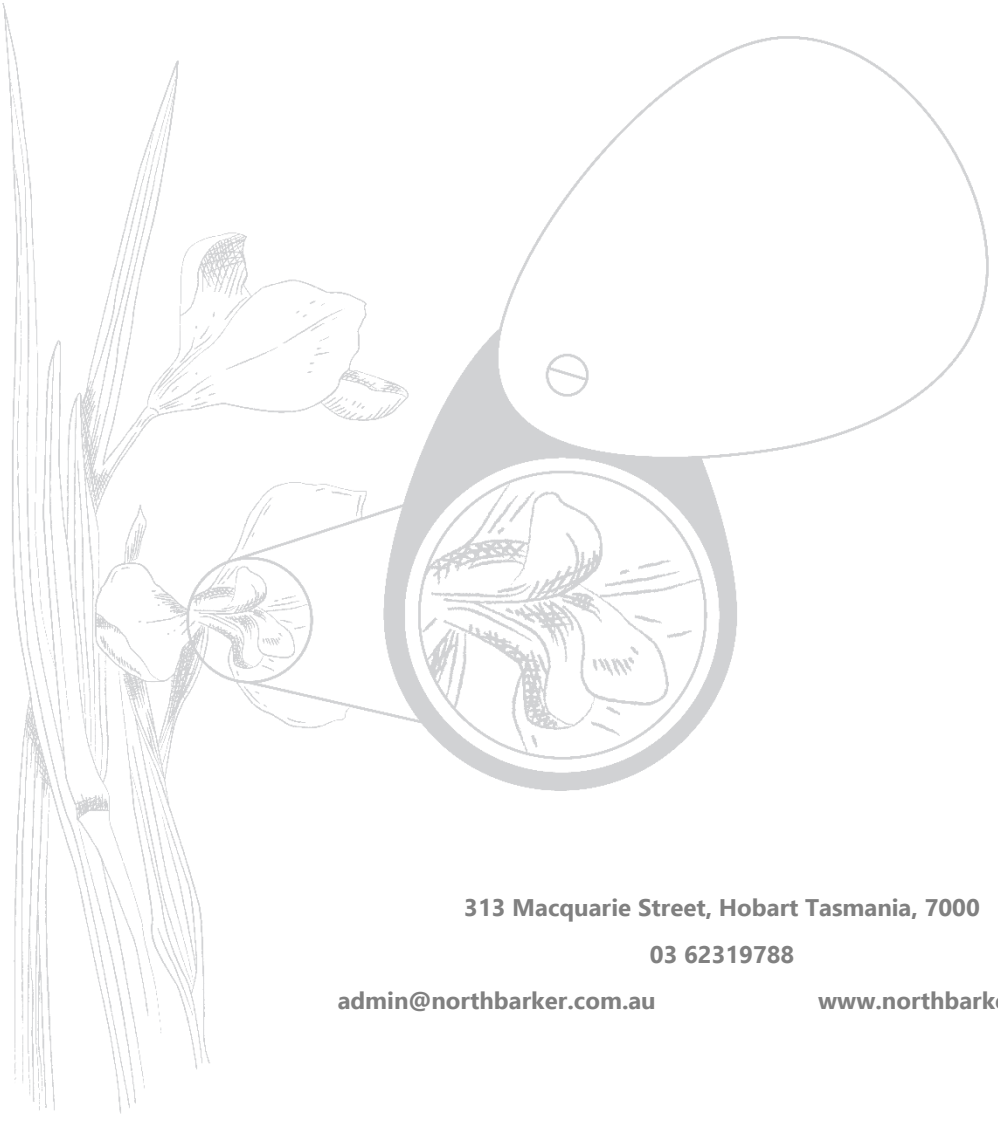
EPBC Act Ref: 2022/09295

Northern Midlands Irrigation Scheme
Preliminary Documentation

Tasmanian Irrigation

8th March 2024

IDB023



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File Control

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Location	Poatina to Mona Vale
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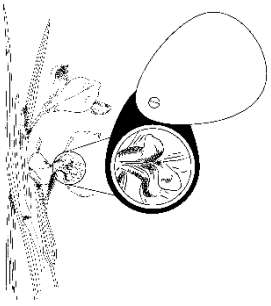
Document Version	Date	Author / Comment	Title
Version 0.1	16/12/2022	Drafted by Aleida Williams and Jared Parry Reviewed by Tasmanian Irrigation 19/12/2022	Ecologist (AW) Senior Ecologist (JP)
Version 1.0	22/12/2022	Edited and delivered to Tasmanian Irrigation by Grant Daniels	Managing Director / Principal Ecologist
Version 2.0	23/03/2023	Edited and delivered to Tasmanian Irrigation (with TI input) by Jared Parry and Grant Daniels Additional detail/information was added to Version 2.0 in response to additional comments and requests for further information from the regulators in response to a review of Version 1.0 (with comments received on 16/2/23 and final comments on 22/2/23)	Senior Ecologist (JP) Managing Director / Principal Ecologist (GD)
Version 3.0	21/06/2023	Edited and delivered to Tasmanian Irrigation (with TI input) by Jared Parry and Grant Daniels Additional detail/information was added to Version 3.0 in response to additional comments and requests for further information from the regulators in response to a review of Version 2.0 (with comments received on 21/04/23)	Senior Ecologist (JP) Managing Director / Principal Ecologist (GD)
Version 4.0	22/11/2023	Edited and delivered to Tasmanian Irrigation (with TI input) by Jared Parry and Grant Daniels Additional detail/information was added to Version 4.0 in response to additional comments from the regulators in response to a review of Version 3.0 (with comments received on 01/08/23). Offset proposal appended.	Senior Ecologist (JP) Managing Director / Principal Ecologist (GD)
Version 5.0	24/01/2024	Removed offset proposal (and references to) from V4.0. Offset proposal for residual impacts pending approval by DCCEEW – Jared Parry	Senior Ecologist
Version 6.0	08/03/2024	Updated to address comments from public submission and updates to statistics following further alignment reductions – Jared Parry	Senior Ecologist



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List of Acronyms

Excluding TASVEG Mapping Units, measurement units and abbreviations defined within figures or tables

AEDT	Australian Eastern Daylight Time
AEST	Australian Eastern Standard Time
AHR	Aboriginal Heritage Register
AHT	Aboriginal Heritage Tasmania
BCR	Benefit – Cost Ratio
BT	Balance Tank
CHMA	Cultural Heritage Management Australia
DBH	Diameter at Breast Height
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DEM	Digital Elevation Model
DFTD	Devil Facial Tumour Disease
EOI	Expression of Interest
EPBCA	*Environment Protection and Biodiversity Conservation Act 1999*
EPR	Environmental Protection Requirements
ESD	Ecologically Sustainable Development
Farm WAP	Tasmanian Irrigation Farm Water Access Plan
FPA	Forest Practices Authority (Tasmania)
GIS	Geographic Information System
GPS	Global Positioning System
IRR	Internal Rate of Return
MNES	Matters of National Environmental Significance
NBES	North Barker Ecosystem Services
NCA	Tasmanian *Nature Conservation Act 2002*
NMIS	Northern Midlands Irrigation Scheme
NPV	Net Present Value
NRE	Department of Natural Resources and Environment (Tasmania)
NVA	Natural Values Atlas Database (NRE, Tasmania)
NWIDF	National Water Infrastructure Development Fund
PAD	Potential Archaeological Deposit
PMST	Protected Matters Search Tool (DCCEEW, Commonwealth)
RFAI	Request for Additional Information
SPRAT	Species Profile and Threats Database (DCCEEW, Commonwealth)
THR	Tasmanian Heritage Register
TI	Tasmanian Irrigation
TSPA	Tasmanian *Threatened Species Protection Act 1995*
UDP	Unanticipated Discovery Plan

SUMMARY

The following document provides further detailed information requested to assist the assessment of potential impacts on matters protected by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBCA) for the development of the Northern Midlands Irrigation Scheme (NMIS). The proposed scheme will distribute 25,500 ML of water annually to 40 landholders within the Scheme district through a pipeline network extending approximately 138 km. This document is supplementary to the information already provided in the referral (**EPBC Ref: 2022/09295**). Table 1 summarises the information provided in relation to the Request for Additional Information (RFAI) that was issued on the 08/11/2022. Additional detail/information was added to Version 2.0 in response to additional comments and requests for further information from the regulators in response to a review of Version 1.0 (with comments received on 16/2/23 and final comments on 22/2/23. Version 3.0 added further information based on comments received on 21/04/2023. Version 4.0 adds further information and input surrounding offsets based on comments received via email on 01/08/2023, and Version 5.0 has removed an offset proposal (which has been submitted separately). This version (Version 6.0) addresses comments from a single public submission (issued 19/02/2024), as well as updates to impact areas after a final review and reduction of corridor areas.

The primary attachment is the original Referral document (**Attachment 1**) and its own attendant Attachments. Some of the studies provided as Attachments to the referral have since been completed or updated. These are now included as Attachments to this document where relevant.

LOCATION OF INFORMATION

Table 1: Summary of information provided within this Preliminary Documentation

Document Section	Page Numbers	Title	Content
	1-2	Summary	
1	3-11	Description of the action	This section addressed **RFAI1**, describing the activities associated with the proposed action, the location and size, and the timing and duration of the proposed action, as well as describing any ongoing operational requirements.
2	12-26	Description of the environment	This section provides a detailed description of the environment within the proposed action area and provides a description of the land use within and adjacent to the proposed action area. **RFAI2**.
3	27-189	Matters of National Environmental Significance	This section addresses **RFAI3**, **RFAI4**, and **RFAI5**, covering the following the following MNES: • Tasmanian devil (*Sarcophilus harrisii*) • Eastern quoll (*Dasyurus viverrinus*) • Spotted-tail quoll (*Dasyurus maculatus maculatus*) • Tasmanian wedge-tailed eagle (*Aquila audax fleayi*) • Tasmanian masked owl (*Tyto novaehollandiae castanops*)

Document Section	Page Numbers	Title	Content
			• Swan galaxias (*Galaxias fontanus*) • Green and gold frog (*Litoria raniformis*) • Grassland greenhood (*Pterostylis ziegeleri*) • Propellor plant (*Stenanthemum pimeleoides*) • Matted flax-lily (*Dianella amoena*) • Lowland native grasslands of Tasmania Detailed discussions surrounding impacts to Tasmanian devils and Tasmanian wedge-tailed eagles are emphasised to address key issues from **RFAI4(d)** and **RFAI4(e)**.
4	190-193	Residual impacts and proposed offsets	This section addresses residual impacts and proposed offsets in line with **RFAI6**.
5	194-197	Social and economic	This section addresses the social and economic impacts of the proposed action, with details of public consultation, and project costs and benefits of the proposed action. **RFAI7**.
6	197-201	Other approvals and conditions	This section lists all other approvals and conditions that apply to the proposed action. **RFAI8**.
7	201-202	Environmental record of person proposing to take the action	This section gives a summary of the environmental record of the person(s) proposing the action. **RFAI9**.
8	203-204	Ecologically sustainable development	The section provides a description of the proposed action in relation to the principles of ecologically sustainable development and the objects and requirements of the EPBC Act. **RFAI10**.
9	205-210	Conclusion	This section provides an overall conclusion regarding the environmental acceptability of the proposal, including discussion on compliance with the principles of ecologically sustainable development and the objects and requirements of the EPBC Act. **RFAI11**.
10	211-220	Information sources	This section provides information regarding the source and currency, and reliability of information sources in line with **RFAI12**, as well as providing a list of references cited in the document.

1. DESCRIPTION OF THE ACTION

1.1. THE ACTION – LOCATION, SIZE AND PURPOSE

Northern Midlands Irrigation Scheme is part of the Pipeline to Prosperity (Tranche 3) suite of schemes proposed by Tasmanian Irrigation Pty Ltd (TI). The scheme covers the regions of Cressy, Powranna, Barton, Conara, Epping Forest, the Lower Macquarie and Isis Rivers, Campbell Town, and Ross (Figure 1).

The NMIS is proposed to be gravity fed from the Poatina Tailrace, with an offtake channel to a small buffer dam adjacent to the tailrace. Water will be pumped from here to a balance tank (BT) located at a localised high point (Poatina BT). The balance tank then gravity feeds the ring main distribution network. Two additional pump stations (Valleyfield and Epping Forest) and several branch lines will further disperse water through the region. An additional balance tank will be constructed near Kirklands (Valleyfield BT). The pipeline network consists of approximately 138 km of large diameter (predominantly 1,000 mm) high-density polyethylene pipeline, with a design peak flow of 170 ML/day. The NMIS is proposed to distribute 25,500 ML of water annually to 40 landholders in the NMIS project area. The infrastructure has a design lifespan of 100 years. The proposed scheme will enable TI to service the majority of properties that submitted an EOI. The scheme will allow for irrigation water to be provided to the NMIS district, which covers an estimated area of 128,400 ha, noting that not all of this district area is irrigable land.

The pipeline alignment broadly follows the Macquarie River, with the main lines following Valleyfield and Macquarie Roads, with several additional branches distributing water along Barton Road, Mount Joy Road, Mona Vale Road, and the Isis River (Figure 1). The proposed construction corridor consists of 25.33 ha of native vegetation, and 420.06 ha of modified land (including 0.70 ha of permanent water). The construction corridor has been narrowed in places to avoid conservation significant values. The corridor is typically 30 m wide, with a 15 km section between Poatina and Quarry Rd at 40 m wide to accommodate dual pipelines.

The works proposed will require excavation along the route, as well as several aquatic crossing points. The work will occur largely through private land. Excavation in the form of trenching will occur only within the proposed construction corridor. Trenching width varies depending on the diameter of pipe required, ranging from 1 m to 5 m depending on whether it is a single trench or dual trench. The depth of the trench varies in depth, ranging from 1 m to 3.5 m, with an average depth of 1.5 m. Figure 2 shows an indicative works area.

Where conditions permit, pipe crossings of permanent water courses will be installed using trenchless processes. This will be determined by the pipe size, type, and size of rock present if any, shape, and length of the crossing and other geotechnical considerations. Transient water course crossings will be conducted using a combination of trenched and trenchless processes to be selected by the construction contractor based on the time of year, presence of water, size of pipe and geotechnical considerations.

A dam is proposed at the northern end of the project area, adjacent to the Hydro Tasmania tail race, north of Poatina Road (Figure 3). The dam is proposed to be a ring tank design with a wall height ranging from 2 m to 7.5 m. The entire dam footprint is located within modified agricultural land. The permanent footprint of the dam covers an area of 17.30 ha. The dam will be lined with HDPE. Areas of fill will be revegetated with grasses, as will the dam wall, in order to reduce visual impacts.

The dam will be essentially a silent asset with some minor noise from the water entering the dam from the tailrace. This noise is expected to be quieter than the water already flowing over the weir structure located directly alongside on Hydro Tasmania's tail race.

The proposed pump station footprints (which includes pump housing and access roads) vary in size and output, ranging from ~700 m^2 to ~2,400 m^2. In total, the pump stations will have an impact footprint of approximately 5,000 m^2 across three sites. All three sites are located within modified land.

The pump stations will be housed in colourbond sheds, pale eucalypt in colour to blend in with the landscape as much as possible. The pump stations are designed to have minimal audible sound expelled into the surrounding area during operations.

Two balance tanks are proposed within the project area, one just to the southeast of the proposed dam (Figure 1), herein referred to as Poatina BT, and one on a hilltop near the junction of Macquarie and Valleyfield Roads (opposite the Kirklands Presbyterian cemetery), herein referred to as Valleyfield BT. The tanks will pale eucalypt in colour in order to blend into the landscape as much as possible.

The balance tanks will have no audible sound during operations. The tanks are designed so water enters and exits from the base of the tank which causes the water entering the tank to be baffled by the water already in the tank.

The Poatina BT (Figure 4) will have an impact footprint (including overflow pond and access roads) of ~7,300 m^2 (27 m in diameter) and will hold 3.45ML of water. This site is located within modified land.

The Valleyfield BT (Figure 5) will have an impact footprint (including overflow pond and access roads) of ~7,100 m^2 (20.7 m in diameter) and will hold 1.35 ML of water. This is situated on the margins of a patch of eucalypt forest, however impact to native vegetation is minimal. Access roads to each balance tank are proposed to be 4 m wide on average, with a passing bay at Valleyfield adding an additional 3 m. Road shoulders are on average 0.5 m.

