project area before or during construction. Indirect impacts relate to the excavation, generation of dust and compaction of areas adjacent to the species which lead to effects on their viability. Without controls in place, the impacts related to FFG Act threatened flora is considered localised and long-term and rated as moderate.

Mitigation

Star of the South will further reduce impacts to native vegetation through refinement of the design (FFM-M001), as far as reasonably practicable. Star of the South will implement 'no-go zones' throughout the alignment to further reduce impacts and protect retained native vegetation (FFM-M005). Star of the South will develop an environmental line list (FFM-M002) which identifies and documents ecological values at relevant chainages across the onshore project area. The environmental line list will guide contractors in the development specific management requirements for these values.

In support of the environmental line list, Star of the South will develop a flora and fauna management plan (FFM-M005) which will document the controls and procedures for construction staff to follow to protect threatened flora during construction. Following detailed design and implementation of all pre-construction controls Star of the South will undertake pre-construction surveys to qualify the extent of threatened flora and seek FFG Act permit to take (FFM-M015) any FFG Act listed species that cannot be retained. Post construction, revegetation for habitats impacted by temporary construction will be implemented to restore habitat connectivity as far as reasonably practicable (FFM-M013). Table 8-27 details impact to native vegetation before and after the implementation of mitigations.

Residual impact

Although the works in Victoria are expected to have a residual impact on habitat for FFG Act listed threatened flora species, the localised loss of individuals or discrete populations is unlikely to result in a significant impact to the species.

Following the implementation of mitigations, residual impacts related to threatened species that cannot be retained will be localised and long-term and rated as minor to moderate (refer Table 8-27 and Table 8-28).

All residual impacts to FFG Act listed threatened flora species will be offset in accordance with the Guidelines, with identified third-party offset sites in the local area meeting these obligations. A protected flora permit to take threatened flora species under the FFG Act will be required for works within public land.

Table 8-27 Summary of impacts to FFG Act threatened flora

Scientific name	Common name	Initial impact	Residual impact			Residual impact rating
			Option AB	Option C	Option D	
Coronidium gunnianum	Pale Swamp Everlasting	Loss of individuals growing beside drainage lines in a Swamp Scrub ecological vegetation class habitat at Lyons Road	Loss of a known population (10 individuals) and 0.653 ha potential habitat.			Minor
Eucalyptus bosistoana	Coast Grey-box	Potential loss of four individuals and loss of habitat for the species	Loss of one small scattered tree and 22 individuals			Minor
Oxalis rubens	Dune Wood-sorrel	Potential loss of individual and loss of habitat for the species	Loss of 0.106 ha of potential habitat			Minor

Scientific name	Common name	Initial impact	Residual impact			Residual impact rating
			Option AB	Option C	Option D	
Prasophyllum spicatum	Dense Leek-orchid	Loss of potential habitat within Heathy Woodland ecological vegetation classes.	No impact	Loss of 0.101 ha potential habitat	No impact	Moderate
Pterostylis grandiflora	Cobra Greenhood	Potential loss of habitat within Plains Grassy Forest and Lowland Forest ecological vegetation classes.	Loss of 3.197 ha potential habitat.	Loss of 4.497 ha potential habitat.	Loss of 4.497 ha potential habitat	Minor
Thelymitra matthewsii	Spiral-leaved Sun-orchid	Potential loss of habitat within Plains Grassy Forest ecological vegetation classes.	2.901 ha potential habitat	4.201 ha potential habitat	4.201 ha potential habitat	Moderate

Table 8-28 Residual impacts on FFG Act listed threatened flora

Potential impact	Receptor group	Receptor sensitivity	Magnitude	Initial consequence	Mitigations	Residual consequence
Clearance of native vegetation impacting FFG Act listed threatened flora	Habitat for FFG Act listed threatened flora (refer to Table 8-27)	High	Low	Moderate	FFM-M001; FFM-M002; FFM-M003; FFM-M004; FFM-M005; FFM-M009; FFM-M011; FFM-M012; FFM-M013; FFM-M015	Minor Moderate

8.6.2 Other impacts

Other potential construction impacts with minor to negligible residual effects on onshore ecology once mitigation measures have been implemented include:

- Construction impacts FFG Act protected flora (FFM-I006)
- Construction impacts waterways (FFM-I007).

8.6.2.1 FFG Act listed protected flora (FFM-I007)

Potential impact

Construction of the works in Victoria may have direct and indirect impacts to nine FFG Act listed protected flora species identified within the study area (refer to Table 8-9). Direct impacts relate to the physical removal of the species within the onshore project area. Indirect impacts relate to the excavation, generation of dust and compaction of areas adjacent to the species which lead to effects on their viability. Unmitigated, the impacts related to FFG Act listed protected flora is considered localised and medium-term and rated as minor.

Mitigation

Star of the South proposes to further reduce impacts to native vegetation through refinement of the design (FFM-M001), as far as reasonably practicable. Star of the South will implement of 'no-go zones' throughout the alignment to further reduce impacts and protect retained native vegetation (FFM-M005). Star of the South will develop an environmental line list (FFM-M002), which identifies and documents ecological values at relevant chainages across the onshore project area. The environmental line list will guide contractors in the development specific management requirements for these values. In support of the environmental line list, Star of the South will develop a flora and fauna management plan (FFM-M005) which will document the controls and procedures for construction staff to follow to protect threatened flora during construction.

Following detailed design and implementation of all pre-construction controls Star of the South will undertake pre-construction surveys to qualify the extent of threatened and generally protected flora and seek FFG Act permit to take any FFG Act listed species that cannot be retained on public land. (FFM-M015). Post construction, revegetation for habitats impacted by temporary construction will be implemented to restore habitat as far as reasonably practicable (FFM-M013).

Residual impact

Although construction of works in Victoria is expected to have residual impact on habitat for FFG Act listed protected flora species, the localised loss of individuals or discrete populations is unlikely to result in a significant impact to the species. Following the implementation of proposed mitigations, residual impacts related to protected FFG Act species are localised and medium-term and rated as minor (refer to Table 8-29).

Table 8-29 Residual impacts on FFG Act listed threatened flora

Potential impact	Receptor group	Receptor sensitivity	Magnitude	Initial consequence	Mitigations	Residual consequence
Clearance of native vegetation impacting FFG Act protected flora	FFG Act protected flora	Medium	Low	Minor	FFM-M001; FFM-M002; FFM-M003; FFM-M004; FFM-M005; FFM-M009; FFM-M011; FFM-M 012; FFM-M013; FFM-M015	Minor

8.6.2.2 Waterways (FFM-I008)

Potential impact

Numerous ephemeral waterways are crossed by the onshore project area, including Warrigal Creek and Morris Creek. Star of the South proposes to use an open trenching construction method to cross waterways, except for unnamed waterway UFI 4282679 which will be crossed using a trenchless construction method, due to its connection with Corner Inlet Ramsar site. The unnamed waterway will be subject to the installation of a temporary causeway to allow vehicles to move across. The proposed crossings of minor waterways could be completed within two to three days per trench during dry periods with minimal impacts on flow regime.

Potential ecological impacts from temporary creek crossings generally relate to removal of native vegetation and aquatic frog and fish habitat. Construction staging within and adjacent to waterways can also change low flow pathways and downstream habitat.

Mitigation

The key management measure to mitigate impacts to waterways will include:

- Procedures to reduce erosion, sedimentation and contamination (FFM-M008) to manage sediment and erosion impacts on aquatic environments
- A designated waterway crossing management plan (FFM-M010) which will define how waterway crossings will be constructed, with the intent of limiting works and impacts to waterway environments. Measure will include, but are not limited to, limiting vegetation removal, management of water quality, maintaining water flows, managing construction timeframes and identifying and implementing response measures for adverse weather.

- Post construction, revegetation for habitats impacted by temporary construction will be implemented to restore habitat connectivity as far as reasonably practicable (FFM-M013).

Residual impact

Following effective implementation of FFM-M008 (procedures to reduce erosion, sedimentation and contamination) and FFM-M010 (waterway crossing management plan), residual impacts related to waterways are localised and short to medium-term and rated as minor (Table 8-30).

Table 8-30 Residual impacts on waterways

Potential impact	Receptor group	Receptor sensitivity	Magnitude	Initial consequence	Mitigations	Residual consequence
Construction across waterways impacting the waterway and habitat for fauna	Aquatic habitat	Medium	Low	Minor	FFM-M001; FFM-M002; FFM003; FFM-M004; FFM-M005; FFM009; FFM-M011; FFM-M012; FFM-M013	Minor

8.6.3 Potential risks

8.6.3.1 Habitat fragmentation (FFM-R009)

Potential risk

Installation of the underground cables will be carried out within a construction corridor up to 60 metres wide. This may disrupt continuity of native vegetation, potentially causing habitat fragmentation, in areas that intersect with the construction corridor. These areas include:

- Roadsides containing corridors of native vegetation
- Waterways with fringing native vegetation
- The H28 Bushland Reserve which adjoins native vegetation on private land.