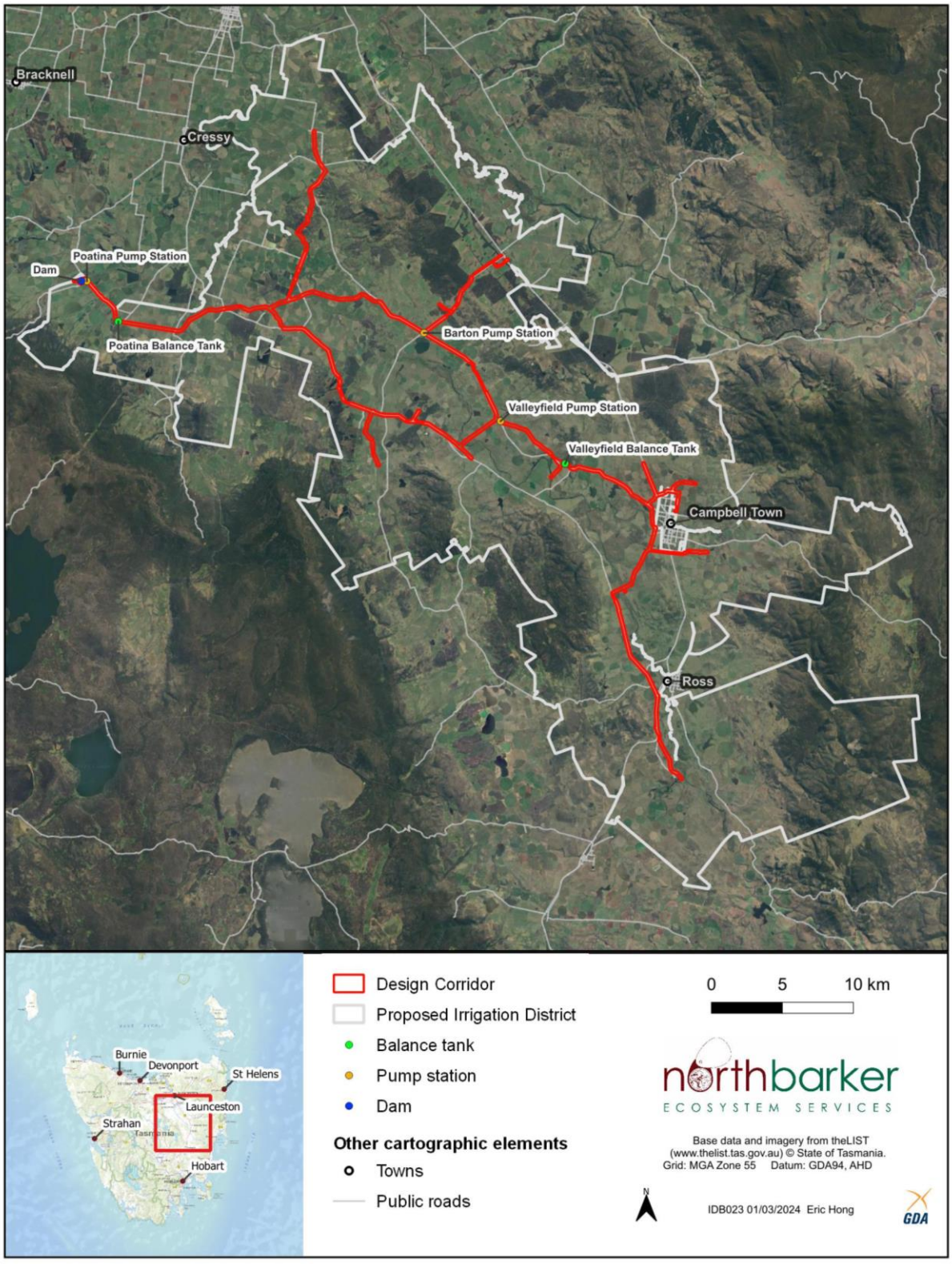


Figure 1: Location of the project area

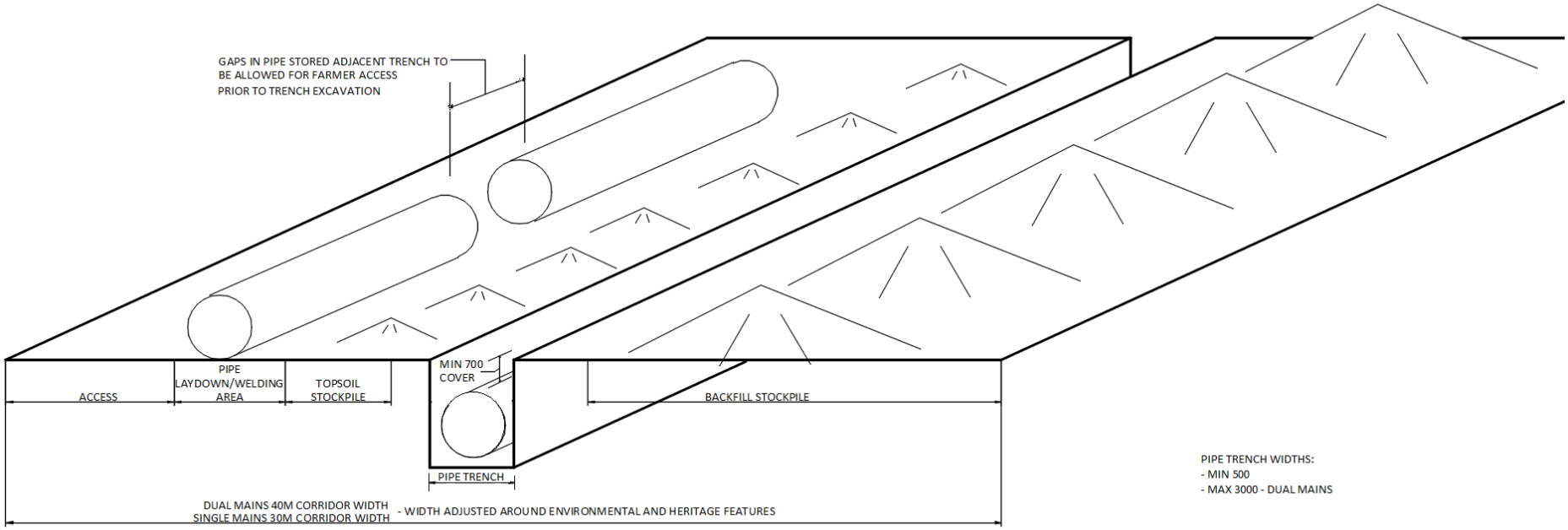


Figure 2: Indicative drawing of a typical construction corridor layout

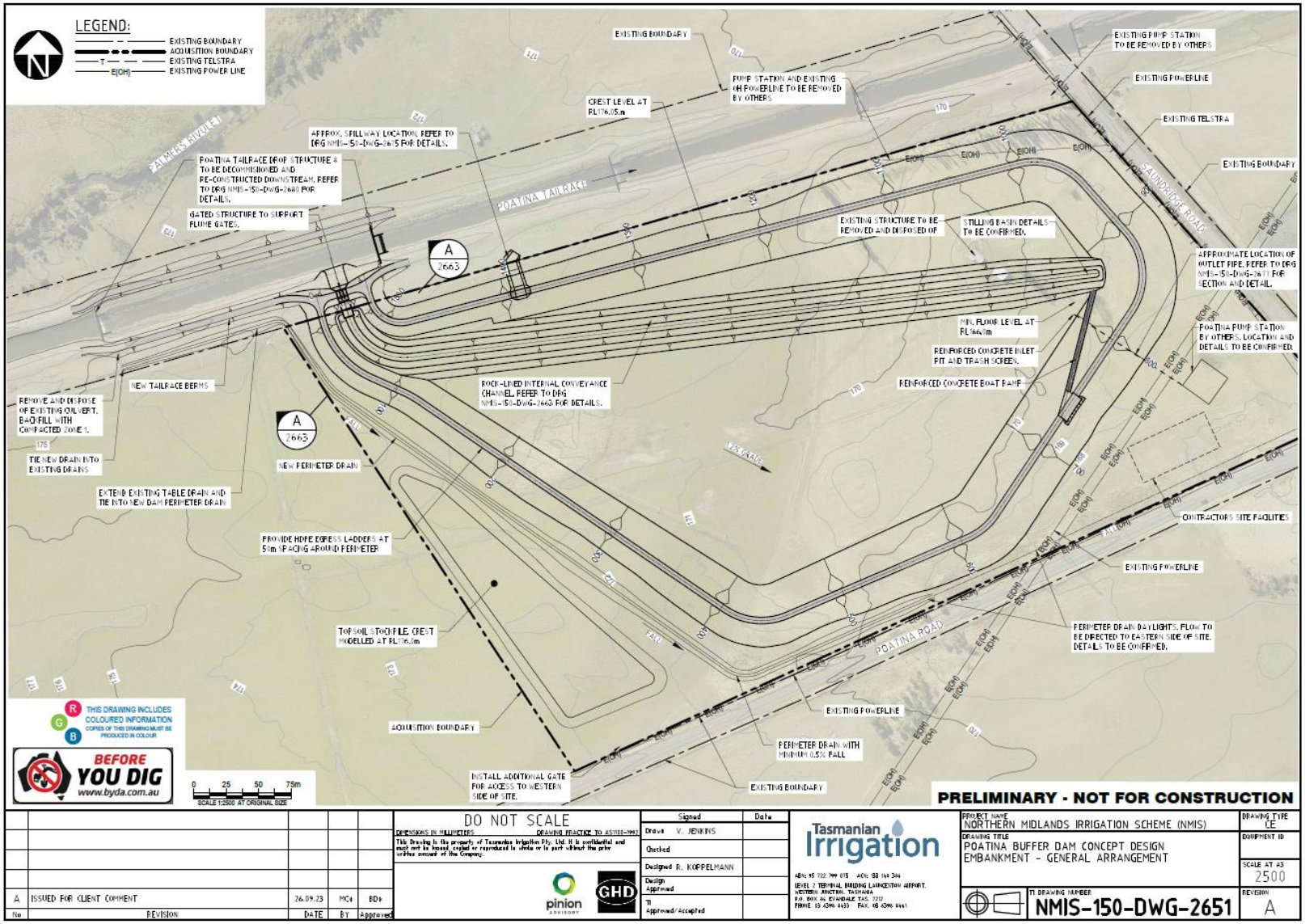


Figure 3: Poatina buffer dam general arrangement

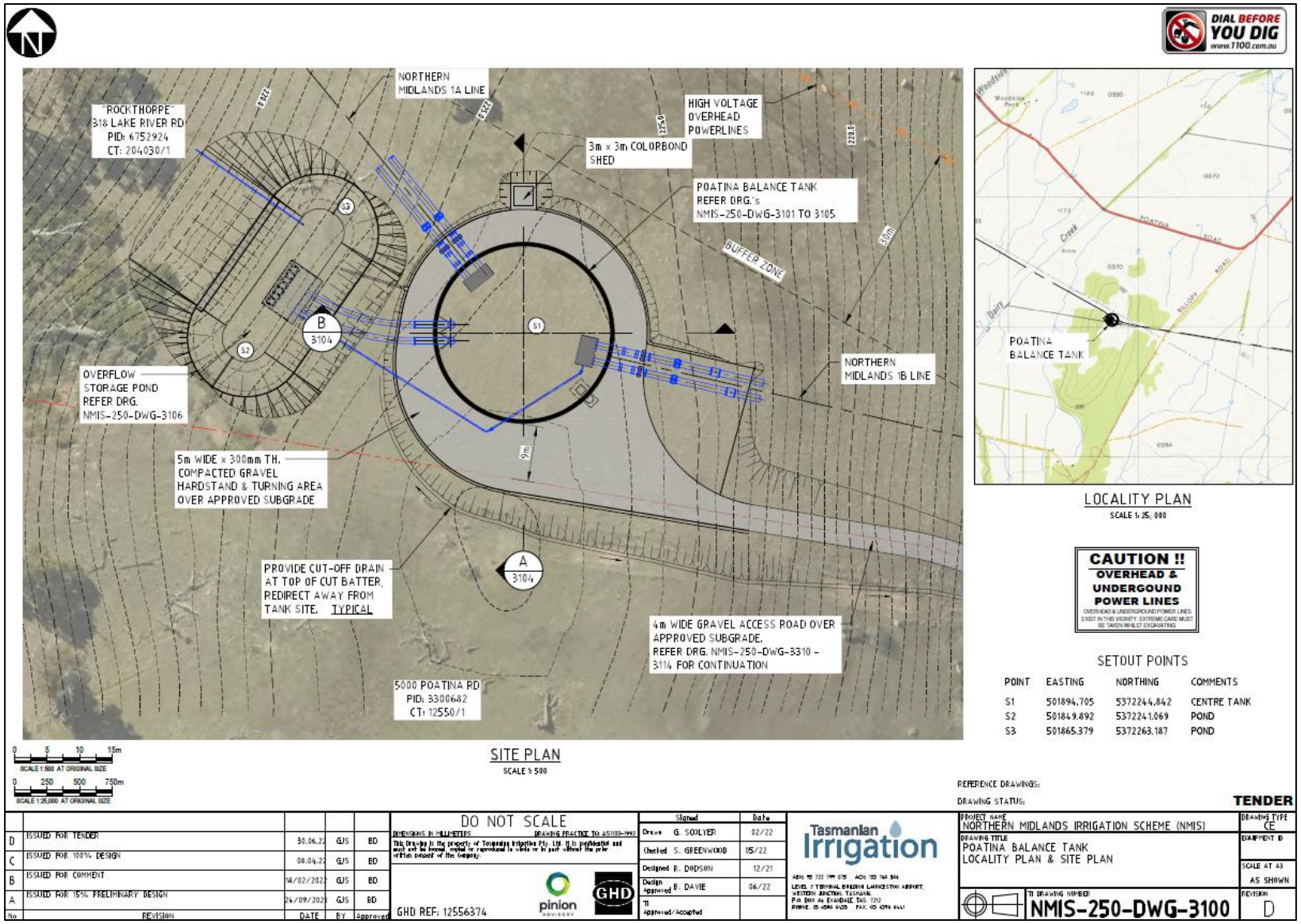


Figure 4: Poatina Balance Tank

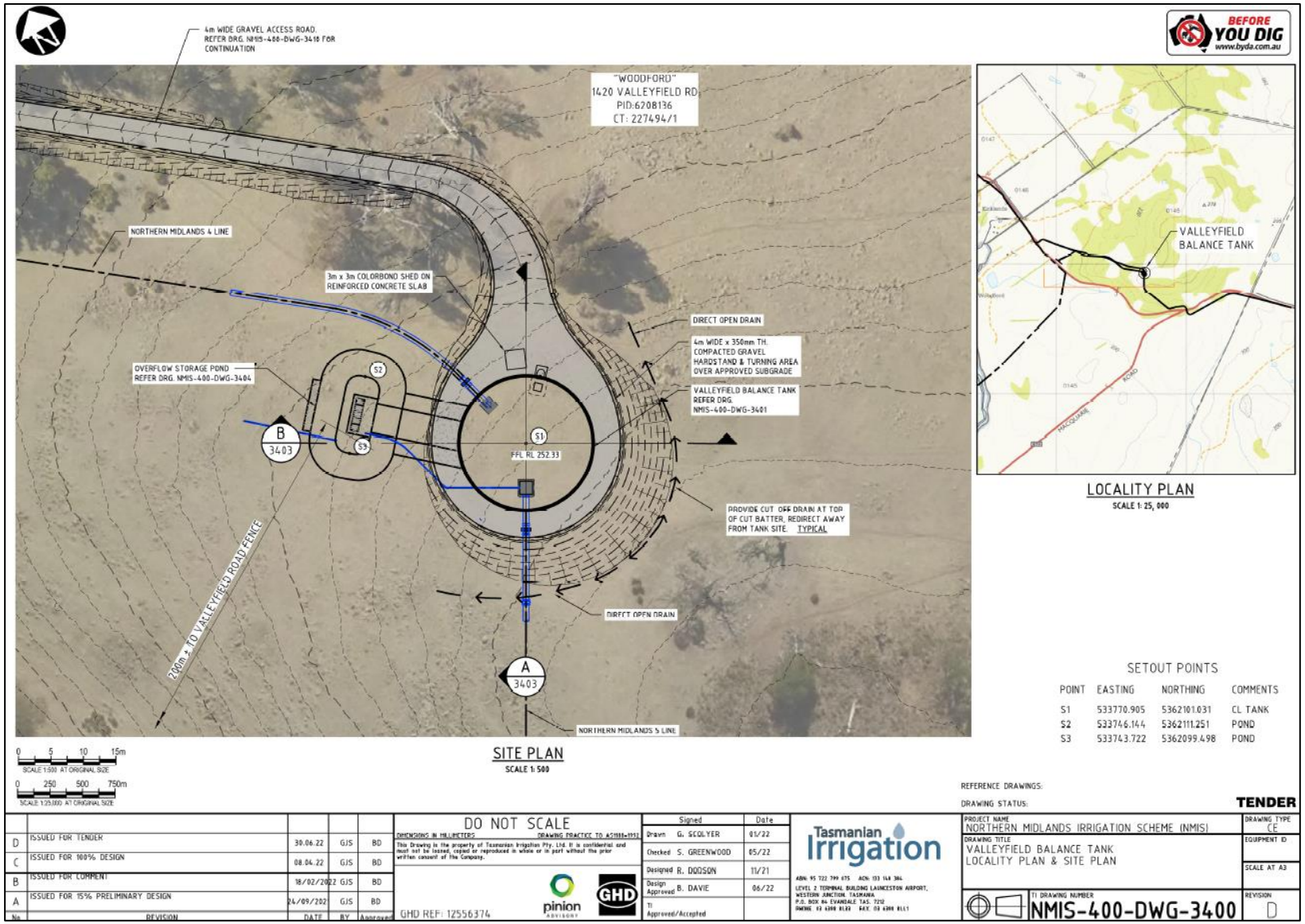


Figure 5: Valleyfield Balance Tank

1.1.1. TASMANIAN IRRIGATION FARM WATER ACCESS PLAN (FARM WAP)

Prior to water distribution, individual irrigators must meet with TI staff to confirm a Farm Water Access Plan (Farm WAP) area[1], to collect data such as water licences and Tasmanian Natural Values Atlas (NVA) records, and any existing farm plans. Further to this, the Farm WAP process is completed by having prequalified consultants conducting soil and biodiversity assessments. The consultants then provide TI with the completed Farm WAP for quality assurance processes and is then verified by the irrigator.

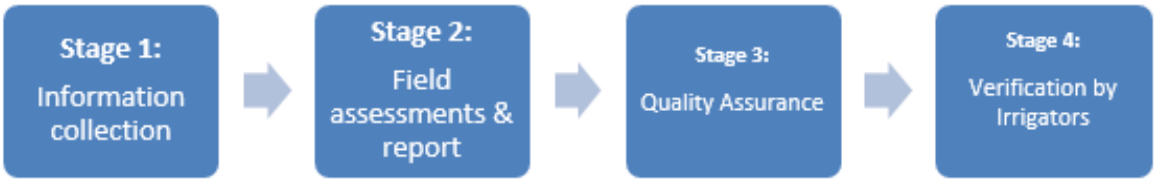
What is a Farm WAP?

Farm WAPs guide the sustainable application of water to ensure the long-term viability of land for agricultural production. They also help manage potential risks to natural values and include maps for use on irrigated properties. Farm WAPs are a condition of Federal and State Government approval for all Tasmanian Irrigation built schemes. The Northern Midlands Irrigation Scheme includes the requirement to have a Farm WAP covering all land and dams that TI water is applied to. The main purpose of Farm WAPs is to identify and manage:

- risks to soil health on the irrigated properties,
- risks to watercourse and groundwater in the receiving environment from the application of water, and
- natural values on each irrigated property.

How Farm WAPs are prepared

TI facilitates the preparation of Farm WAPs for new schemes. There are four stages as follows:



Farm WAPs can only be completed by a prequalified consultant who has been approved by the Minister and are prepared in accordance with the soil, water and biodiversity modules approved by the Department of Natural Resources and Environment, Tasmania. The overall time to develop Farm WAPs can be more than six months.