Habitat fragmentation has the potential to affect species that are dependent on continuous patches of vegetation for movement and dispersal, including include reptiles, frogs, small mammals, and small birds.

The transmission route has been selected to avoid large tracts of remnant vegetation, leading only to discrete areas of the works in Victoria experiencing fragmentation elements.

Mitigation

Star of the South proposes to further reduce impacts to native vegetation through refinement of the design (FFM-M001), during the development of the detailed design as far as reasonably practicable. Star of the South will implement 'no-go zones' throughout the alignment to further reduce impacts and protect retained native vegetation (FFM-M005). Star of the South will develop an environmental line list (FFM-M002) which identifies and documents ecological values at relevant chainages across the onshore project area. The environmental line list will guide contractors in the development specific management requirements for these values.

Star of the South will document mitigation measures to minimise disturbance, injury or death of wildlife during construction in a flora and fauna management plan (FFM-M006), including pre-habitat clearing surveys with suitably qualified wildlife specialists to ensure nests and hollows are free from threatened fauna prior to their removal. Post construction, revegetation for habitats impacted by temporary construction will be implemented to restore habitat connectivity as far as reasonably practicable (FFM-M013).

Residual risk

Following effective implementation of mitigations FFM-M005 (flora and fauna management plan), FFM-M006 (fencing and trenching design) and FFM-M013 (revegetation program), residual risks related to fragmentation are considered localised and short to medium-term and rated as low (refer to Table 8-31). Disruption to movement of fauna is unlikely to be significant as most species likely to use the roadsides are mobile and able to stay in fragmented landscapes.

Table 8-31 Risk of habitat fragmentation

Potential risk	Receptor group	Receptor sensitivity	Magnitude	Initial risk	Mitigations	Residual risk
Clearance of native vegetation disrupting connectivity for wildlife (habitat fragmentation) leading to exacerbation of FFG Act threatening processes	Native vegetation and habitat	Low	Medium	Low	FFM-M001; FFM-M002; FFM-M003; FFM-M004; FFM-M005; FFM-M009; FFM-M011; FFM-M012; FFM-M013	Low

8.6.3.2 Indirect impacts on retained native vegetation and habitat (FFM-R010)

Potential risk

If construction vehicles and materials are inadvertently transported outside of the onshore project boundary, there is potential for vegetation to be negatively affected through unplanned clearance, smothering by dust, soil compaction, sedimentation, pollution, dust, noise, light, frack out risk/creation of sinkholes.

Mitigation

To manage potential risks to retained vegetation and habitat, measures will be developed and incorporated into a Construction Environmental Management Plan which will incorporate a range of procedures to avoid and minimise indirect impacts (FFM-M003). These include, but are not limited to:

- Establishing onshore project boundaries with particular focus where the works in Victoria interfaces with conservation reserves (FFM-M005 and FFM-M009)
- Stockpile, sediment and erosion management procedures (FFM-M008)
- Minimising night-time works where practical to do so, to reduce impacts of noise and light on nocturnal animals (FFM-M006).
- Avoiding impacts on Hooded Plover within beach dunes during shore crossing activities (OFF-M05)

Post construction, revegetation for habitats impacted by temporary construction will be implemented to restore habitat connectivity as far as reasonably practicable (FFM-M013).

Residual risk

Following effective implementation of mitigations, residual risks related to retained vegetation and habitat are considered localised and short term and rated as low (refer to Table 8-32).

Table 8-32 Risk of indirect impacts on retained native vegetation and habitat

Potential risk	Receptor group	Receptor sensitivity	Magnitude	Initial risk	Mitigations	Residual risk
Degradation or loss of native vegetation and habitat (inadvertent clearance, smothering by dust, soil compaction, sedimentation, pollution, dust, noise, light, frack out risk/creation of sinkholes)	Native vegetation	High	Negligible	Low	FFM-M002; FFM-M003; FFM-M004; FFM-M005; FFM-M006; FFM-M008; FFM-M009; FFM-M013; OFF-M05	Low

8.6.3.3 Introduction and spread of weeds, pathogens or pest animals (FFM-R011)

Potential risk

Proposed construction activities and methods may result in increased impacts on biodiversity from threats including weeds, pathogens and pest animals leading to the exacerbation of an FFG Act threatening process. The introduction and spread of weeds and pathogens may result in a decline in retained vegetation quality, which then can result in a reduction of native fauna habitat. The introduction of weeds (particularly woody weeds) may also increase the availability of shelter for pest animals. Increases in the presence of pest fauna species may lead to a general decline in habitat and ecosystem structure.