Who is responsible for, and complying with, a Farm WAP?

The person irrigating the land (the irrigator) is responsible for:

- having a Farm WAP in place,
- ensuring TI water is only applied to land where a current Farm WAP is in place,
- informing TI of any changes to practices, so TI can assist with the updating and approval of a revised Farm WAP prior to those changed practices being implemented,
- applying the water in accordance with the Farm WAP requirements including ensuring that the volume of water applied matches the land capability and crop water usage volumes,
- complying with the management actions and monitoring schedules prescribed in the Farm WAP
- keeping records of irrigation, chemical and fertiliser use in compliance with Tasmanian regulations.

Ordinarily the landowner is the irrigator and therefore the person responsible for obtaining a Farm WAP. In situations where water is transferred or land is leased, a business arrangement between the

[1] Tasmanian Irrigation (2020)

irrigator and the landowner and/or lessee may be required to facilitate obtaining the Farm WAP. We recommend to irrigators that Farm WAPs are reviewed and checked upon transfer, and prior to each irrigation season, to ensure the Farm WAP area covers the proposed irrigation area and that the land capability is appropriate.

What compliance monitoring relates to Farm WAPs?

In accordance with conditions of approval of the irrigation schemes under the Tasmanian *Water Management Act 1999*, TI has implemented a Farm WAP auditing program. The program includes annual audits of randomly selected Farm WAPs, and triggered audits where non-compliance is identified or monitoring results indicating a decline in scheme water quality or other environmental factors.

Audits focus on compliance with the management prescriptions set out in each Farm WAP. Criteria to be addressed includes whether water has been applied in accordance with the Farm WAP, whether land capability limitations and biodiversity have been managed, monitoring has been undertaken, and required records are being kept in accordance with the Farm WAP.

Non-compliance penalties range from offering further information on best practices, through to corrective action notices being issued, and in extreme situations water delivery services being withdrawn.

Further information can be found in the Tasmanian Irrigation Farm Water Access Plans Biodiversity Module (**Attachment 2**).

1.2. THE ACTION – TIMING

The project is proposed to be completed over four stages, with anticipated timing listed below.

December 2023 – Awarded contract

May 2024 – Commence construction

March 2026 – Complete construction

April/June 2026 – Commission scheme

2026/27 – First full irrigation season

Ongoing maintenance is expected to be minimal, with operations and maintenance typically restricted to 1 light vehicle (operating in daylight hours, weekdays only). The scope of maintenance will vary from scheme-wide to single sites. Major maintenance will be periodic at the primary asset sites (pump stations, balance tanks and dams). This will include the use of light and heavy vehicles over a period of up to a week, in daylight hours. Pump stations will typically have annual maintenance with 2 or 3 light vehicles, and significant maintenance involving some heavy vehicles (1 to 2) every 5-10 years. Balance tanks and the dam will typically require additional vehicles every 10 years, which may include heavy vehicles and heavy plant for up to a week.

2. DESCRIPTION OF THE ENVIRONMENT

The scheme covers the regions of Cressy, Powranna, Barton, Conara, Epping Forest, the Lower Macquarie and Isis Rivers, Campbell Town, and Ross. The pipeline alignment broadly follows the Macquarie River, with the main lines following Valleyfield and Macquarie Roads, with several additional branches distributing water along Barton Road, Mount Joy Road, Mona Vale Road, and the Isis River.

The proposal area varies in elevation between 160 m and 250 m above sea level; however, the proposed works will take place within a broad river valley that is relatively flat.

2.1. VEGETATION

Vegetation types were mapped throughout the design corridor as part of the natural values assessment, which informs statements on the distribution of vegetation types throughout this section, noting in some cases the characteristics of the vegetation reflect types of land use, which are highlighted where relevant (**See Attachment 3, Section 3.1**). Statements on the composition of communities, including the presence of weeds, threatened flora, habitat values, etc., are referring to observations made within the natural values assessment (and presented in **Attachment 3**).

The NMIS region has a strong agricultural history, with much of the broader area dominated by modified pasture and cropping land. Forest remnants are scattered throughout the NMIS region. This is reflected by the distribution of vegetation within the project area. A summary of the vegetation communities present is in Table 2. The vast majority (411.63 ha, 92.54 %) of the proposed construction impact area is agricultural land, and a further 8.37 ha (1.74 %) is other modified land classes (i.e. non-native vegetation units under the TASVEG classification system) or water. Native vegetation is generally in a moderate condition, with condition improving away from the fringes of remnants, where weeds are often prevalent (as per the natural values assessment). Native forests contain few large trees having evidently been selectively logged in the past. Grazing was observed to be frequent within many native vegetation patches.

2.1.1. VEGETATION – DESIGN CORRIDOR

Eighteen TASVEG mapping units were mapped within the design corridor area during the natural values assessment, nine of which are native communities and nine are non-native communities. The status of the nine native vegetation communities in both a State and local context is presented in Table 2. Table 3 summarises the impact in relation to the vegetation class, location, and permanency of impact. A total of only 24.80 ha of native vegetation will be impacted within the construction corridor (as well as 420.00 ha of modified/water/non-native vegetation), with the corridor modified substantially from its initial design to reduce the impact on native vegetation as much as possible. The remaining avoidance area within the design corridor is 2,194.19 ha (121.50 ha of native vegetation). A total of 20.03 ha (of which only 0.91 ha is native vegetation) will be lost due to permanent infrastructure. The balance will have scope for natural and assisted revegetation after the pipeline is installed. Vegetation within the design corridor is displayed in **Attachment 4**, and further information is provided in **Attachment 3, Section 3.1**.

AHL – Lacustrine Herbland – Lentic wetlands near the Campbell Town Golf Course occur on a transition zone of Tertiary basalt and Quaternary sands and gravels. All other patches occur on sands and gravels. The AHL community is treeless and is seasonally inundated. Agricultural weeds are present but not dominant. Tasmanian *Threatened Species Protection Act 1995* (TSPA) listed flora are present within this community across several sites. This community is listed as threatened under the Tasmanian *Nature Conservation Act 2002* (NCA); however, it does not correspond to an ecological community listed as an MNES under the EPBCA.

ASF – Aquatic Sedgeland and Rushland – All recorded areas of ASF occur on Quaternary gravels and sands. The ASF community is treeless and dominated by tall sedges, however a wetland at Rokeby Road is surrounded by a dense infestation of gorse. This community is listed as threatened under the Tasmanian NCA; however, it does not correspond to an ecological community listed as an MNES under the EPBCA.

DAZ - *Eucalyptus amygdalina* forest and woodland on Cainozoic deposits – This community occurs exclusively on sand and gravel deposits, which differentiate it from other *E. amygdalina* forest communities. There is evidence to suggest that the areas of DAZ have been subject to selective logging, and landscape-level clearance has occurred in places (best seen on Barton Road where DAZ has been left as a shelter belt). The community is generally in good condition, with weeds only prevalent on the edge of remnant patches where disturbance is most evident. This community is listed as threatened under the Tasmanian NCA; however, it does not correspond to an ecological community listed as an MNES under the EPBCA.

DPO – *Eucalyptus pauciflora* forest and woodland not on dolerite – This community occurs as small remnant patches across the survey area, and one larger remnant near Mount Joy Road. It occurs on Quaternary sands and gravels. There is evidence of disturbance, and likely a history of fire given the prevalence of bracken fern in the understory. The forest canopy is more closed that the other eucalypt communities in the survey area. This community is not listed as threatened under any State or Commonwealth Acts.

DVG – *Eucalyptus viminalis* grassy forest and woodland – This community occurs on a Jurassic dolerite ridge on Valleyfield Road, and on Quaternary sands and gravels east of Campbell Town. Vegetation structure is very open, and large trees are scarce, likely due to selective logging. This community is not listed as threatened under any State or Commonwealth Acts.

GCL - Lowland grassland complex – Patches of GCL typically occur on flats, often adjacent to a forest patch. The substrate consists of Quaternary gravels, sands, and silts. An exception to this is two patches near Campbell Town which occur on basalt derived soils.

GSL - Lowland grassy sedgeland – The single patch of GSL occurs on gravels and sands. The community occurs in a mosaic of GCL and agricultural land. The community is dominated by large tussocks, however there is a high frequency of herbaceous weeds throughout.

GTL - Lowland *Themeda triandra* grassland – *Themeda* grasslands on Valleyfield Road occur on Quaternary sands and gravels, and a patch near Campbell Town occurs on Tertiary basalt. In all cases of GTL, the patch quality is relatively poor, with very low herb diversity and a high number of herbaceous weeds. Gorse is a common occurrence at the patch near Campbell Town.

The grassland communities are not listed under the Tasmanian NCA, however if certain criteria are met, these communities can qualify as components of the EPBCA critically endangered lowland native grasslands of Tasmania, which is determined from criteria listed in Policy Statement 3.18 of the EPBCA. All grassland patches recorded during the natural values surveys were assessed against the listing criteria: all patches failed to qualify on multiple criteria, largely due to lacking herb diversity, insufficient tussock cover, and/or weed cover (see **Section 3.4.1** for further details).

2.1.2. VEGETATION – DAM FOOTPRINT

The vegetation within the proposed dam footprint area (totalling 17.30 ha) is entirely cleared agricultural land and modified tailrace elements. The dam site at the time of observation for the natural values assessment was a canola crop (south of the Poatina tailrace). There is no suitable habitat for threatened flora or fauna beyond marginal foraging habitat for raptors and carnivores, equivalent to habitat widespread/ubiquitous throughout the broader surrounding landscape. Immediately adjacent to the dam is a proposed pump station that has an impact footprint of 0.97 ha. This is also entirely located within cleared land.

Table 2: Summary of impacts to native vegetation, and regional context

Vegetation Community	Vegetation Type	Total Within Design Corridor	Total Within Construction Corridor	Total Within Northern Midlands Council	Total Reserved Within Northern Midlands Council	Total Within Northern Midlands Bioregion	Total Reserved Within Northern Midlands Bioregion	Total Within Tasmania	Total Reserved in Tasmania
AHL – Lacustrine herbland	Native non-forest vegetation	1.88	0.24	200	50 (25%)	100	30 (30%)	3,200	2,000 (65%)
ASF – Aquatic sedgeland and rushland	Native non-forest vegetation	0.59	0.00	800	400 (50%)	1,200	500 (42%)	7,100	4,300 (60%)
DAZ – *Eucalyptus amygdalina* inland forest and woodland on Cainozoic deposits	Native forested vegetation	31.13	5.09	16,400	5,700 (35%)	18,900	6,000 (32%)	22,200	7,200 (32 %)
DPO – *Eucalyptus pauciflora* forest and woodland not on dolerite	Native forested vegetation	38.14	6.08	1,300	300 (23%)	400	100 (25%)	10,000	3,100 (31%)
DVG – *Eucalyptus viminalis* grassy forest and woodland	Native forested vegetation	5.98	1.29	49,100	8,900 (18%)	27,700	5,500 (20%)	103,900	17,500 (17%)
GCL – Lowland grassland complex	Native non-forest vegetation	60.36	10.28	24,300	1,800 (7%)	20,500	1,300 (6%)	69,100	3,300 (5%)
GPL – Lowland *Poa labillardierei* grassland	Native non-forest vegetation	6.39	1.69	6,200	800 (13%)	3,900	500 (13%)	14,000	1,700 (13%)
GSL – Lowland grassy sedgeland	Native non-forest vegetation	1.04	0.10	1,200	200 (16%)	600	100 (16%)	6,700	500 (7%)
GTL – Lowland *Themeda triandra* grassland	Native non-forest vegetation	0.79	0.03	5,500	1,900 (35%)	4,200	1,400 (33%)	7,600	2,300 (31%)

Table 3: Summary of impacts in relation to vegetation type, location, and permanency

	Design Corridor	Construction Corridor	Avoidance Area	Permanent Impact
Native Non-forest Vegetation	75.25	12.46	58.70	0.61
Native Forested Vegetation	71.05	12.35	62.80	0.30
Modified (exc. Agricultural)	75.00	7.72	67.28	0.11
Water	14.52	0.65	13.86	0.00
Agricultural	2,403.17	411.63	1,991.54	19.01
Total	**2,638.99**	**444.81**	**2,193.19**	**20.03**

2.2. FLORA

Within the project area 263 native and 142 introduced species of plant were recorded (**Attachment 3, Attachment 4, and Attachment 5**). The predominant flora species within each vegetation community are described in the natural values assessment report (**See Attachment 3, Pages 10-19**). Twenty-two flora species listed under the Tasmanian TSPA were recorded during natural values surveys (5 of which are outside of the design corridor following realignments and redesign). Three of these species are also listed as threatened under the Commonwealth EPBCA. Table 4 provides a list of threatened species within the project area, with comments on the habitat, project specific distribution, and scale of potential impacts.

The presence of additional threatened species known from within 500 m (or up to 5 km) of the project area, as per the Tasmanian Natural Values Atlas database, was considered throughout all site assessments. A copy of the Natural Values Atlas report from this database is in **Attachment 6.**

Table 4: Threatened flora recorded within the project area with reference to potential impacts

Species	Status (TSPA/EPBCA)	NVA Records within 5 km (including NBES records)	Notes	Within Design Corridor	Within Indicative Construction Corridor	Scope for Further Avoidance and Impact Minimisation
Bolboschoenus caldwellii	Rare / -	27	Occurs in saline waterways on Valleyfield Road. Large patches recorded outside of design corridor.	**0.43 ha**	**0.09 ha**	Minor incursions are likely to be unavoidable.
Calocephalus lacteus	Rare / -	260	Recorded near the Macquarie River at Hoggs Ford	**-**	**-**	Not within current impact footprint.
Coronidium gunnianum	Endangered (pending) / -	22	Located within low-quality GCL near Valleyfield Road, and a	**55 plants**	**5 plants**	Potential for minor deviations

Species	Status (TSPA/EPBCA)	NVA Records within 5 km (including NBES records)	Notes	Within Design Corridor	Within Indicative Construction Corridor	Scope for Further Avoidance and Impact Minimisation
			roadside area on Macquarie Road.			to avoid impacts.
Dianella amoena	Rare / ENDANGERED	427	Located within low-quality GCL near Valleyfield Road. Recorded in the general area and previous pipeline alignments.	**4 m^2**	**4 m^2**	Potential for minor deviations to avoid impacts.
Haloragis heterophylla	Rare / -	132	Located near the Campbell Town Golf Course.	**-**	**-**	Not within current impact footprint.
Juncus vaginatus	Rare / -	7	Located within GPL adjacent to the Campbell Town Golf Course.	**-**	**-**	Not within current impact footprint.
Lobelia pratioides	Vulnerable / -	27	Occurs within lentic wetlands west of the Campbell Town Gold Course.	**1.30 ha**	**0.08 ha**	Limited scope to avoid. Likely to revegetate post-disturbance.
Persicaria decipiens	Vulnerable / -	7	Small patches (8 m^2) on the Isis River with the design corridor, and ~13 m^2 on the Macquarie River near Macquarie Settlement Road, outside of the design area. One small patch occurs on the edge of the construction corridor on the Blackman River.	**18 m^2**	**-**	Potential for minor deviations to avoid impacts.
Pterostylis ziegeleri	Vulnerable / VULNERABLE	72	A large population concentrated on the northern side of Valleyfield Road. Population extends well beyond design corridor. 10 plants observed south of the road; however, numbers may vary with seasonal fluctuations.	**0 plants**	**0 plants**	Design has been modified to avoid impacts.

Species	Status (TSPA/EPBCA)	NVA Records within 5 km (including NBES records)	Notes	Within Design Corridor	Within Indicative Construction Corridor	Scope for Further Avoidance and Impact Minimisation
Puccinellia perlaxa	Rare / -	33	Occurs in saline flats along Valleyfield Road. Patches typically contain 100's to 1000's of plants. Occurs in several locations outside of the design corridor.	**0.59 ha**	**0.26 ha**	Alignment has been modified to avoid in some places, however some impacts are likely.
Pultenaea humilis	Vulnerable / -	161	Located in DAZ on Barton Road. Well recorded and reserved in the region.	**6 plants**	**0 plants**	No impacts anticipated.
Pultenaea prostrata	Vulnerable / -	412	Recorded in 2 locations, one at a rail crossing, the other on Ashby Road. Well recorded and reserved in the region.	**7 m^2**	**7 m^2**	Some scope to avoid at Ashby Road by deviating slightly to the east.
Schoenoplectus tabernaemontani	Rare / -	17	Recorded along the Macquarie River	**-**	**-**	Not within current impact footprint.
Scleranthus fasciculatus	Vulnerable / -	17	Patch near Valleyfield Road on edge of construction corridor.	**10 m^2**	**-**	Impacts are likely to be avoidable.
Senecio campylocarpus	Vulnerable / -	26	Recorded along the Elizabeth River, east of Campbell Town	**-**	**-**	Not within current impact footprint.
Spyridium vexilliferum var. *vexilliferum*	Rare / -	121	Recorded within DAZ in the Tom Gibson Reserve.	**1 plant**	**0 plants**	No impacts anticipated.
Stenanthemum pimeleoides	Vulnerable / VULNERABLE	118	Located in DAZ on Barton Road. Well recorded and reserved in the region.	**5 m^2**	**-**	Scope to avoid by utilizing NE side of fence line, and thus avoiding the Tom Gibson Reserve.
Vallisneria australis	Rare / -	14	Approximately 2.2 ha was recorded in the Macquarie River within 700 m proximity of pipeline crossing points.	**0.35 ha**	**0.03 ha**	Minimal impacts anticipated.

Species	Status (TSPA/EPBCA)	NVA Records within 5 km (including NBES records)	Notes	Within Design Corridor	Within Indicative Construction Corridor	Scope for Further Avoidance and Impact Minimisation
			Likely to be more widespread if further surveys were conducted.			
Vittadinia cuneata var. *cuneata*	Rare / -	530	Recorded on a road cutting at Mona Vale Road. Further records occur outside of the design corridor. Well recorded in the region.	-	-	No impacts anticipated.
Wilsonia rotundifolia	Rare / -	63	Recorded in a wetland on Valleyfield Road and at Merton Vale.	**0.02 ha**	**0.02 ha**	Design has been modified to avoid impacts.