Mitigation

Measures to manage and control impacts on retained vegetation from biosecurity threats (weeds, pathogens, and pest animals) will be outlined in a biosecurity management plan (FFM-007). Measures in the plan will include, but are not limited to, site hygiene protocols and weed management measures.

Residual risk

Following effective implementation of FFM-M007 (biosecurity management plan), residual risks related to retained vegetation are considered localised and long term and rated as medium (refer to Table 8-33).

Table 8-33 Risk of introduction and spread of weeds, pathogens or pest animals during construction

Potential risk	Receptor group	Receptor sensitivity	Magnitude	Initial risk	Mitigations	Residual risk
Introduction or spread of weeds, pathogens, or pest species leading to the exacerbation of an FFG Act threatening process	Native vegetation and habitat	High	Low	Medium	FFM-M002; FFM-M003; FFM-M004; FFM-M007	Medium

8.6.3.4 Fauna injury and mortality (FFM-R012)

Potential risk

Habitat removal may lead to direct injury and mortality of fauna through trauma caused by machinery, entrapment in open trenches and vehicle-wildlife collisions. Species most at risk are hollow-dwelling birds and mammals, nesting birds, ground-dwelling small mammals, reptiles and frogs. This includes threatened and non-threatened species. Works may also unintentionally disturb and displace fauna occupying retained habitat adjacent to the onshore project area. Species most at risk are frogs and lizards or species that breed and shelter in hollows including possums.

Mitigation

A flora and fauna management plan (FFM-M005) will be prepared by Star of the South and in consultation with the Victorian Department of Energy, Environment and Climate Action, which outlines measures to minimise impacts on non-threatened and threatened fauna from construction. The plan will include measures such as:

- Habitat pre-clearing surveys by qualified wildlife spotter catchers (FFM-M006)
- Training for contractors on fauna identification and processes when encountering fauna (FFM-M004)
- Avoidance of habitat removal across breeding seasons, were practicable (FFM-M006).

Residual risk

Following effective implementation of FFM-M004 , FFM-M005 and FFM-M006, residual risks related to retained vegetation are localised and short term and rated as low (refer to Table 8-34).

Table 8-34 Risk ranking of fauna injury and mortality

Potential risk	Receptor group	Receptor sensitivity	Magnitude	Initial risk	Mitigations	Residual risk
Direct fauna mortality	Protected wildlife (threatened and non-threatened species)	Low	Low	Low	FFM-M002; FFM-M003; FFM-M004; FFM-M005; FFM-M006.	Low

8.6.3.5 Groundwater dependent ecosystems (FFM-R013)

Potential risk

Dewatering of trenches and joint bays during construction may lower the groundwater level at the pumped location, forming a temporary and localised area of reduced groundwater level.

Dewatering, therefore, has the potential to temporarily reduce groundwater depth affecting terrestrial, aquatic and subterranean ecosystems that are dependent on groundwater. Following construction activities requiring dewatering, groundwater levels are expected to return to previous levels.

Ecological vegetation classes identified as high potential terrestrial groundwater dependent ecosystems that are known, or likely, to be intersected by the excavations based on where they are located within the onshore project area are presented in Table 8-35.

Table 8-35 Ecological vegetation classes that have a high potential to be groundwater dependant ecosystems

Component	High potential groundwater dependent ecosystem ecological vegetation class	Area that ecological vegetation class may be affected: (distance from excavation edge)		Duration of potential impact: (max. duration of dewatering)
		Drawdown of 0.5 m	Drawdown of 0.1 m	
Transition joint bays	Coast Banksia Woodland	103 m	161 m	90 days
	Coastal Dune Scrub			
	Estuarine Wetland			
Joint bays	Coast Banksia Woodland	33 m	63 m	30 days
	Riparian Scrub			
	Swamp Scrub			
Trenches	Coast Banksia Woodland	6 m	10 m	1.5 days
	Riparian Scrub			
	Swamp Scrub			

The works in Victoria have the potential to impact aquatic and subterranean groundwater dependent ecosystems where the works intersects groundwater at creek lines and coarse-grained sediments, resulting in temporary drawdown of groundwater levels.

Mitigation

To manage potential impacts to groundwater dependent ecosystems, dewatering will be planned to avoid the driest periods to assist in mitigating any changes in moisture availability for any groundwater dependent ecosystems. If required, Star of the South will consider artificial irrigation of groundwater dependent ecosystems to maintain soil moisture levels and plant moisture availability. The measures to manage risks to groundwater dependent ecosystems will be incorporated into a dewatering plan (FFM-M014).

Residual risk

Following effective implementation of mitigations (FFM-M014), residual risks related to groundwater dependent ecosystems are considered localised and short term and rated as low (refer to Table 8-36).

Table 8-36 Risk to groundwater dependent ecosystems

Potential risk	Receptor group	Receptor sensitivity	Magnitude	Initial risk	Mitigations	Residual risk
Alterations to groundwater hydrology during construction leading to decline in the extent and health of groundwater dependent ecosystems	Groundwater dependent ecosystems	High	Low	Medium	FFM-M0014	Low

8.6.3.6 Exacerbating threatening processes (FFM-R014)

Potential risk

Threatening processes under the FFG Act relate to a cumulation of impacts to species and habitats. This relates to the initiation or exacerbation of vegetation clearance, habitat fragmentation, loss of habitat, alteration to waterways, degradation to retained vegetation, impacts to water quality and increased incursions of weeds, pathogens and pests.

Mitigation

To avoid and minimise impacts to native vegetation and habitat, Star of the South has located the transmission alignment in areas without native vegetation and habitat wherever possible. In addition, where works in Victoria intersect high value native vegetation and habitat, Star of the South has sought to:

- Reduce the construction footprint
- Implement trenchless construction techniques to install underground cables.

During detailed design, Star of the South will seek to further reduce impacts to native vegetation as far as reasonably practicable (FFM-M001). As total avoidance of native vegetation is not possible across the entire transmission alignment, Star of the South has developed 'no-go zones' to further reduce impacts to native vegetation (refer to Figure 14-1 in *Technical Report G – Onshore Ecology*). No-go zones delineate and prevent specific construction activities within areas of native vegetation (FFM-M005).

For the remaining threatening processes, the primary means of managing and mitigating impacts is through the development of detailed measures stipulated in a Construction Environmental Management Plan (FFM-M003), flora and fauna management plan (FFM-M005) and biosecurity management plan (FFM-M007).

Residual risk

Exacerbation of threatening processes associated with native vegetation loss, hollow-bearing tree removal and habitat fragmentation are outlined in Sections 8.6.1.1, and 8.6.3.1 respectively. Implementation of mitigations will minimise exacerbation of threatening processes but not completely avoid exacerbation.

Other threatening processes including the introduction or spread of weeds, pathogens and pest animals, and degradation of riparian vegetation (vegetation located along the waterways and wetlands) should be able to be managed through implementation of measures to be defined in the Construction Environmental Management Plan and relevant sub-plans (FFM-M003, FFM-M005 and FFM-M007). No residual impacts are anticipated.

Following effective implementation of mitigations, residual risks related to retained vegetation are considered localised and short term and rated as low (refer to Table 8-37).

Table 8-37 Risk of exacerbating threatening processes

Potential risk	Receptor group	Receptor sensitivity	Magnitude	Initial risk	Mitigations	Residual risk
Initiation and /or exacerbation of other listed potentially threatening processes under the FFG Act	Native vegetation and habitat	High	Low	Low	FFM-M002; FFM-M003; FFM-M005; FFM-M007;	Low

8.7 Operation impacts

This section discusses the impacts and risks associated with the operation of the onshore cable infrastructure in Victoria that relate to onshore ecology receptor groups.

8.7.1 Key impacts

The operational phase impact assessment identified no impacts on onshore ecology with an impact rating of moderate or higher once mitigation measures have been implemented.

8.7.2 Potential risks

8.7.2.1 Indirect impacts on retained native vegetation and habitat (FFM-R016)

Potential risk

The operational phase has the potential to impact on retained vegetation and habitat in Victoria by:

- Weed or pathogen spread through regular vehicular traffic and associated personnel and equipment
- Loss of native vegetation by incursions of maintenance activity beyond the operation easement
- Ongoing ‘edge effects’ (the change in the composition of ecological communities at the border where two different habitats meet) which, in turn, may allow for increased opportunity for predation and weed or pathogen incursion
- Noise during maintenance activities along the easement that may result in temporary disturbance to local fauna species
- Dust generated during maintenance settling on and impacting the health of vegetation
- Surface water run off carrying pollution and/or sediment into waterways
- Removal of regenerating native vegetation if emergency works are required in the operational transmission easement.