2.2.1. WEEDS

A total of 142 introduced species were recorded during surveys for the natural values assessment (**See Attachment 3, Section 3.3, Attachment 4, and Attachment 5)**, 15 of which are listed as declared under the Tasmanian *Biosecurity Act 2019*. The declared weeds present within the project area are listed in Table 5. Six of these are listed as Zone A (isolated infestations) species within the Northern Midlands municipality according to the relevant Statutory Weed Management Plans under the Tasmanian *Biosecurity Act 2019*.

Table 5: Weeds recorded within the project area during the natural values assessment (Attachment 3)

Species	Biosecurity Act Zone	Notes
African boxthorn *Lycium ferocissimum*	Zone B	Observations were sparse throughout the survey area, however some occurrences contained tall, dense infestations.
blackberry *Rubus fruticosus*	Zone B	Recorded along the railway line at Epping Forest, and occasionally along fence lines throughout the survey area.
Californian thistle *Cirsium arvense* var. *arvense*	Zone B	A single patch covering an area of 20 m^2 was recorded on the banks of the Elizabeth River. This area was included in a previous iteration of the pipeline design but is now unlikely to be impacted due to works.
cotton thistle *Onopordum acanthium*	Zone A	Localised patches of cotton thistle were observed predominantly in agricultural land in areas south of Barton Road
crack willow *Salix fragilis* var. *fragilis*	Zone B	Widespread and abundant throughout waterways in the survey area. It occurs predominantly along the Macquarie, Isis, and Lake Rivers. In some locations access to the waterway is impeded due to the density of willow.
English broom	Zone B	This species was recorded near the Campbell Town Golf Course.

Species	Biosecurity Act Zone	Notes
Cytisus scoparius		Approximately 15 plants were recorded over two sites.
gorse *Ulex europaeus*	Zone B	Widespread throughout the entire survey area, in places forming a dense, impenetrable thicket. It occurs in both native and non-native vegetation, although typically only at the edge of native forest.
nodding thistle *Carduus nutans*	Zone A	Observed in numerous locations within and surrounding the survey area. Occurrences of nodding thistle were typically observed in large clusters, some containing hundreds of plants.
perforated St John's wort *Hypericum perforatum* subsp. *veronense*	Zone A	One patch containing approximately 25 plants was recorded on Valleyfield Road at Blanchard's Creek.
ragwort *Senecio jacobaea*	Zone A	A single plant was observed along Ashby Road, an area no longer within the current project alignment.
silver pampasgrass *Cortaderia selloana*	Zone A	A single patch containing 20 plants was recorded at a property on Valleyfield Road
slender thistle *Carduus pycnocephalus*	Zone B	Occurs throughout the survey area, often in large, dense clusters, often at the edges of paddocks or disturbed areas
Spanish heath *Erica lusitanica*	Zone A	A single plant was recorded along Macquarie Road, east of Macquarie Settlement Road.
white horehound *Marrubium vulgare*	Zone B	Isolated, small populations of this species were recorded within agricultural land. Plant numbers are generally limited to one or two plants. One patch recorded contained ~50 plants.
white weed *Lepidium draba*	Zone A	Observations of white weed were made at the U-turn bay on Mona Vale Road, in a drainage ditch adjacent to the bitumen. The spread of this weed was contained to within 2-3 m of the road edge and was not recorded in the adjacent vegetated area.

2.3. PATHOGENS

Cinnamon Root Rot Fungus - According to the Tasmanian Natural Values Atlas[2], root rot (*Phytophthora cinnamomi*) is the only known biosecurity risk within 5 km of the pipeline alignment (3 records near Powranna Road). Based on verified observation points for this pathogen, the most likely area where the pathogen may be present around the project area is around Barton Road. No symptomatic evidence of the pathogen was noted during the ecological assessments.

Chytrid Fungus

Chytrid fungus (*Batrachochytrium dendrobatidis*) causes the infectious disease, chytridiomycosis, which is affecting amphibians worldwide, including Tasmania. Human population density has been found to be a highly influential (positive) variable in the presence of the pathogen[3], although this is not strongly reflected in the known distribution in Tasmania (Figure 6). The spread of the pathogen is nonetheless considered likely to be promoted by human activity in Tasmania, as its occurrence in

[2] Department of Natural Resources and Environment Tasmania (2023)
[3] Rohr *et al.* (2011)

remote wilderness areas is positively associated with variables linked to human-disturbance, including gravel roads[4].

No observations of the pathogen have been reported from within five kilometres of the project area, with the nearest recorded occurrences approximately 13 km northwest of the proposed dam site, along the Liffey River south of Bracknell[5]. Testing conducted in the irrigation district, specifically for source and receiving waters as part of the Midlands Water Scheme[6], returned negative results ~10 years ago (Table 6). These findings are consistent with studies conducted by DPIPWE in 2008[7], in which very few occurrences were confirmed within the Midlands region (Figure 6), however noting the area was not prioritised for that project (ostensibly due to relatively low regional suitability and low likelihood of occurrences impacts highly susceptible conservation significant species).

When 100 different predictive models were averaged, the environmental suitability of the northern Midlands for chytrid occurrence was found to be very low (effectively being part of the least suitable part of Tasmania), with suitability showing a positive relationship with precipitation, moderated negatively by temperature variability (Figure 7) – with the northern Midlands having low precipitation and variable temperatures (both strongly limiting factors for the occurrence of chytrid). The predictive environmental variables within the northern Midlands are not considered to have changed meaningfully since the area was last tested for the pathogen, nor would human dispersal variables be expected to have changed. Combining this with the fact that the modelling indicates the area is inherently low in suitability for the occurrence of chytrid, which is supported by the general paucity of records in the broader area, further targeted surveys for the pathogen were considered unnecessary for this proposal. A conservative mitigation approach of managing for its *potential* occurrence in aquatic areas has been adopted instead, with this revolving around hygiene measures to prevent introduction at given locations and/or limit the potential for spreading chytrid from one location to the next should it be present. The implementation of hygiene measures will be included in a project specific Weed and Hygiene Management Plan and will apply to the entire project area. While general hygiene measures will be adopted throughout the scheme area, targeted washdown procedures with respect to chytrid fungus need only apply in instances where works intersect with an area suitable for its occurrence and expression (i.e., waterways and dams).

Table 6: Result from source water pathogen assessment of Midlands Water Scheme (Source: Tasmanian Irrigation)

Species	Total number assessed	Source Location	Chytrid Present
Common Froglet (*Crinia signifera*)	13	Floods Creek	No
Tasmanian Froglet (*Crinia tasmaniensis*)	27	Arthurs Lake	No
Brown Tree Frog (*Litoria ewingii*)	33	Arthurs Lake	No

[4] Pauza *et al.* (2010)
[5] Tasmanian Natural Values Atlas data – as of 23 November 2023
[6] Tasmanian Irrigation (2018)
[7] Philips *et al.* (2010)

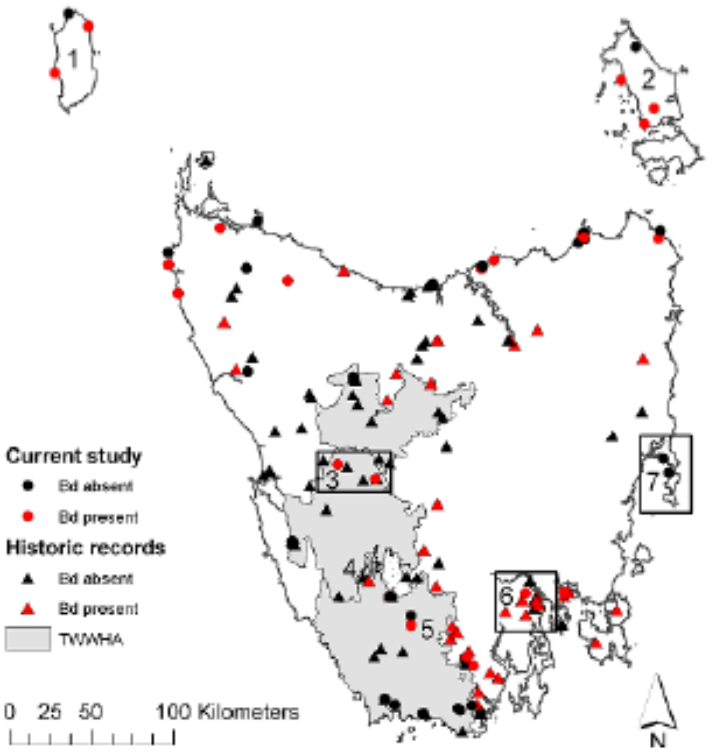


Figure 6: Distribution of *Batrachochytrium dendrobatidis* in Tasmania.

Source: Philips *et al.* (2010) (Noting historic records within the study were collated from additional sources referenced within).

Numbers on figures are referred to in the source text; 1= King Island, 2=Flinders Island, 3=Lyell Highway, 4=Strathgordon, 5= Scotts Peak Dam Road, 6= Hobart region, 7= Freycinet Peninsula. TWWHA = Tasmanian Wilderness World Heritage Area.

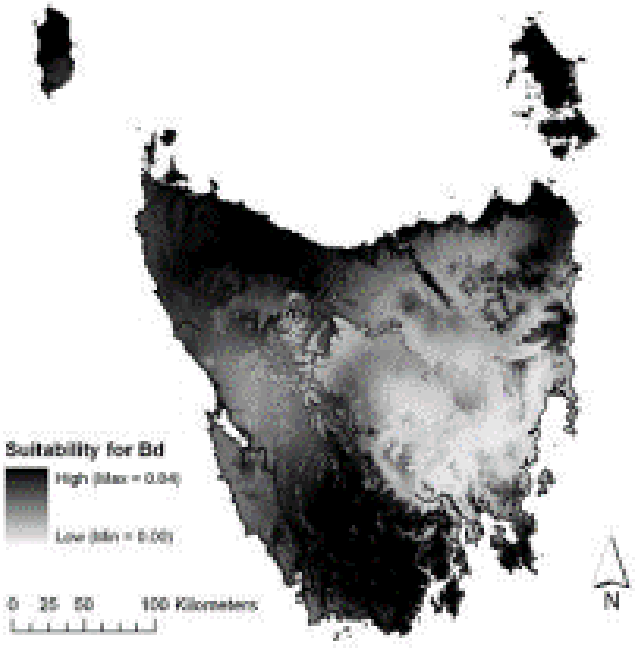


Figure 7: Average suitability (based on 100 models) for occurrence of *Batrachochytrium dendrobatidis* occurrence in Tasmania.

Source: Philips *et al.* (2010)

The Devil Facial Tumour Disease (DTFD) - The occurrence of DTFD is documented throughout the Midlands region according to the most recent distribution maps[8]. The scope of the proposal will not conceivably cause further spread or virility of this disease within the Tasmanian devil population (see **Section 3.2.1** for more detail) and was thus not targeted for testing and identification in the current study.

Toxoplasmosis – *Toxoplasmosis gondii* is a parasite that has been reported to be a significant cause of morbidity and mortality in marsupials. Impacts of toxoplasmosis on marsupials can include blindness, ataxia, incoordination, head tilt, and limb paralysis. Cats are a common host of this parasite, although it is thought that all endothermic vertebrates are capable of acting as hosts. It is likely that it is present throughout the irrigation district as feral cats are effectively ubiquitous in such environments; however, the proposed actions are unlikely to cause the further spread of the parasite nor vectors and thus it was not targeted with surveys in the current study.

2.4. GEOLOGY

The geology of the proposal area (derived from Mineral Resources Tasmania Geological Polygons 250K data[9]) is largely comprised of Quaternary sands and gravels, with intermittent seams of Jurassic dolerite on rises, and occasional areas of sandstone and mudstone. The area around Campbell Town is made up of Quaternary gravels and Tertiary basalt.

There are 8 geoconservation sites within 5 km of the proposed pipeline[10], however the impact area does not intersect with any of the following:

- Epping Forest Soils
- Horton Hill Interbedded Aeolian and Slope Deposits
- Grimes Lagoon
- White Lagoon Lunette
- Deflation Basins of Eastern Tasmania in Good Condition (4 sites)
- Poatina Group Type Section
- Great Western Tiers Escarpment
- Central Plateau Terrain

2.5. FAUNA

Habitat quality in the survey area varies in relation to potential use by fauna species.

Tussock skinks *Pseudemoia pagenstecheri* (TSPA vulnerable) were found within patches of higher quality grasslands in and around the project area (**Attachment 7, Map 5**). Green-lined ground beetles *Catadromus lacordairei* (TSPA vulnerable) were detected in log piles near the tussock skink survey sites (**Attachment 7, Map 5**). Both of these species were the subject of targeted searches on account of habitat quality derived from the vegetation mapping (see **Section 3.1**). Other species recorded as a result of these targeted surveys were the eastern three-line skink *Bassiana duperreyi*, southern grass skink *Pseudemoia entrecasteauxii*, spotted marsh frog *Limnodynastes tasmaniensis*, and brown tree frog *Litoria ewingii*.

Forest patches provide habitat for marsupials to shelter during the day (before foraging within the open areas, including cleared land, at night), with the most frequently observed incidentally during the natural values assessment being Bennett's wallaby (*Macropus rufogriseus*) and the Tasmanian pademelon (*Thylogale billardierii*). Occasional burrows that may be utilised by wombats (*Vombatus ursinus*) and other marsupials were observed in the broader area during the natural values assessment but not within the design corridor. The project area contains habitat suitable for the eastern-barred

[8] Department of Climate Change, Energy, the Environment and Water (2023a)
[9] Available as thematic layers on LISTmap (https://www.thelist.tas.gov.au/app/content/home/)
[10] Department of Natural Resources and Environment Tasmania (2023))

bandicoot (*Perameles gunnii*), as well as wide ranging carnivores such as the Tasmanian devil (*Sarcophilus harrisii*) and the eastern quoll (*Dasyurus viverrinus*), noting however that suitable habitat does not perfectly result in occupation when land use traits and history are influential.

Habitat suitable for the nesting and foraging of a variety of non-threatened avian fauna occurs throughout the forest patches in particular, with species present typically those adapted to open and fragmented environments. Targeted surveys were undertaken in the natural values assessment for eagle nesting locations, with nine eagle nests known from within 1.2 km of the proposed pipeline (**Attachment 8, Figure 1**) – the wedge-tailed eagle was observed in the local area during surveys (as was the white-bellied sea eagle) and is thought to be responsible for most/all of these known nests. Habitat suitable for masked owls occurs throughout the broader area and the species is known to be present within some equivalent mosaics of agricultural landscapes elsewhere in the northern Midlands. Numerous viable potential nesting and/or roosting trees have been reported from various projects in the local area (at the irrigation district level), however no masked owl nests or roosts have been confirmed/reported within the irrigation district, with the nearest reported nest being 15 km north around Devon Hills[11].

2.6. HERITAGE

2.6.1. EUROPEAN HERITAGE

Cultural Heritage Management Australia (CHMA) was engaged by TI to undertake the historic heritage assessment for the NMIS. The field survey assessment was undertaken over a period of 6 months, between November 2021 and May 2022. The field survey covered the original network of proposed pipeline corridors (approximately 157 km in length) and subsequent realignment options (approximately 30 km of realignments).

A total of 15 heritage features were recorded within, and in the vicinity of the surveyed section of the pipeline corridors. These include:

- Seven heritage tree plantings, all of which are likely to be associated with the heritage memorial plantings along the Midland Highway.
- Four hawthorn hedgerows which have cultural rural landscape significance.
- Two well features.
- One set of building foundations.
- One cemetery (Isis Cemetery).

None of these recorded historic heritage features are listed on any State or Commonwealth heritage registers. They are all assessed as being of local heritage significance but would not meet the threshold requirements for State significance.

It is confirmed that the two recorded well features, the building foundations and the Isis cemetery will be avoided by construction works. It is noted that the headstones in the Isis cemetery have been previously relocated, as such, the graves are currently unmarked, and careful designation of exclusion areas will be required to avoid any disturbance.

The seven recorded heritage tree plantings will also be avoided, and measures will be put in place to minimise any potential impacts to the root systems of these trees. There is the potential that there may be minor impacts to the four recorded hawthorn hedgerows. Management strategies will be implemented to ensure that impacted sections of hedgerows will be re-instated post construction.

In addition, the heritage registers search undertaken for the project shows that the pipeline corridor intersects with the boundaries of eight properties that are listed on the Tasmanian Heritage Register (THR). Works to places included in the THR require approval, either through a Certificate of Exemption

[11] Department of Natural Resources and Environment Tasmania (2023)

for works which will have no or negligible impact, or through a discretionary permit for those works which may impact on the significance of the place. The preferred pipeline corridor will not impact on any buildings or heritage features on these eight properties and that any impacts on heritage values will be negligible. TI have acquired Certificates of Exemption for all of the 8 properties, the remaining property does not require approval as the pipeline does not intersect with the listed portion of the property. An Unanticipated Discovery Plan (UDP) has been developed for the NMIS project to deal with historic heritage during pipeline construction works.

The Tasmanian Wilderness World Heritage Area boundary is located 5 km south of Poatina, and two Australian Convict Sites (Brickendon and Woolmers Estate) are located approximately 7 km northwest of the northernmost extent of the pipeline at Powranna.

2.6.2. INDIGENOUS HERITAGE

Cultural Heritage Management Australia was engaged by TI to undertake the Aboriginal heritage assessment for the NMIS. The CHMA personnel who participated in this project are:

- Stuart Huys (Principal Archaeologist);
- Rocky Sainty (Aboriginal Heritage Officer);
- Vernon Graham (Aboriginal Heritage Officer);
- Shay Hannah (CHMA Archaeologist);
- Tom Taverner (CHMA Archaeologist);
- Mike Walsh (GIS Officer).

The field survey assessment was undertaken over a period of 12 months, between November 2021 and November 2022. The field survey covered the original network of proposed pipeline corridors (approximately 157 km in length) and subsequent realignment options (approximately 30 km of realignments). Two CHMA archaeologists and an Aboriginal Heritage Officer were involved in all survey assessments.

The survey assessment works undertaken to date for the NMIS corridor alignments have resulted in the recording of 17 Aboriginal heritage sites within, or within a 100 m buffer of the pipeline corridors. These include:

- Five isolated artefacts;
- Twelve artefact scatters;

In addition, there are five Potential Archaeological Deposits (PADs) that were recorded. These are areas where there is an elevated potential for sub-surface cultural heritage deposits to be present. Three of these PAD areas are associated with recorded Aboriginal sites (Site N2 – PAD1, Site N19 – PAD2, Site AH1424 – PAD3). At the other two PAD areas (PAD4 and PAD5) there are no confirmed sites as yet.

As part of the Aboriginal heritage assessment, a search was undertaken of the Aboriginal Heritage Register (AHR) in order to determine whether there were any previously registered Aboriginal site located within the pipeline corridors. The search results show that whilst there are numerous registered Aboriginal sites in the vicinity of the pipeline corridors (166 registered sites within 5 km), none of these sites are situated directly within the pipeline corridors.

TI have been examining options for avoiding the 17 identified Aboriginal heritage sites and the five PAD areas. It is now confirmed that 13 of the recorded Aboriginal sites and four of the PAD areas can be avoided. Appropriate measures will be put in place during construction to ensure that these sites and PADs will be protected and conserved in-situ. Pipeline construction works are likely to impact on 12 of the recorded Aboriginal sites. This includes nine isolated artefacts and three low density artefact scatters. One of these low-density artefact scatters will only be partially impacted. Construction works will also impact on PAD4.

All Aboriginal relics are protected under the Tasmanian *Aboriginal Heritage Act 1975,* and it is illegal to destroy, damage, deface, conceal, or otherwise interfere with a relic, unless in accordance with the terms of a permit granted by the Minister. TI will be submitting permit applications to impact these 4 (3 isolated artefacts and 1 artefact scatter) Aboriginal heritage sites. PAD4 will be managed under an Unanticipated Discovery Plan (UDP) (**see Attachment 9, Pages 18-19**). The UDP will also apply for all pipeline construction works.

2.7. HYDROLOGY AND AQUATIC VALUES[12]

Mean annual rainfall for the area is around 503 mm per annum, with precipitation consistent across all seasons.

The project area is located within the broad valley of the Macquarie River, with the Elizabeth River and Lake River the major tributaries flowing into it. The Macquarie River flows from near Rawlinna in the Eastern Tiers, and meanders south and then west, before flowing north through Ross and west of Campbell Town, before flowing into the South Esk River at Longford. The Macquarie River is the central river system with catchments areas originating in both the Eastern and Western Tiers.

This catchment is one of the driest areas in the State, lying in a rain shadow from the Western Tiers. Historic rainfall data for the catchment indicates a trend towards a drier climate in the catchment. This contrasts with a rising trend in evaporation rates within the catchment (annual average evaporation is 1,000 mm).

The local hydrology has been altered variously from its natural state, in particular with water diverted (for agricultural purposes) from rivers and smaller streams into farm dams and irrigation channels. Rainfall is also supplemented in various areas, primarily with use of pivot irrigation, particularly those areas that are heavily cropped and grazed.

Aquatic flora were surveyed and sampled (in conjunction with the terrestrial flora) as part of the natural values assessment, limited to what could be observed in the water and what could be collected safely from the margins. Given the suite of marginal and fully aquatic species recorded using these techniques, including fully submerged aquatic threatened species, additional targeted survey effort was not considered to be required (i.e. the survey effort considered to be adequate for the purposes of assessment and informed mitigation). This consideration included which species may have been fully submerged beyond visible areas (i.e. potentially not recorded), the context of their potential conservation value, and the risk the project would present to such species in these scenarios (also considering mitigation measures available).

In terms of vegetation, the general condition of waterways within the project area is poor, with many smaller streams highly modified in agricultural land, and weed species, notably willow and hawthorn, present in place of native riparian vegetation in others (with essentially no meaningful examples of native riparian woody vegetation left in the district based on available vegetation mapping).

The Macquarie River catchment was already known to contain several threatened flora species (TSPA listed) associated with permanent or seasonal waterways (or other aquatic habitats), such as *Bolboschoenus caldwellii*, *Puccinellia perlaxa*, *Lobelia pratioides, Schoenoplectus tabernaemontani* and *Vallisneria australis,* all of which were recorded at new (previously unreported) locations during the natural values assessment for this project, indicating the survey method was consistent with past observations and providing much context on the potential impacts in relation to local abundances. In addition, a fully submerged TSPA threatened aquatic species, *Utricularia australis*, and a TSPA threatened rush that occurs in areas of wet soil, *Juncus vaginatus*, were both recorded as part of the natural values assessment despite not previously having been reported from within >10 km from the

[12] With statements derived from observations made during the natural values assessment surveys and climatic data from the Bureau of Meteorology - http://www.bom.gov.au/

alignment (noting occurrences of both of these species were removed from the design corridor by realignments). TSPA listed aquatic/wetland species within the project area will be subject to permit conditions where there are unavoidable impacts, with conditions having the potential to include additional targeted survey effort if current data is insufficient to inform the consideration of impacts and/or mitigation.

Targeted aquatic fauna surveys were not conducted as part of the natural values assessment beyond visual inspection of waterways and the potential for noting calls from aquatic habitats during the general survey efforts. Whilst some of the smaller streams in the district may support threatened fauna species, notably the Swan galaxias (*Galaxias fontanus*), the larger watercourses such as the Macquarie River are less likely to support threatened aquatic species due to the predatory brown trout (*Salmo trutta*) and the extensive history of modification. Irrespective of confirming presence/absence of potential threatened aquatic fauna, aquatic crossing protocols have been developed for the project to minimise impact to waterways across the project area and mitigate potential impacts to species such as the Swan galaxias should they be present at the time of works.

2.8. LAND USE

The majority of the proposal area is private freehold, with small areas on the Macquarie River Public Reserve. Barton Road contains several areas of Conservation Covenant, as well as the Tom Gibson Nature Reserve, which are both administered under the Tasmanian *Nature Conservation Act 2002*. Small areas of Crown Land occur around Epping Forest and Campbell Town.

Within the NMIS district, 56,461 ha of land is classed as suitable for long-term irrigation (largely class 4 and 5), 8,015 ha of which is classed as prime agricultural land.

The proposal area is predominantly used for agricultural activities including meat production, vegetable and cereal cropping, stone fruits, and fodder, as well as dry-land grazing. Private production timber plantations occur within the irrigation district. The Macquarie River is a State-managed trout fishery, and the Tom Gibson Nature Reserve is used recreationally.

The Poatina region contains a power station that is powered through hydroelectric activity. Several areas of hydro infrastructure occur near to the proposed pipeline.

A TasRail freight line follows the Midland Highway and is crossed by the proposed pipeline at Campbell Town (3 crossings) and Epping Forest (2 crossings).

There are several townships of various populations located within the irrigation district, including Campbell Town, Epping Forest, Conara, Powranna, Delmont, and Isis. Further to this, several historic homesteads are located throughout the district. Towns along the Midlands Highway are popular rest stops for travellers, and they contain various facilities such as cafes, hotels, fuel stations and truck stops, as well as recreational facilities such as sporting fields, golf courses, and parks. There are several historic cemeteries located throughout the district.

3. MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE – IMPACTS AND MITIGATION MEASURES

To identify and assess the environmental values, biological records from the region were examined using the following resources:

- EPBCA protected matters report[13] – all matters of national environmental significance that may occur in the area or relate to the area in some way. **Attachment 10**.
- Natural Values Atlas[14] – This Tasmanian Department of Natural Resources and Environment (NRE) database includes biological records. **Attachment 6**.
- TASVEG 4.0 Digital Data.

This desktop data was verified, supplemented, and superseded by extensive field surveys as part of the natural values assessments undertaken to inform the approvals process. A summary of surveys undertaken for the project is provided in Table 7.

Survey effort was conducted in a manner consistent with guidelines[15], and included targeted fine-scale consideration of the potential for high priority values, such as concluding the absence of lowland grasslands of Tasmania within the project area, and conducting a targeted survey of tussock skinks.

Table 7: Summary of field surveys

Date(s)	Survey	Notes
15/12/2020	Initial reconnaissance	Preliminary alignment survey, largely conducted by car to identify critical values for avoidance at a high level.
6/05/2021	Eagle nest survey	Aerial survey for eagle nests across the project area.
9-12/02/2021	Initial alignment survey	First pass alignment survey to identify further key values and to determine full natural values survey priorities.
30-31/03/2021	*Puccinellia perlaxa* survey	Targeted survey of saline flats to determine the extent of *Puccinellia perlaxa*, which was previously poorly recorded in the region.
16/06/2021	Drone reconnaissance survey	Drone survey to identify patches of grassland that may qualify for listing in areas being considered for realignments.
27-30/09/2021	Natural values survey	Full flora and fauna assessment of the proposed design corridor.
27/10/2021	Eagle nest activity assessment	Assessment of 4 nests within 1000 m of the proposed design corridor for eagle activity (selected on the basis of potentially disruptive ground works [geo-tech investigations] planned during that breeding season in the vicinity of particular nests).
15-19/11/2021	Targeted threatened flora and fauna survey, and EPBCA grassland assessment	Targeted surveys for spring flowering threatened flora. Detailed assessments of grasslands with potential to qualify for EPBCA listing.
02/12/2021	Dam site surveys	Flora and fauna surveys of potential dam sites.

[13] Commonwealth of Australia (2023)
[14] Department of Natural Resources and Environment Tasmania (2023)
[15] Department of Primary Industries, Parks, Water, and Environment (2019)

Date(s)	Survey	Notes
2-3/03/2022	Eagle nest extension survey	Ground survey for nests in additional areas of realignment not picked up in the initial surveys.
03/06/2022	Forest Practices site visit	Walkthrough with a Forest Practices officer to assess the potential for a Forest Practices Plan and inform a tree clearance protocol for selected areas.
29/05 – 01/06/2023	*Vallisneria australis* survey	Extension survey of broader areas of the Macquarie River and other waterways for contextualising potential impacts.
28/06/2023	Eagle nest survey	Aerial survey for eagle nests across the project area.
08/08/2023	Eagle nest survey	Ground survey for eagle nests not relocated during aerial search.
19/09/2023	Dam relocation and minor realignment survey	Flora and fauna assessment of a new dam site and pipeline realignment.

3.1. OVERVIEW AND METHODS

3.1.1. VEGETATION MAPPING

In Tasmania, the primary source on the distribution of vegetation is the statewide TASVEG[16] mapping database (with TASVEG 4.0 being the latest, and current distribution data available in the TASVEG Live database version). The compilation of TASVEG has been an iterative process of improvement and refinement upon the original base layer, that was collated from several sources[17]. As a result, data within TASVEG do not completely represent vegetation extent and distribution at a single date. Indeed, some areas are still mapped at a coarser scale than the general 1:25,000 or based on interpretation of imagery over ten years old[18]. Furthermore, vegetation mapping at any scale can be an exercise in judgement, with an inherent potential for errors in interpretation. Subsequently, it is standard practice to truth TASVEG data using recent imagery and ground sampling[19].

The image interpretation process for the current proposal involved several satellite images accessed via Google Earth Pro[20]. The images had a resolution of no more than 2.5 m, with capture dates ranging from 07/09/2019 to 29/11/2021, with most images captured on the earlier date. Imagery was examined for patterns of tone, texture, colour, and contrast to identify homogeneous patches of vegetation (aerial signatures). This was also informed by the interpretation of environmental traits such as slope, aspect, and elevation, due to their consistent associations with vegetation units[21]. Patches were then manually assigned to TASVEG units based on correlation with existing polygons within the TASVEG database and evident aerial signatures.

Ground sampling was undertaken over the course of all field visits. Ground sampling involved one or two ecologists traversing the survey area (mostly on foot) in a stratified fashion that ensured ground sampling of the complete range of image signatures. When a patch was ground sampled, the observer assessed the requisite traits of vegetation structure, floristics, geology, and environment to discriminate the patch from any other possible TASVEG units using the descriptions and stepwise keys

[16] Department of Primary Industries, Parks, Water, and Environment (2020)
[17] Harris and Kitchener (2005)
[18] Kitchener and Harris (2013)
[19] Tasmanian Vegetation Monitoring and Mapping Program (2013)
[20] Google Earth Pro (2021), December 2021 – DigitalGlobe, TerraMetrics, CNES/ Airbus
[21] Kirkpatrick and Nunez (1980)

within the online versions of the current TASVEG companion manual[22]. Boundary discrimination was based on image interpretation and aided by point data collected on a hand-held GPS unit. All ground sampling was undertaken during the daytime, mostly in fine weather due to the potential sampling constraints associated with reduced visibility from rain and/or low light.

This combination of image interpretation followed by stratified ground sampling and interpolation is consistent with the NRE guidelines for natural values assessments (section 7, DPIPWE 2015a[23]) as well as the methods applied within vegetation mapping elsewhere[24] and described in ecological manuals[25].

TASVEG units observed on site were cross-referenced against all vegetation communities listed as threatened under the Tasmanian *Nature Conservation Act 2002* and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

All types of vegetation and all perceivable habitats within the project area were investigated. This habitat is mapped in **Attachment 4** and **Attachment 7**, which includes all native vegetation units as described in **Section 3.1 of Attachment 3**. Three EBPCA listed flora species were recorded during field surveys, with designs modified to avoid these to the maximum extent possible.

3.1.2. FLORA SEARCHES

Flora surveys were strategically timed to maximize the opportunity to detect seasonal threatened flora. Nonetheless, due to seasonal variations in detectability and accurate discrimination (*i.e.* identification of closely related species), there may be some herb, orchid and/or graminoid species present on the route that were overlooked due to flowering at times of the year other than when the survey was undertaken; due to lack of visibility, submerged species could also be under-surveyed to some degree. Targeted surveys were undertaken however when this was considered a potentially significant limitation, e.g. the targeted spring flowering flora survey. To further compensate for the potential for values to be overlooked, field data from the present study were supplemented with data and range predictions from the Tasmanian Natural Values Atlas[26] (**Attachment 6**) and the EPBCA Significant Matters Database[27] (**Attachment 10**). All threatened plant species known to occur in the local area (500 m) are considered in terms of habitat suitability on site – a wider radius of 5 km was considered in our background assessment, but due to the nature of the works (relatively confined impact area) and the species in question, it was not considered necessary to present detailed consideration of the additional species in the report.

3.1.2.1. VEGETATION REHABILITATION

The impact footprint of the construction corridor covers 444.81 ha, 24.80 ha of which is native vegetation. Of this native vegetation, 0.91 ha will be permanent loss of vegetation, the remaining 23.89 ha will be rehabilitated post-construction. This vegetation may provide foraging and denning habitat of MNES fauna, including the Tasmanian devil, eastern quoll, and spotted-tail quoll, and thus can be taken to inform some of the discussion around habitat changes for fauna post-works.

Prior to the commencement of the action, to compensate for the temporary disturbance to vegetation, the civil contractor must submit a Revegetation Plan (RP) to the Tasmanian Irrigation for approval. The environmental outcome of the RP is to restore 23.89 ha of native vegetation (habitat) available for foraging and denning for threatened carnivores. The RP must be consistent with the department's *Environmental Management Plan Guidelines*[28], and will include:

[22] Kitchener and Harris (2013)
[23] Department of Primary Industries, Parks, Water, and Environment (2019)
[24] The Nature Conservancy (1994)
[25] Kuchler and Zonneveld (2012)
[26] Department of Natural Resources and Environment Tasmania (2023)
[27] Commonwealth of Australia (2023)
[28] Commonwealth of Australia (2014)

a) Details of the habitat requirements of the relevant protected matters.
b) A table of commitments made in the plan to achieve environmental outcomes, with reference to where these commitments are made in the plan.
c) Compliance with commitments made in the Federal referral and preliminary documentation, as well as the Natural Values Assessment for the NMIS project.
d) Commitments capable of ensuring that the environmental outcomes are achieved, which include:
    a. Commencing revegetation immediately post disturbance.
    b. Methods of revegetation (and corrective actions should the primary method not be successful).
    c. Measures, including for hygiene, ground preparation, and weed and herbivore control, and the approximate timing of the measures to be undertaken prior to, during, and following planting/seeding to ensure the success of the revegetation.
e) Reporting and review mechanisms to ensure compliance with the RP.
f) A monitoring program which includes measurable performance indicators, trigger values for corrective actions, timing, and frequency of monitoring, and proposed corrective actions, and the timing and methods of submitting monitoring data to the department.

Areas of native vegetation that require post-works rehabilitation should follow best practices guidelines and recommendations for revegetation of native habitats[29]. The preferred method for rehabilitating native vegetation patches within the construction corridor is via natural regeneration from the soil seed bank (Table 8). To achieve this, topsoil must be stored separately from backfill, as it displayed in Figure 2.

Ongoing monitoring of rehabilitated sites will be conducted to evaluate the condition of native vegetation patches post-disturbance. If natural regeneration is not successful, other methods of regeneration, including direct seeding and direct planting may be required to promote regeneration. An estimation of rehabilitation timeframes and conversion type is provided in Table 8.

The following steps must be followed to ensure minimal impact and allow for successful rehabilitation.

- Identify potential impact areas. Clearly demarcate areas not within the impact area to minimise the risk of unanticipated impacts outside of the footprint.
- Reduce the construction corridor to the smallest extent possible within native vegetation.
- Keep topsoil and backfill separated (Figure 2). This allows for the retention of the soil seed bank, which will provide the greatest opportunity for natural regeneration.
- Monitor rehabilitation areas monthly post construction. If native herbs and grasses are not readily colonising after 6 months, the following methods may be required:
    - Fence off rehabilitation area (temporarily) to reduce browsing by mammals. This will allow for seedling establishment.
    - If this fails, plantings (sourced from a local native plant supplier) may be required. These may require temporary protections from browsing pressure (i.e. corflute or mesh plant guards).
    - Plantings should be timed as to maximise the likelihood of success[30] (late spring is recommended due to the frost-prone nature of the project area.
- Monitor for weeds. This will be implemented through a project-wide Weed and Hygiene Management Plan.