Mitigation

To manage potential operational risks to retained native vegetation and habitat an Operation Environmental Management Plan will be prepared and implemented by Star of the South (FFM-M011). The plan will contain measures to protect retained biodiversity values during operations, such as:

- Inductions to ensure awareness of values and measures to be implemented to protect those values
- Defining the extent of permitted maintenance and inspection works including no-go zones to protect retained native vegetation and threatened flora and fauna habitat
- Weed and pathogen hygiene measures and control.

Residual risk

The frequency of vehicle movement and maintenance activities during the operation phase is not expected to lead to excessive or extensive risks of inadvertent impacts on retained native vegetation or disturbance to wildlife. Following implementation of mitigation FFM-M011 (Operation Environmental Management Plan), residual risks related to retained vegetation are considered localised and short term and rated as low (refer to Table 8-38).

Table 8-38 Risk to retained native vegetation and habitat

Potential risk	Receptor group	Receptor sensitivity	Magnitude	Initial risk	Mitigations	Residual risk
Indirect impacts leading to degradation or loss of retained native vegetation and habitat	Native vegetation and habitat	High	Negligible	Low	FFM-M002; FFM-M004; FFM-M005; FFM-M007; FFM-M008; FFM-M011; FFM-M013	Low

8.7.2.2 Introduction or spread of weeds, pathogens and pest animals (FFM-R017)

Potential risk

There is a potential risk for the spread of weeds, pathogens and pest animals during operation. The frequency of access required to maintain the asset will be low, which reduces the potential for the risk to occur.

Mitigation

Weed, pathogen and pest control protocols outlined in the Operation Environmental Management Plan (FFM-M011) will ensure the risk is minimised as far as reasonably practicable.

Residual risk

Following effective implementation of mitigation FFM-M011 (Operation Environmental Management Plan), residual risks related to retained vegetation are considered localised and short term and rated as low (refer to Table 8-39).

Table 8-39 Risk of introduction or spread of weeds, pathogens and pest animals during operation

Potential risk	Receptor group	Receptor sensitivity	Magnitude	Initial risk	Mitigations	Residual risk
Introduction and/or spread of weeds and pathogens	Native vegetation and habitat	High	Negligible	Low	FFM-M002; FFM-M004; FFM-M007; FFM-M011	Low

8.7.2.3 Habitat fragmentation (FFM-R018)

Potential risk

The operational transmission easement will maintain clearances, meaning fragmentation impacts from the construction phase will remain throughout the operational phase. Given the duration to which this risk applies, the consequence is rated higher than in the initial construction phase.

Mitigation

Measures to minimise the risk are limited, due to the requirements to maintain safety clearances throughout the operational period. Compliance with measures outlined in the Operation Environmental Management Plan (FFM-M011) will ensure the risk is not exacerbated further.

Residual risk

Following effective implementation of mitigation FFM-M011, residual risks related to retained vegetation are localised, long term and rated as medium (refer to Table 8-40).

Table 8-40 Risk of habitat fragmentation

Potential risk	Receptor group	Receptor sensitivity	Magnitude	Initial risk	Mitigations	Residual risk
Prevention of regrowth of native vegetation contributing to ongoing habitat fragmentation	Protected wildlife (threatened and non-threatened)	Medium	Medium	Medium	FFM-M011	Medium

8.7.2.4 Fauna injury and mortality (FFM-R019)

Potential risk

Risks associated with fauna injury and mortality relate to interactions between wildlife and maintenance vehicles.

Mitigation

Measures outlined in the Operation Environmental Management Plan (FFM-M011) regarding vehicle speeds and protocols for interacting with wildlife will ensure risks are minimised as far as reasonably practicable.

Residual risk

Following effective implementation of mitigation FFM-M011 (Operation Environmental Management Plan), residual risks related to fauna injury and mortality are considered localised and short term and rated as low (refer to Table 8-41).

Table 8-41 Risk of fauna injury and mortality during operation

Potential risk	Receptor group	Receptor sensitivity	Magnitude	Initial risk	Mitigations	Residual risk
Fauna mortality as a result of increased traffic within the onshore project area	Protected wildlife (threatened and non-threatened)	Low	Low	Low	FFM-M004; FFM-M006; FFM-M011	Low

8.8 Decommissioning assessment

8.8.1 Impact assessment

Impacts associated with decommissioning relate to the potential removal of native vegetation to remove link and fibre pits and typical construction related impacts such as sedimentation, noise and dust.

A decommissioning environmental management plan (FFM-M012) will be prepared in accordance with the future regulatory requirements. Native vegetation and fauna habitats affected by works in Victoria will ultimately regenerate and most species recolonise those restored areas.

Residual impacts are limited to the easement until all vegetation has grown to its full height. Hollow tree availability is expected to be constrained for decades given the time taken for hollow formation in eucalypts.

8.9 Cumulative impacts

This section provides an assessment of the potential for cumulative impacts of works in Victoria with other proposed developments in the region. The method to consider cumulative impacts is described in *Chapter 6 – Assessment Framework.*

Potential cumulative impacts arise when the effects of a single project on a receptor are considered along with the effects of other projects on the same receptor. Projects that are operational are part of the baseline environment, and the cumulative impact assessment focuses on future developments following a tiered assessment methodology.

The projects identified in the cumulative assessment for onshore ecology are summarised in Table 8-42.

Table 8-42 Summary of cumulative impact assessment for onshore ecology

Project	Project Description	Findings of Assessment
Golden Beach Gas Project	Golden Beach Gas Project involves the development of the Golden Beach gas field in the Gippsland Basin to provide gas supply and storage infrastructure. The project comprises the construction, operation and eventual decommissioning of two offshore wells (approximately 3.8 km offshore), a 3.8 km subsea and shore crossing pipeline, an 18.8 km buried onshore pipeline, and pipeline facilities including a compressor station.	Spatial relevance: The Golden Beach Gas Project 18.8 km buried onshore pipeline, and pipeline facilities including a compressor station within approximately 30 km of the onshore transmission alignment for the Star of the South Offshore Wind Farm. The offshore component of the Golden Beach Gas Project is approximately 50 km from the offshore wind farm at the nearest point.
Marinus Link	Marinus Link is a proposed undersea electricity connection between Victoria and Tasmania. Marinus Link requires the construction of a high voltage direct current electricity interconnector between Tasmania and Victoria including a subsea cable and onshore cable and converter facilities. The shore crossing is proposed to be located at Waratah Bay. The onshore cable extends underground for approximately 90 km to the converter station adjacent to the existing terminal station at either Driffield or Hazelwood.	Spatial relevance: The project is of similar scale to Star of the South and in the same bioregion. There is overlap in the habitats to be impacted (coastal and near-coastal habitat).

Project	Project Description	Findings of Assessment
Gippsland Offshore Wind Transmission 2GW Project (VicGrid)	The proposed Gippsland Offshore Wind Transmission 2GW Project is a new overhead transmission line from the Latrobe Valley to a new onshore connection hub in Giffard. The proposed VicGrid connection hub comprises a high-voltage substation plant and equipment, including transformers, synchronous condensers and switchgear. The construction period is indicated as 2027 to 2030.	Spatial relevance: the Star of the South onshore transmission system is proposed to connect in with the VicGrid connection hub in Giffard, therefore the projects will be directly adjacent. The projects may impact on common flora and fauna values. Temporal relevance: based on the project timeframes, it is possible that construction periods could overlap. Operational periods will overlap. Potential cumulative risk pathway: construction and operation of the VicGrid connection hub could impact on threatened fauna and native vegetation within the Gippsland Plains bioregion.
Great Eastern Offshore Windfarm	The proposed Great Eastern Offshore Windfarm, proposed by developer Corio is a fixed-bottom offshore wind farm approximately 22 km off the central Gippsland coast. The project is proposed to generate up to 2.5GW once operational. The onshore component of the project is proposed to connect to the same VicGrid connection hub as the Star of the South Offshore Wind Farm Project via an approximately 10km long transmission system.	Spatial relevance: the projects will connect to the same connection hub. Temporal relevance: based on the project timeframes, it is possible that construction periods could overlap. Operational periods will overlap. Potential cumulative risk pathway: construction and operation of the Corio project could impact on threatened fauna and native vegetation within the Gippsland Plains bioregion.