[29] NRM South (2013); Page & Thorp (2010)
[30] NRM South (2013)

Table 8: Rehabilitation methods and expected timeframe for each vegetation class in areas of temporary impact

Pre-Construction Vegetation Class	Post-Construction Vegetation Class	Area of Impact (% of Construction Corridor)	Rehabilitation Method	Contingency Methods	Expected Timeframe
Native non-forest vegetation	Native non-forest vegetation	12.35 (2.78 %)	Natural Regeneration	Direct Seeding Direct Planting	6 – 12 Months
Native forested vegetation	Native non-forest vegetation	12.46 (2.78 %)	Natural Regeneration	Direct Seeding Direct Planting	6 – 12 Months
Modified (exc. agricultural)	Modified (exc. agricultural)	7.72 (1.74 %)	Natural Regeneration	Direct Seeding	2 – 5 Months
Water	Water	0.65 (0.15 %)	Not Applicable	Not Applicable	Not Applicable
Agricultural	Agricultural	411.63 (92.54 %)	Direct Seeding	Follow-up Direct Seeding	2 – 5 Months

3.1.3. THREATENED FAUNA

Threatened fauna were initially surveyed by searching for any evidence of occurrence detectable during the natural values surveys, and by assessment of the potential suitability of habitat to support specific species (as informed by vegetation and habitat mapping during the natural values assessment), which accords with the *Survey guidelines for Australia's threatened mammals*[31]. The importance of specific habitat features, such as potential nest and den sites and foraging resources, were considered. Targeted survey effort was undertaken for particular values where there was additional value to be gained from pinpointing particular habitat elements and/or confirming the presence/absence of particular species, including: an aerial eagle nest search to a 1.5 km radius, an investigation of potential viewsheds from each known nest, an activity assessment of selected nests within the 20/21 breeding season, and targeted ground surveys of other species. Results of initial natural values surveys informed the need for the targeted fauna surveys, which were undertaken for tussock skinks and green-line ground beetle, as well as the need to develop protocols to manage threatened fauna and their habitats where this was considered to be equally important or more important than identifying which species were present in a particular habitat element at the time of survey (namely habitat trees, forest clearance, green-lined ground beetles, and denning mammals, including the Tasmanian devil, eastern and spotted-tailed quoll), noting that this was considered to be a more robust approach than simply focussing on species observations, as occupation of a habitat elements can change over time, such that an observation during planning phase may not be as effective for mitigation as a protocol that allows for and mitigates for species presence/occupation at the time of works – this is particularly the case for wide-ranging low density species such as devils, quolls and masked owls, for which allowing for their presence by managing impacts to key habitat variables is more constructive than purely establishing presence or absence in an area at a particular point in time.

Nonetheless, survey effort greatly exceeded the minimum survey requirements for indirect searches for diurnal mammals defined in the *Survey guidelines for Australia's threatened mammals*[32]. The

[31] Department of Sustainability, Environment, Water, Population and Communities (2011)
[32] Department of Sustainability, Environment, Water, Population and Communities (2011)

guidelines recommend a minimum day-time search effort of two hours for every one-hectare survey site of a stratified sampling program in a subject site up to 5 hectares. The surveys for this project concentrated on areas of native vegetation (totalling 146.31 ha) as these areas provide the highest suitability for denning structures and prey availability[33]. A search survey effort of >250 hours was spent within this habitat (**Attachment 3, Section 2.1**), equating to an average of around 1.7 hours of survey searching within every hectare of native vegetation, which far exceeds the recommendation of 2 hours of searching for 1 in every 5 hectares.

3.1.4. SIGNIFICANT IMPACT ASSESSMENT

The EPBC Act is structured for self-assessment so the proponent must determine whether or not the project is considered a 'controlled action', which, if confirmed, would require approval from the Commonwealth Minister. An action will require approval from the Minister if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance, which encompasses all species and habitats listed under the Act. A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends on the sensitivity, value, and quality of the environment, which is impacted, and upon the intensity, duration, magnitude, and geographic extent of the impacts. A proponent must consider all of these factors when determining whether an action is 'likely' to have a significant impact on matters of national environmental significance. To be likely, it is not necessary for a significant impact to have a greater than 50 % chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility. If there is scientific uncertainty about the impacts of an action and potential impacts are serious or irreversible, the precautionary principle is applicable. Accordingly, a lack of scientific certainty about the potential impacts of an action will not itself justify a decision that the action is not likely to have a significant impact on the environment. Substantial penalties apply for taking an action that has, will have, or is likely to have a significant impact on a matter of national environmental significance without approval[34].

Significant Impact criteria are identical for critically endangered and endangered species. The criteria for vulnerable species only apply to 'important populations'. Ecological communities are assessed against slightly different criteria to flora and fauna MNES.

3.1.4.1. WHAT IS A POPULATION OF A SPECIES?

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.

3.1.4.2. IMPORTANT POPULATION

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:

[33] Andersen *et al.* (2017); Andersen *et al.* (2020); Jones & Rose (1996); Troy (2014)

[34] Statements in this section referring to self-assessment guidelines and impact criteria have been taken verbatim or paraphrased from the Matters of National Environmental Significance: Significant Impact Guidelines 1.1. Commonwealth of Australia 2013

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

3.1.4.3. SIGNIFICANT IMPACT CRITERIA[35]

Critically endangered and endangered species (statements in brackets applies to vulnerable species)

An action is considered likely to have a significant impact if there is a real chance or possibility that it will:

1. lead to a long-term decrease in the size of a (important) population;
2. reduce the area of occupancy of the species (important population);
3. fragment an existing population into two or more (important) populations;
4. adversely affect habitat critical to the survival of a species;
5. disrupt the breeding cycle of a (important) population;
6. modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline;
7. result in invasive species that are harmful to the species becoming established in the species' habitat;
8. introduce disease that may cause the species to decline; or
9. interfere (substantially) with the recovery of the species.

Critically endangered and endangered ecological communities

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

1. reduce the extent of an ecological community
2. fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines
3. adversely affect habitat critical to the survival of an ecological community
4. 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
5. 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
6. 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
7. interfere with the recovery of an ecological community

These criteria are assessed for each individual species and/or ecological community in **Section 3.2**, **Section 3.3**, and **Section 3.4**.

[35] Commonwealth of Australia (2013)

3.2. THREATENED FAUNA

This subsection details MNES fauna relevant to the request for additional information, covering context, survey findings, and proposed avoidance/mitigation measures that have been put in place to minimise potential impacts. An overall summary of mitigation for all MNES is provided in **Section 3.5**. Maps of MNES distribution in relation to the project area, and Tasmania are provided in the relevant Sections for each MNES. MNES flora and ecological communities follow in subsequent sections.

3.2.1. TASMANIAN DEVIL (*SARCOPHILUS HARRISII*)

3.2.1.1. CONTEXT

The Tasmanian devil was listed on the EPBCA as endangered following the significant impact of devil facial tumour disease (DFTD). DFTD has spread across most of Tasmania (Figure 8), including the area of the action, with population declines averaging 80% since first reported[36]. DFTD is the single most significant cause of mortality and therefore threat to the conservation of the Tasmanian devil[37]. The reduced population is also likely to be more sensitive to additional threats such as death by roadkill, competition with cats and foxes, and loss or disturbance of areas surrounding traditional dens where young are raised[38]. The protection of breeding opportunities is particularly important for the species due to the mortalities from demographic pressures [39].

Commonwealth guidelines for surveying Tasmanian devils (and quolls)[40] have a focus on detecting the presence of a species. This differs from the Tasmanian NRE guidelines[41] which are explicitly intended to assess impacts of development proposals and subsequently focus on potential denning opportunities, recognising the priority of limiting demographic pressures in such cases rather than merely identifying the presence of the species in the area, given it is effectively ubiquitous in Tasmania and very rarely limited by habitat availability due to broad and flexible habitat preferences for foraging and general occurrence[42].

Tasmanian devils are usually solitary animals, but they share continuously overlapping home ranges and come into contact with other Tasmanian devils around prey carcasses and during the mating season[43]. They travel up to 16 km a night, although individuals have been recorded covering more than 50 km in a single night[44]. The animals are active during the day where there is no human disturbance but otherwise hunt during the night (Pemberton *pers. comm.*). In daytime animals hole up in shelter, including underground dens, wombat burrows, hollows, and caves. Communal denning, particularly natal dens, occur in clusters with suitable geomorphology above the water table.

Potential habitat for the Tasmanian devil is all terrestrial native habitats, forestry plantations and pasture. Devils require shelter (e.g. dense vegetation, hollow logs, burrows, or caves) and hunting habitat (open understorey mixed with patches of dense vegetation) within their home range (4-27 km^2)[45]. Potential denning habitat for the Tasmanian devil is areas of burrowable, well-drained soil, log piles or sheltered overhangs such as cliffs, rocky outcrops, knolls, caves, and earth banks, free from risk of inundation and with at least one entrance through which a devil could pass. Significant habitat for the Tasmanian devil is defined as a patch of potential denning habitat where three or more entrances (large enough for a devil to pass through) may be found within 100 m of one another, and where no

[36] Hawkins *et al.* (2006)
[37] Department of Primary Industries, Parks, Water, and Environment (2010)
[38] Department of Primary Industries, Parks, Water, and Environment (2010)
[39] Environment Strategic Business Unit (2023)
[40] Department of Sustainability, Environment, Water, Population & Communities (2011)
[41] Environment Strategic Business Unit (2023)
[42] Jones & Barmuta (2000)
[43] Hamede *et al.* (2009)
[44] Hamede *et al.* (2009)
[45] Jones *et al.* (2004); Forest Practices Authority (2013); Threatened Species Section (2022a)

other potential denning habitat with three or more entrances may be found within a 1 km radius, being the approximate area of the smallest recorded devil home range[46]. This definition of significance is relied upon because it supersedes EPBCA conservation and listing advice and has been developed through collaboration between Tasmanian experts[47].

Devils thrive in a landscape mosaic of native habitat and agricultural land. The population uses all the habitat mosaic but typically does not use areas of cleared land more than 500 m from continuous habitat[48] (Pemberton *pers. comm.*). Dense wet eucalypt and rainforest, alpine areas, dense wet heath, and open grassland all support only low densities of devils[49]. Devils are more abundant in habitats (open eucalypt forests and woodlands, coastal scrub) that support dense populations of their prey (macropods, wombats, possums)[50].

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area, including 'a geographically distinct regional population' or 'a population, or collection of local populations, that occurs within a particular bioregion'. The Species Profile and Threats Database (SPRAT) profile for devils divides them into two genetically distinct populations[51]:

1) north-western; and
2) eastern/south-western

The proposal design area (2,638.99 ha) is within the known geographical and ecological range of the eastern/south-western population (which in total has a range of 50,630 square km[52]), and overlaps with the core range of the species as defined on the Tasmanian Natural Values Atlas as the area within the known range known to support the highest densities of the species and/or thought to be of greatest importance for the maintenance of breeding populations of the species – noting that this definition and core range mapping covers a vast area.

The presence of DFTD was first recorded in the vicinity of the project area in 2002 (at a monitoring site at Epping Forest), with high proportions of observed devils exhibiting signs disease[53]. There are 38 verified observations of the species known from within 500 m of the proposal footprint (this covers an area of 14,150 ha), with the most recent record being from 2021[54] (Figure 9). Twenty of these records are listed as carcasses, with these occurring on the major transit routes in the region (Midland Highway, Barton Road, Macquarie Road, and Valleyfield/Mt Joy Road). There are a further 205 observations known within 5 km (an area of 117,836 ha) with the most recent occurring in 2022[55]. Sixty-two of these observations are carcasses, 27 of which are attributed to the Midland Highway[56]. The highest densities of live observations are from large forest remnants. Distribution of devils within the broader area are shown in Figure 9. Results of spotlight transect studies at Epping Forest suggest that devil density in the area is extremely sparse (67 devil observations between 1985 and 2019)[57]. These low densities in the region are consistent with the lack of evidence of presence of the species found within the natural values surveys (**Section 3.2.1.2**).

Although, no potential dens were observed in the surveys (**Section 3.2.1.2**), to further investigate denning suitability, habitat was modelled using vegetation characteristics and land use attributes to

[46] Forest Practices Authority (2013); Threatened Species Section (2022a); Pemberton (1990)
[47] Forest Practices Authority (2013); Threatened Species Section (2022a)
[48] Guiler (1970)
[49] Jones *et al.* (2004)
[50] Jones & Barmuta (1998)
[51] Department of Climate Change, Energy, the Environment and Water (2023a)
[52] Department of Climate Change, Energy, the Environment and Water (2023a)
[53] Cunningham *et al.* (2021); Hawkins *et al* (2006)
[54] Department of Natural Resources and Environment Tasmania (2023)
[55] Tasmanian Natural Values Atlas data – as of 23 November 2023
[56] Tasmanian Natural Values Atlas data – as of 23 November 2023
[57] Cunningham *et al.* (2021)

determine the suitability across the project area. The stratification of potential denning habitat attributes is detailed in Table 9.

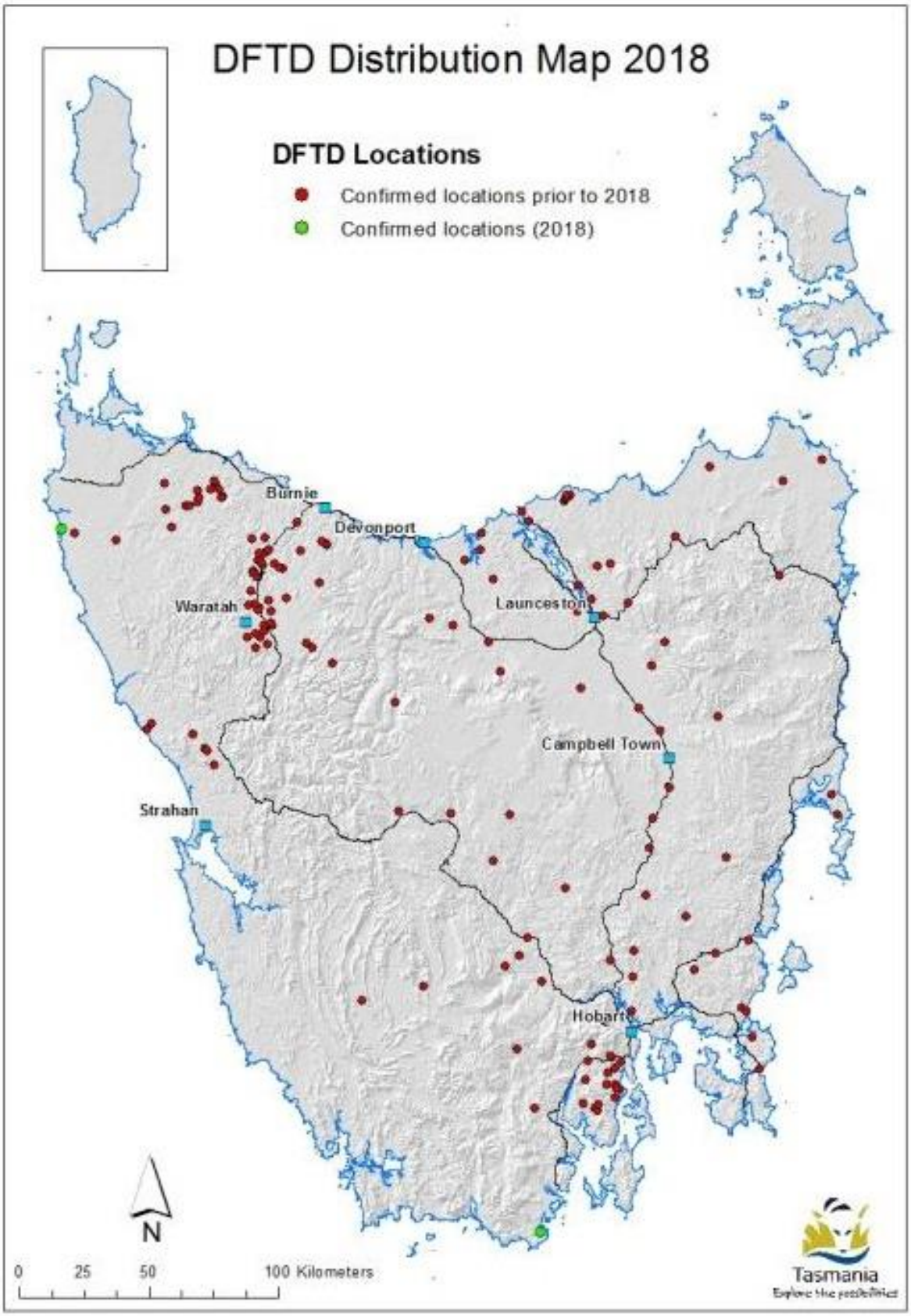


Figure 8: Distribution of devil facial tumour disease

Table 9: Tasmanian devil denning habitat suitability classes

Suitability class for devil maternal natal den	Rationale
Optimal (Denning and Foraging) [Plate 1 & Plate 2]	This category contains areas deemed optimal for denning opportunities based on field observations and site attributes. Characteristics include: • All areas of dry forest TASVEG units (ideal soil and sheltering conditions)[58]. • Grasslands within 100 m of native forest units and/or with a dense layer of shrubs (ideal soil and sheltering conditions)[59]. • Silvicultural forest (FPH/FPS) areas (ideal soil and sheltering conditions, including the presence of windrows)[60]. • Regenerating cleared land (FRG) within a native mosaic and with optimal soil and sheltering characteristics (including the presence of log piles)[61].
Sub-optimal (Denning and Foraging) [Plate 3]	This category includes remaining areas of intermediate habitat, including (but not limited to) those with the following traits: • Seasonally inundated lagoons and other wetland habitats not classified as unsuitable (*i.e.* those that dry out in summer)[62]. • Exposed grassland (lacking shrub cover) distant (>100 m) from native forest[63]. • FAC vegetation (good shelter at canopy level, but less suitable at ground level)[64].
Unsuitable (Foraging Only) [Plate 4]	This class captures all areas that are deemed unsuitable for denning opportunities, based on field observations and site attributes. Characteristics include: • Permanently inundated areas denoted by OAQ and ASF on vegetation mapping[65]. • Areas of FAG or FUM > 100 m from native vegetation. These areas are likely too far separated from high prey densities for energetically efficient maternal denning. In addition to this, exposed sites make young devils vulnerable around their dens and are thus not selected by adults[66]. **Note -** FAG and FUM within 100 m of native forest considered suitable but sub-optimal; and noting that micro-siting during a den management protocol should overrule the classification of unsuitable if micro-habitats suitable for denning are present within the FAG and/or FUM > 100 m from native forest, including the presence of rock and log piles, or thickets of suitable vegetation within the broader cleared area – these areas should be elevated to consideration as suitable in such scenarios.

[58] Pemberton (1990); Thalmann *et al.* (2016); Jones & Barmuta (2000); Jones *et al.* (2023)
[59] Thalmann *et al.* (2016); Jones & Barmuta (2000); Lyall (2017)
[60] Jones *et al.* (2023); Lyall (2017)
[61] Pemberton (1990); Thalmann *et al.* (2016)
[62] Thalmann *et al.* (2016); Environment Strategic Business Unit (2023)
[63] Thalmann *et al.* (2016); Jones & Barmuta (2000); Lyall (2017); Andersen *et al.* (2017); Guiler (1970)
[64] Thalmann *et al.* (2016); Lyall (2017)
[65] Environment Strategic Business Unit (2023)
[66] Jones *et al.* (2023); Andersen *et al.* (2017)

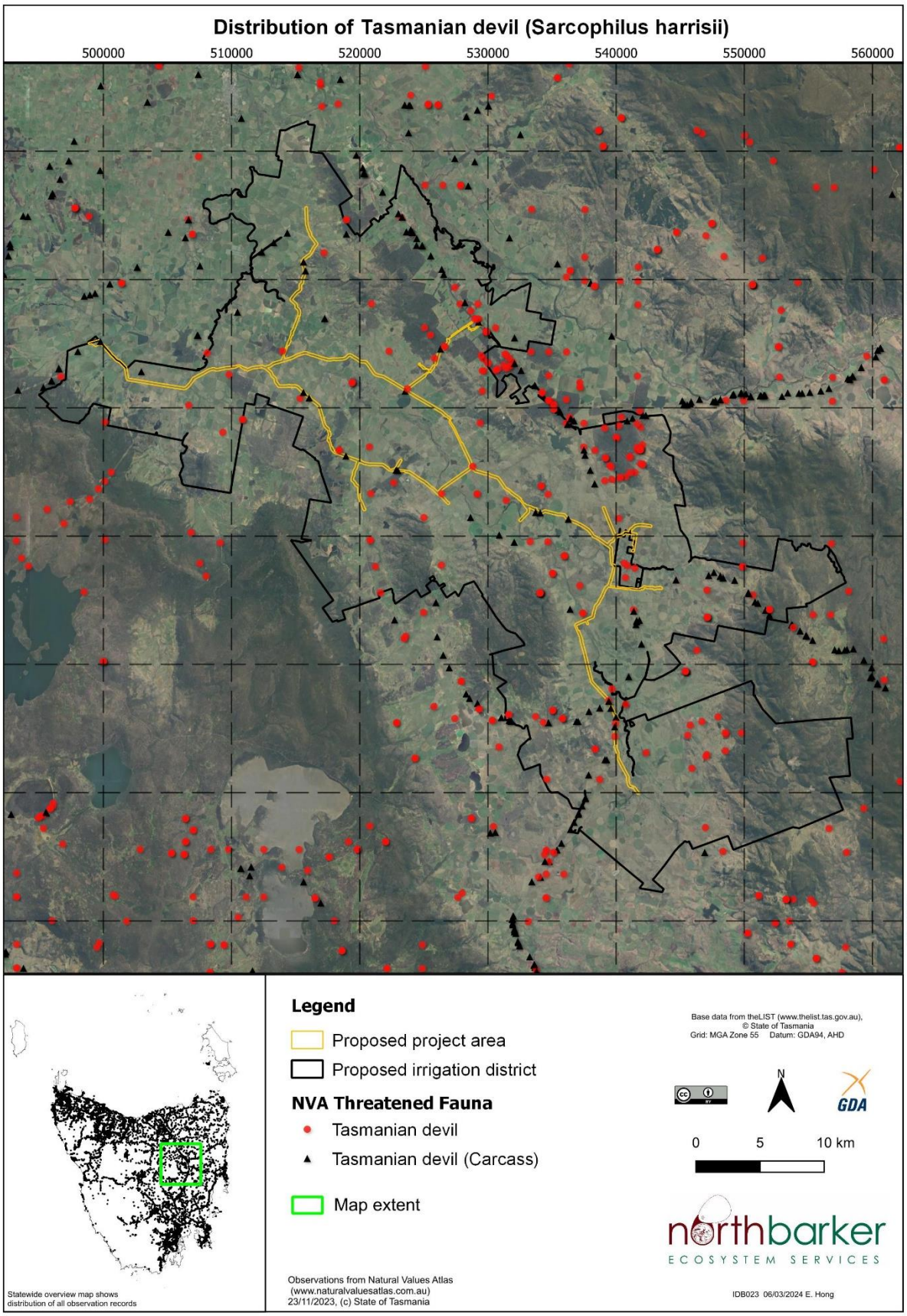


Figure 9: Distribution of the Tasmanian devil sightings and carcass records

3.2.1.2. SURVEY FINDINGS

Surveys were conducted during baseline natural values surveys across the duration of field assessments, following the general search techniques specified in the State guidelines[67]. No evidence in the form of scats, carcasses, footprints, or other identifiable features were recorded during surveys, and no burrows suitable for denning were recorded within the project area over the duration of field surveys (40 person days, >250 hours targeted search effort within stratified habitat), noting ground level visibility was very high and visual search effort in excess of the NRE guidelines for devil den management[68]. Survey effort also exceeded the minimum survey requirement for indirect searches for diurnal mammals defined in the *Survey guidelines for Australia's threatened mammals*[69]. The guidelines recommend a minimum day-time search effort of two hours for every one-hectare survey site of a stratified sampling program in a subject site up to 5 hectares. The surveys for this project concentrated on areas of native vegetation (totalling 146.31 ha) as these areas provide the highest suitability for denning structures and prey availability[70]. A search survey effort of >250 hours was spent within this habitat (**Attachment 3, Section 2.1**), equating to an average of around 1.7 hours of survey searching within every hectare of native vegetation, which far exceeds the recommendation of 2 hours of searching for 1 in every 5 hectares.

Despite the lack of direct evidence of Tasmanian devils in the project area, its presence is not discounted simply due to the species being effectively ubiquitous across Tasmania and varying locationally by frequency of occurrence and population density associated with habitat variables (including land use), environmental traits, and the distribution of DFTD[71]. In areas with frequent occurrences and/or high densities of devils, indicators of presence are readily encountered (tracks, scats, etc), which is why these are an accepted survey detection technique[72]; the absence of these indicators during surveys would thus indicate the project area is sparsely/infrequently utilised, consistent with nearby standardised searches[73]. Nonetheless, with the species having very broad habitat use and no factors ruling out its presence entirely, it can be expected that devils traverse through the project area and may use parts of it while foraging or simply moving within their range, which is consistent with observations recorded on the Tasmanian Natural Values Atlas. Denning opportunities (which are important in habitat quality and for consideration of avoiding and mitigating impacts) are limited based on survey findings, with none being detected during ground surveys and the majority of the project area being modelled as unsuitable (83.22 %) or sub-optimal (12.85 %) for the potential presence of dens and/or burrows (Table 9). Only 3.93 % of the design corridor has been identified as optimal potential denning habitat based upon habitat modelling (Figure 10, Table 9).

Given the species is relatively non-specific in relation to terrestrial habitat use, the entire design corridor is potential habitat for general foraging/dispersal (noting key aspects such as prey density and local use may vary within the area overall, favouring native vegetation, but this doesn't make other areas inherently unsuitable to the degree where they can be said to have no value)[74]. This is an important distinction as it relates to quality of habitat within the impact corridor following works (and to a lesser extent during).

[67] Environment Strategic Business Unit (2023)
[68] Environment Strategic Business Unit (2023)
[69] Department of Sustainability, Environment, Water, Population and Communities (2011)
[70] Andersen *et al.* (2017); Andersen *et al.* (2020); Jones & Rose (1996); Troy (2014)
[71] Cunningham *et al.* (2021)
[72] Department of Sustainability, Environment, Water, Population and Communities (2011)
[73] Cunningham *et al.* (2021)
[74] Jones & Barmuta (2000); Jones *et al.* (2023); Andersen *et al.* (2017); Andersen *et al.* (2020)

3.2.1.3. IMPACTS

Population context

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area, including 'a geographically distinct regional population' or 'a population, or collection of local populations, that occurs within a particular bioregion'. The SPRAT profile for devils divides them into two genetically distinct populations:

1) north-western; and
2) eastern/south-western[75]

The project area falls within the range of the eastern/south-western population, which covers a range of 50,630 km^2 [76]. With such a large population area, the only conceivable way that the proposal could lead to a long-term decrease in the size of the Tasmanian devil population across that entire region would be if the proposal led to major changes in habitat availability or substantially increased demographic pressures on the species at the regional level. In contrast, the total project potential impact area itself of 444.81 ha is only 0.0088 % of the range of the population as a whole. The proposal is therefore extremely unlikely to substantially impact the size of this devil population as the area within which impacts are contained is simply too small in proportion to overall population.

Habitat loss/change

Surveys and analysis conducted by NBES have established that only 416.68 ha of the roughly 2,638.99 ha design corridor represents potential denning habitat for the Tasmanian devil (109.51 ha of which is classed as optimal, with the remaining 307.17 ha classed as sub-optimal) (refer to Table 10). The remaining 2,222.31 ha of habitat is classed as unsuitable for denning and represents foraging habitat only (noting areas of optimal and sub-optimal denning suitability are also suitable for foraging).

The proposed construction corridor, which is the limit of impacts, contains 74.62 ha of potential denning habitat (consisting of 17.47 ha of optimal habitat and 57.15 ha of sub-optimal habitat). In contrast, a total of 370.19 ha of unsuitable denning habitat (potential foraging only) is present within the construction corridor (Table 10 and Table 11). The majority of impacts therefore and proposed within land determined to be unsuitable for denning and suitable for foraging only, noting foraging habitat is essentially ubiquitous due to the ecology of the devil.

In addition, 95.50 % of the impact footprint within the construction corridor (424.78 ha), from the long-term perspective of devil habitat use, will merely be habitat disturbance, with the extent of the pipeline post-works once more becoming viable habitat for foraging, dispersal (and potentially denning but still less likely than foraging/dispersal based on pre-existing landscape attributes such as the extent of cleared land) (*i.e.* it will still meet the definitions within Table 9) – even during construction there will be scope for devils to move through areas in a relatively unfettered fashion and for the works area to still provide habitat value in that sense. Areas that currently support woody vegetation (12.46 ha, or 2.80 % of the construction corridor area) are expected to be the most altered, in that woody vegetation may be the slowest to recover and/or be rehabilitated, and the fact that forest will not return to forest, which is incompatible with the pipeline. However, as per the definitions in Table 9, an area does not need to remain as forest to remain as viable habitat, and these areas will remain adjacent to larger forested patches with all the inherent habitat values such as prey and shelter opportunities. Habitat viability (from a denning perspective) has been remodelled in Figure 11 from the perspective of post-works habitat changes, demonstrating that 99.70 % of the habitat (loss of 1.33 ha of denning habitat) in the construction corridor will be unchanged in terms of denning suitability, with the results displayed in Table 12.

[75] Department of Climate Change, Energy, the Environment and Water (2023a)
[76] Department of Climate Change, Energy, the Environment and Water (2023a)

Areas of impact within forest units will remain treeless post works but will be rehabilitated with grassy and shrubby vegetation present in the local area under rehabilitation commitments (**Section 2.1.1.1**). For the habitats that already lack woody vegetation, the installation of the pipeline will result in no habitat change post works and/or have a very rapid return to equivalent habitat value (e.g. less than 6 months) facilitated by revegetation commitments. During this period of rehabilitation, the recovering ground will still meet the viable habitat definitions within Table 9, as the temporary absence of vegetation will not preclude devils from using the area at a local or landscape scale, even if it is just for dispersal or opportunistic foraging on bare ground. The process of construction, consisting of excavation and re-filling, will be completed on a local scale within a one to three day period in most cases (with discrete sections open for up to a maximum of two weeks), meaning construction related disturbance timeframes are very low. Measures will be put in place such that if a devil were to find its way into an open trench, there are a sufficient number of ramps placed within the trench to allow animals to readily vacate the trench. Trenches will typically be open for a length of 1-200 m, with a maximum trench length of 500 m.

The limited nature of the permanent works is such that permanent habitat loss is extremely minor in the context of the broader area (20.03 ha of total habitat loss). Only areas proposed to contain balance tanks, pump stations, and a dam will constitute permanent habitat loss in that viable habitat will be converted to inviable habitat – these areas comprise 0.66 ha of optimal denning habitat, 0.67 ha of sub-optimal denning habitat, and 18.70 ha of unsuitable denning habitat – all of which constitute potential foraging habitat - as per the definitions in Table 9 and with the habitat loss outlined in Table 11). Proportionally, this loss of 20.03 ha (inclusive of 1.33 ha of potential denning habitat) of habitat constitutes 0.0003 % of the overall range of the respective devil population.

The potential impact from the project applies to a greater extent to local individuals. At the scale of an individual, the proposal's area of impact is less than half the area of an individual devil's home range, with the permanent loss of habitat representing the loss of 0.007 % of a single devils range (based on a home range of 27 km^2)[77]. Given the measured density of devils in the broader area is extremely low[78], this scale of loss is extremely unlikely to lead to a significant decrease in population size nor result in any population fragmentation (noting devils are effectively impervious to fragmentation for all but the largest geographic barriers (e.g. large expanses of deep permanent water such as Bass Strait).

[77] Andersen *et al.* (2020)
[78] Cunningham *et al.* (2021)

Table 10: Impacts to devil and quoll denning (and foraging) habitat prior to construction in context of the availability within 5 km (all areas in hectares)

	Potential Impact Area			Avoidance Area	
Denning Habitat Class (Note all classes are potential foraging habitat)	**Total Permanent Impacts** {% of class within construction corridor} [% of class within design corridor] (% of class within 5 km)	**Temporary Impacts** {% of class within construction corridor} [% of class within design corridor] (% of class within 5 km)	**Total Within Construction Corridor** [% of class within design corridor] (% of class within 5 km)	**Total Within Design Corridor** (Excluding Construction Corridor)	**Total Within 5 km**
Optimal	0.66 {3.78 %} [0.60 %] (0.002 %)	16.81 {96.22 %} [15.35 %] (0.05 %)	17.47 [15.95 %] (0.05 %)	109.51 (92.04)	32,144.20
Sub-optimal	0.67 {1.18 %} [0.22 %] (0.004 %)	56.48 {98.82 %} [18.39 %] (0.35 %)	57.15 [18.61 %] (0.35 %)	307.17 (250.02)	16,306.84
Unsuitable	18.70 {5.05 %} [0.84 %] (0.03 %)	351.49 {94.95 %} [15.82 %] (0.51 %)	370.19 [16.66 %] (0.53 %)	2,222.31 (1,852.13)	69,385.64
Total	**20.03**	**424.78**	**444.81**	**2,194.19**	**117,836.68**

Table 11: Summary of impacts to devil (and quoll) denning habitat suitability classes (all areas in hectares)

	Infrastructure Description			Impact Summary		
Habitat Class (Note all classes are potential foraging habitat)	**Pump Stations [% of Permanent Impacts] (% of Total Impacts)**	**Balance Tanks [% of Permanent Impacts] (% of Total Impacts)**	**Dam [% of Permanent Impacts] (% of Total Impacts)**	**Total Permanent Impacts (% of Total Impacts)**	**Temporary Impacts (% of Total Impacts)**	**Total (% of Total Impacts)**
Optimal	-	0.66 [100 %] (3.78 %)	-	0.66 (3.78 %)	16.81 (96.22 %)	**17.47 (3.93 %)**
Sub-optimal	0.21 [30.72 %] (0.36 %)	0.47 [69.28 %] (0.81 %)	-	0.67 (1.17 %)	56.48 (98.83 %)	**57.15 (12.85 %)**
Unsuitable	1.08 [5.77 %] (0.29 %)	0.31 [1.68 %] (0.08 %)	17.30 [92.55 %] (4.92 %)	18.70 (5.05 %)	351.49 (94.95 %)	**370.19 (83.22 %)**
Total	**1.28**	**1.44**	**17.30**	**20.03**	**424.78**	**444.81**

Table 12: Tasmanian devil (and quoll) denning habitat modelling results comparing pre and post construction changes (all areas in hectares)

Denning Habitat Class (Note all classes are potential foraging habitat)	Total Within Construction Corridor (Pre-Construction)	Total Within Construction Corridor (Post-Construction)	Net Change in Area	Conversion Type
Optimal	17.47	16.58	-0.89	0.66 ha lost to permanent infrastructure (unsuitable) 0.23 ha converted to sub-optimal
Sub-optimal	57.15	56.73	-0.42	0.67 ha lost to permanent infrastructure (unsuitable) 0.23 ha gained from optimal 0.02 ha gained from vegetation changes
Unsuitable	370.19	371.51	1.34	0.66 ha gained from permanent infrastructure (optimal) 0.67 ha gained from permanent infrastructure (sub-optimal) 0.02 ha lost from vegetation changes
Total	**444.81**	**444.81**	**-**	

Plate 1: Example of optimal denning habitat in *Eucalyptus amygdalina* forest along Barton Road

Plate 2: Example of optimal denning habitat. Native grassland within 100 m of a forest edge

Plate 3: An example of sub-optimal denning habitat. Exposed grassland with a lack of shrubs to provide shelter, and >100 m from a forest edge

Plate 4: Cultivated land provides unsuitable denning habitat. This habitat type is widespread through the project area

Roadkill

Analysis of the available traffic data[79] indicates that the major roads are expected to have an increase of night-time traffic (largely around dawn and dusk) on all major project roads (Figure 12), as indicated in **Attachment 11**. Given this expected increase in traffic, it can be expected that there will be an increased probability of roadkill incidence (proportional to traffic increases) without mitigation.

Proportional roadkill data[80] (Table 13) suggests that the Midland Highway is twice as likely to have a collision impact with a Tasmanian devil than on Macquarie Road, which is one of the major C roads within the project area (Table 13). It is acknowledged that this roadkill data may not be an entirely accurate reflection of the collision rates more broadly due to varied reporting rates. It is also understood that the Tasmanian Department of State Growth periodically conduct roadkill removal on State managed roads, which may skew the data toward roads that are surveyed at a higher frequency. Nonetheless, the proportion of traffic on the Midland Highway relative to the smaller project roads (Table 13), provides some insight into the scale of roadkill impacts to Tasmanian devils and quolls and can be taken as a proxy for baseline rates of mortalities.