The cumulative assessment considered unmitigated scenarios of the scoped cumulative projects to provide a conservative cumulative assessment. The assessment found works in Victoria have the potential to contribute to cumulative impacts on native vegetation, trees and specific FFG threatened flora and fauna species habitat when considered with the projects in the zone of influence. The potential for cumulative impacts does not alter the identified impact ratings or proposed mitigations within sections 8.6, 8.7 and 8.8. It is expected that as each project within the zone of influence will also be subject to the employment of avoidance and minimise principles as a condition of their respective approvals. The effective implementation of approval conditions for each project minimises the potential for cumulative impacts from the conservative unmitigated scenarios assessed.

8.10 Summary of mitigation, monitoring and contingency measures

8.10.1 Mitigation measures

The following section outlines the mitigation measures developed to avoid and minimise impacts on onshore ecology within the study area. The focus of these mitigation measures is:

1 Avoiding impacts where possible

2 Developing, preparing and implementing project-specific measures to minimise impacts.

Detailed descriptions of each measure can be found in *Chapter 26 – Victorian Environmental Management Framework*, but the simplified mitigation measures are as follows:

Table 8-43 Mitigation measures relevant to onshore ecology

ID	Mitigation measure
FFM-M001	Avoidance of impacts to ecological values during the design phase
FFM-M002	Prepare an Environmental Line List
FFM-M003	Prepare and implement a Construction Environmental Management Plan and sub-plans
FFM-M004	Contractor inductions and awareness
FFM-M005	Prevent construction impacting on retained vegetation and habitat not approved for removal
FFM-M006	Minimise disturbance, injury, or death of wildlife
FFM-M007	Control spread and/or introduction of weeds, pathogens and/or pest animals
FFM-M008	Reduce erosion, sedimentation and contamination risk to retained vegetation and habitat (including waterways)
FFM-M009	Protect values within conservation reserves
FFM-M010	Manage impacts on waterways
FFM-M011	Prepare and implement an Operation Environmental Management Plan
FFM-M012	Prepare and implement a Decommissioning Environmental Management Plan.
FFM-M013	Site reinstatement and rehabilitation
FFM-M014	Prepare and implement a dewatering Plan
FFM-M015	Targeted survey for protected flora on public land

8.10.2 Monitoring and contingency measures

Monitoring requirements and contingency measures will be defined by Star of the South in the relevant plans to be prepared in consultation with relevant authorities.

8.11 Offsets

Residual impacts to native vegetation will be offset in accordance with the Guidelines. Up to 8.197 General Habitat Units, with a minimum strategic biodiversity score of 0.394 and 119 large trees will be required to be offset (refer to *Technical Report G – Onshore Ecology*). Star of the South has identified third-party offset sites with the local area meeting these obligations which will be secured. Due to the conservative nature of this assessment including the 15-metre buffer zone on either side of the alignment, it is anticipated further avoidance can be achieved through the detailed design, reducing the total area of native vegetation removal and associated offset obligations required for works in Victoria.

8.12 Conclusion

The onshore project area encompasses diverse landforms such as coastal and near-coastal areas, lowland plains and historically cleared and fragmented habitats primarily comprising grazing paddocks and plantations. Patches of forest and woodlands are found along roadsides, conservation reserves, and private land, while numerous ephemeral waterways occur along the transmission alignment. Native vegetation is primarily restricted to roadside and conservation reserves, with ten ecological vegetation classes identified, including the dominant and vulnerable Plains Grassy Forest.

There are several threatened species recorded within the onshore project area. While efforts to avoid impacting these species have been significant, with a reduction of between 33 to 46 per cent in the impact to native vegetation , some unavoidable losses will occur. Direct pathways of impact include the removal of up to 16.142 hectares of native vegetation and impacts to habitat of threatened species. While impact pathways are unavoidable, with the implementation of mitigation measures, the residual impacts to FFG Act listed species are not considered to be significant.

Implementation of trenchless construction methods and a refined transmission alignment will ensure minimal disruption to sensitive ecological areas. Well-defined management plans and protocols, developed in consultation with the Victorian Department of Energy, Environment and Climate Action, will protect ecological values during construction, operation, and decommissioning. Star of the South will offset the removal of native vegetation in accordance with Victorian regulations, with identified third-party offset sites within the local area meeting these obligations.

The works in Victoria have been evaluated to balance development goals with the conservation of ecological values. This is demonstrated through the commitment to avoid and minimise impacts, together with robust mitigation and management plans.

It is considered that the matters outlined in the EES scoping requirements have been adequately addressed as part of the onshore ecology impact assessment.