Macquarie Road is expected to have increases in light vehicle traffic > 40 % during night-time hours, with heavy vehicle traffic expected to be limited to day-time hours. Similar increases in light vehicle use across other projects roads is expected. With this in mind, mitigation measures are proposed in line with studies of roadkill in dasyurids across Tasmania[81].

Table 13: Summary of dasyurid roadkill on project roads since 19/06/2018 and with the main adjacent arterial road, the Midland Highway, provided for additional context[82]

Road	Tasmanian devil	Spotted-tail quoll	Eastern quoll	Total
Midland Highway*	10	5	3	**18**
Macquarie Road	5	1	-	**6**
Cressy Road	1	-	-	**1**
Poatina Road^	1	-	-	**1**
Valleyfield Road	2	-	-	**2**
Barton Road	-	-	-	**0**
Ashby Road	0	1	-	**1**
Total	**19**	**7**	**3**	**29**

*** Recorded between Mona Vale Road and Powranna Road, within the project area**
^ Recorded between Poatina township and Macquarie Road, within the project area

3.2.1.4. MITIGATION MEASURES

Despite the large area of unsuitable denning habitat across the NMIS project area (Figure 10 and Figure 11) and the absence of any known potential burrows to support a den in the proposed footprint, a pre-clearance check and unanticipated den discovery protocol will be implemented throughout the construction phase of the project. This protocol is outlined in **Attachment 12**. The

[79] Provided by Pitt & Sherry for project roads – data collected in April and December 2022
[80] Data downloaded from the Tasmanian Roadkill Reporter app – available through the Tasmanian Natural Values Atlas
[81] Hobday and Minstrell (2008); Jones (2000)
[82] Data downloaded from the Tasmanian Roadkill Reporter app – available through the Tasmanian Natural Values Atlas

other key aspect of mitigation will be in relation to roadkill mitigation, as outlined below. An assessment of the project against the significant impact criteria for Tasmanian devils is provided in Table 15.

Roadkill

The '*Survey guidelines and management advice for development proposals that may impact on the Tasmanian Devil 2015*[83] (the *Survey Guidelines*) outlines a process for assessing the potential impacts of developments requiring road usage on Tasmanian devils. This process focuses on identifying and mitigating impacts on devils, but the mitigation measures are also suitable for reducing road mortalities for other native fauna, including quolls. The process involves completing a traffic impact assessment, then, if Tasmanian devil roadkill mortalities are expected to increase by more than 10 % (based on equivalent predicted rise in night-time traffic for existing roads, and general increase in traffic on new roads), a roadkill assessment and roadkill mitigation plan must be completed. Mitigation measures for the current project therefore will focus on existing roads expected to surpass the 10 % night-time threshold based on being identified as having an estimated > 10 % traffic increase during the construction of the proposed development (particularly based on predictions much higher than 10 % increase during peak hours, which are the most likely to overlap with the definition of night-time in the *Survey Guidelines*).

Traffic data (baseline and predicted) is available for the major roads proposed to be used during the duration of the project – this data is displayed in **Attachment 11**. The roads proposed to be utilised during construction are as follows:

- Cressy Road (Dam construction and pipeline installation)
- Poatina Road (Dam construction and pipeline installation)
- Powranna Road (Dam construction and pipeline installation)
- Mount Joy Road (Pipeline construction)
- Barton Road (Pipeline construction)
- Valleyfield Road (Pipeline construction)
- Macquarie Road between Valleyfield Road and Midland Highway (Pipeline construction)
- Macquarie Road between Valleyfield Road and Poatina Road (Pipeline construction)
- Ashby Road (Pipeline construction)

Given the relatively low existing traffic volumes on all of these roads, it is expected that in most cases, roads will see increases in traffic volumes around the dawn and dusk periods greater than 10 % and thus warrant mitigation. Baseline roadkill data is available in data present on the Tasmanian Natural Values Atlas (Figure 12) and LISTmap - it is probable that this data does not accurately quantify the level of vehicle strike on these roads due to incomplete reporting, but it may nonetheless reflect the pattern of roadkill distribution. The data has thus been utilised to identify high-risk roads in the project area without necessarily drawing conclusions or providing a basis to measure specific increases in roadkill frequency. Nonetheless, due to the predicted increase in traffic alone, the following mitigation measures will be implemented across the project (referred to as the roadkill mitigation protocol/strategy). With these mitigation measures in place (summarised in Table 14), we anticipate project-specific roadkill mortalities can be minimised, with regular monitoring and periodic data review in place to trigger contingency measures if needed.

Traffic times

- As per the *Survey Guidelines,* the definition of night-time to apply to all subsequent mitigation measures includes an hour before dusk and an hour after dawn[84] – noting it will be a requirement of the contractor to define the variation in this period in relation to the various

[83] Environment Strategic Business Unit (2023)
[84] Environment Strategic Business Unit (2023)

requirements on a week-by-week basis as part of their construction environment management practices.

- Heavy rigid vehicles or larger will be limited to daylight hours as much as is practicable – special circumstances may require transport outside of daylight hours only in accordance with the conditions defined in the following subclauses:
    - Special purpose heavy vehicles moving large plant and equipment may operate outside the above times when it is a road traffic requirement to minimise impact on other traffic, and/or comply with any other road authority permits – in such cases these vehicles will have a lead escort vehicle and be limited to a maximum speed of 60 km/h whilst on project roads.
    - In the event that general cartage heavy vehicles are prevented from operating during daylight hours, such as due to weather events, these vehicles will be limited to a maximum speed of 60 km/h during night-times on all project roads – in such cases, these vehicles will travel in a convoy of a minimum of 2 vehicles, with convoys to be separated by at least 15 minutes – by travelling in a convoy, the frequency of individual heavy vehicles will be reduced, thus reducing roadkill opportunities.

Speed limits

- Road speed limits for project vehicles (to be mandated by the responsible Contractor and their requirement to enforce) will be set at a maximum of 80 km/h across the specified project roads (Figure 12) during daylight hours and at 60 km/h during night time[85].
- In addition, areas identified as adjacent to optimal potential denning habitat (based on devil habitat modelling in Figure 10) and thus seen as the most likely areas to support fauna in general, will be further limited to 60 km/h at all times for project vehicles. These identified areas are as follows (Figure 12):
    - Barton Road (Midland Highway to Mt Joy Road)
    - Powranna Road (Midland Highway to Mt Joy Road)
    - Macquarie Road (Glen Connell Road to Barton Road)
    - Macquarie Road (Quarry Road to Delmont Road)
    - Valleyfield Road (Macquarie Road to 200 m beyond balance tank access)
- These limits will be advertised using semi-permanent project specific signage and enforced under contract requirements.

Additional measures

- Project vehicles will be fitted with a basic, high-frequency animal repellent device (which emits an ultra-sonic sound wave at speeds above 50 km/h). The installation and operation of these devices will be audited periodically as part of the Contractors construction environmental management requirements (to be linked to contract commitments).

Monitoring

- During the construction phase, all internal roads within the current works or commute routes shall be monitored daily for roadkill (with documentation recording inspection was completed along with noting when, where and species of any roadkill), with mortalities removed from the road surface immediately upon location (to limit likelihood of predators being attracted to the carcass). The same shall apply to selected arterial roads that will be subject to increased use as project staff commute to the site from places of accommodation. Roadkill will be noted as a project vehicle collision or if it is found incidentally (and not already reported) assumed to be the result of collision from a non-project vehicle.

[85] Precluding situations where the speed limits may be less than these amounts under existing conditions and/or under temporary conditions applied for other road traffic management.

- The project roadkill data will be periodically independently reviewed (minimum every 6 months through construction), with scope to assess collision rates and determine if site access measures will require reassessment and further mitigation implemented where applicable.

As further conditions of TI's Environmental Protection Requirements (contractual obligations for contractors):

- Wildlife hit by project vehicles must be recorded, including details of when, where, and species if identifiable. These records will be reported to TI along with the monthly report. Mortalities must also be reported to NRE through the Roadkill Reporter app[86]. Roadkill attributed to non-project vehicles will be tallied separately. Data collected throughout the construction phase of the project be submitted to the Department of Climate Change, Energy, the Environment and Water upon the completion of works.
- No animals are to be deliberately killed with vehicles.
- If any injured wildlife is found, WIRES Wildlife Rescue (1300 094 737) will be contacted immediately, and arrangements made for transferring injured wildlife to specialist carers at an animal hospital, vet, or refuge. If rehabilitation is not possible, animals are to be dealt with humanely in accordance with the *Best Practice Guidelines for Wildlife Rehabilitation Version 2 (2021)* set out by the Department of Natural Resources and Environment Tasmania.

[86] Available at https://nre.tas.gov.au/wildlife-management/living-with-wildlife/tasmanian-wildlife-roadkill/tasmanian-roadkill-reporter-app

3.2.1.5. SUMMARY OF MITIGATION AND AVOIDANCE MEASURES

Table 14: Summary of mitigation and avoidance measures for the Tasmanian devil

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
Pre-clearance check and unanticipated den discovery protocol	Prior to the commencement of the action, the civil contractor must implement the pre-clearance check and unanticipated den discovery protocol as detailed in **Attachment 12**. This protocol will require approvals under the Tasmanian *Nature Conservation Act 2002* should dens be required to be decommissioned. The application of this protocol must: a) Be conducted within two weeks of the commencement of any vegetation clearance and must be applied to a 50 m buffer of the works area. b) If dens are located, they must be subject to a den monitoring assessment as detailed in Section B of the protocol. c) Comply with the reporting and regulation components of Section C of the protocol.	Tasmanian Irrigation Civil Contractor	Two weeks prior to any vegetation clearance, including a 50 m buffer.	**Very high** The application of this protocol is consistent with the management advice given in the *Survey Guidelines and Management Advice for Development Proposals that may impact on the Tasmanian Devil* [87] . These guidelines were developed in 2015 with the input from several experts in the management and ecology of Tasmanian dasyurids. While the effectiveness of the pre-clearance checks are difficult to define, the process is designed in such a manner that the potential for direct impacts to individuals is removed through a thorough search and monitoring program.
Roadkill mitigation	During the construction phase of the action, the civil contractor must comply with roadkill mitigation measures as detailed in **Section 3.2.1.4**. Roadkill mitigation measures include: a) Reduction of speed across all project roads for project vehicles. b) Centralising transport of key infrastructure to core roads.	Tasmanian Irrigation Civil Contractor	All project roads. Ongoing throughout construction phase of the project.	**Very high** The application of the roadkill mitigation strategy is consistent with the management advice given in the *Survey Guidelines and Management Advice for Development Proposals that may impact on the Tasmanian Devil* [88] . These guidelines were developed in 2015 with the input from several experts in the management and ecology of

[87] Environment Strategic Business Unit (2023)
[88] Environment Strategic Business Unit (2023)

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
	c) Restricting use of roads outside of daylight hours as much as is practicable. d) Project vehicles will be fitted with a basic, high-frequency animal repellent device. e) Specific mitigation for special purpose vehicles, including travel convoys, escort vehicles, and further speed reduction.			Tasmanian dasyurids. The strategies proposed in this roadkill mitigation plan are somewhat tested, with reduction of driver speed likely to be an effective in reducing overall collision numbers[89], and limiting vehicles from night-time use is also likely to reduce collision risk as the majority of species likely to be at risk from collision are crepuscular or nocturnal[90] The effectiveness of high-frequency animal repellent devices is challenging to assess, with trials of virtual fencing yielding mixed results but areas in which it has been effective consistent with the current project area[91].
Roadkill monitoring	Collision data must be reviewed at a minimum of every 6 months. Data must be submitted to the Department of Natural Resources and Environment Tasmania and the Department of Climate Change, Energy, the Environment and Water.	Tasmanian Irrigation Civil Contractor	All project roads. Ongoing throughout construction phase of the project.	**Very high** The monitoring and review component of the roadkill mitigation plan has a very high likelihood of effectiveness as the roadkill plan allows for adaptive management on project roads in the event that project vehicles lead to an increase in roadkill beyond the baseline levels.

[89] Hobday & Minstrell (2008); Hobday (2010)
[90] Lester (2015); Hobday & Minstrell (2008)
[91] Fox *et al.* (2019); Magnus *et al.* (2004)

3.2.1.6. SIGNIFICANT IMPACT ASSESSMENT

Table 15: Significant impact criteria with regards to the Tasmanian devil

Significant Impact Criteria	Likelihood of Significant Impact	Comments
1. Lead to a long-term decrease in the size of a population.	None	A 'population of a species' is defined under the EPBCA as an occurrence of the species in a particular area, including 'a geographically distinct regional population' or 'a population, or collection of local populations, that occurs within a particular bioregion'. The SPRAT profile for devils divides them into two genetically distinct populations: 1) north-western; and 2) eastern/south-western[92] With the project area falling within the range of the eastern/south-western population, the only conceivable way that the proposal could lead to a long-term decrease in the size of the Tasmanian devil population across that entire region would be if the proposal led to major changes in habitat availability or substantially increased demographic pressures on the species at the regional level. As this is not the case (see discussion above), the action will not lead to a long-term decrease in the size of a population.
2. Reduce the area of occupancy of the species.	None	At the scale of an individual, the project impact area (444.81 ha) is less than half the area of an individual devil's home range[93], with only 20.03 ha of this being permanent impact. Given the measured density of devils in the broader area[94], and the temporary nature of much of the proposed works, the action will not reduce the area of occupancy of this species as they will still effectively be able to occur in the same area after works as before.
3. Fragment an existing population into two or more populations.	None	Devils are resilient to habitat fragmentation[95]. To fragment a population into two or more populations, this project would have to create a barrier that devils could not/would not cross, for example, the 2 km wide body of water separating Bruny Island from mainland Tasmania (devils have never occurred on Bruny Island). The proposal instead involves a very narrow linear strip of disturbance, mostly being temporary impacts from the point of the ecology of the devil. Devils readily move through human-modified landscapes and will even select roads for movement and foraging[96], so it is highly unlikely that this proposal will prevent ongoing interaction among devils in the population nor impact the ability of devils to disperse

[92] Department of Climate Change, Energy, the Environment and Water (2023a)
[93] Andersen *et al.* (2020)
[94] Cunningham *et al.* (2021)
[95] Andersen *et al.* (2017)
[96] Andersen *et al.* (2017)

Significant Impact Criteria	Likelihood of Significant Impact	Comments
		through the surrounding already fragmented landscape. As such, the action will not fragment an existing population into two or more populations.
4. Adversely affect habitat critical to the survival of a species.	None	The Draft Tasmanian Devil Recovery Plan[97] states that critical devil habitat includes 'all disease-free areas within mainland Tasmania with suitable devil habitat', 'all areas of pre-disease core habitat', and 'areas that may be required under the recovery program for the future introduction of Tasmanian devils'. 'Disease' refers to Devil Facial Tumour Disease (DFTD), the most significant threat to devils. The proposal area has been diseased for >20 years[98]. The proposed action has a permanent infrastructure footprint of 20.03 ha. All other impacts are temporary only and will not reduce the extent of available foraging and denning habitat beyond the permanent impact areas. All impacts are subject to a pre-clearance check and unanticipated den discovery protocol, which will protect the interruption of a breeding event in the unlikely scenario of one occurring at the point of works within the impact corridor. With this measure in place, the action will not adversely affect habitat critical to the survival of this species.
5. Disrupt the breeding cycle of a population.	None	All impacts are subject to a pre-clearance check and unanticipated den discovery protocol. Should a den be located during this check, measures are put in place to ensure that there is no impact to breeding devils. With this measure in place, the action will not disrupt the breeding cycle of a population (or individuals),
6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	None	The proposed Action has a permanent infrastructure footprint of 20.03 ha. All other impacts are temporary only and will not reduce the extent of available foraging and denning habitat beyond the permanent impact areas, noting that the vast majority of impacts occur within modified land. All impacts are subject to a pre-clearance check and unanticipated den discovery protocol. With this measure in place, the action will not modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.
7. Result in invasive species that are harmful to the species becoming established in the species' habitat.	None	There is no likelihood that the action will result in and invasive species that are harmful to the species (such as foxes) becoming established in the species' habitat as the landscape suitability for invasion of such species will not change as a result of works and there is no conceivable reason the projects works will result in a direct introduction of such a species as the project will operate under weed and hygiene management practices. In addition, the surrounding landscape (see **Section 2**) already continues numerous introduced plants and animals that co-occur with the devil throughout its range

[97] Department of Primary Industries, Parks, Water, and Environment (2010)
[98] Cunningham *et al.* (2021)

Significant Impact Criteria	Likelihood of Significant Impact	Comments
		with no apparent detrimental impacts.
8. Introduce disease that may cause the species to decline.	None	DFTD has been confirmed as present in the general area since at least 2002[99]. The proposed action will not introduce further disease that may cause the species to decline, nor is there any possibility that the action could further spread DFTD.
9. Interfere with the recovery of the species.	None	Given that the main threat to the Tasmanian devil is DFTD, the recovery of the species is contingent on work to manage this disease and cultivate safeguards against the loss of all wild individuals. Currently the recovery of the Tasmanian devil is based around the work being undertaken by the 'Save the Tasmanian Devil Program'. The Draft Tasmanian Devil Recovery Plan[100] identifies the following actions: 1) Maintain and manage insurance populations 2) Manage DFTD in the wild 3) Monitor Tasmanian devils 4) Conduct disease investigations 5) Manage other threats in the wild 6) Research and measure habitat variables 7) Coordinate recovery program 8) Communicate with the community and stakeholders 'Other threats' in Action 5 include the threat of foxes in Tasmania, collisions with vehicles, habitat loss and illegal culling. As outlined above, the proposal is unlikely to cause significant habitat loss for devils. Roadkill mitigation measures are to be put in place to limit the potential for collisions from project traffic. These measures should minimise risks to the component of the local devil population from the increased traffic during construction. Thus, with the recommended mitigation measures in place, this action will not interfere with the recovery of this species.
Summary		
The proposed action will not have a significant impact on the Tasmanian devil.		

[99] Cunningham *et al.* (2021); Hawkins *et al* (2006)
[100] Department of Primary Industries, Parks, Water, and Environment (2010)

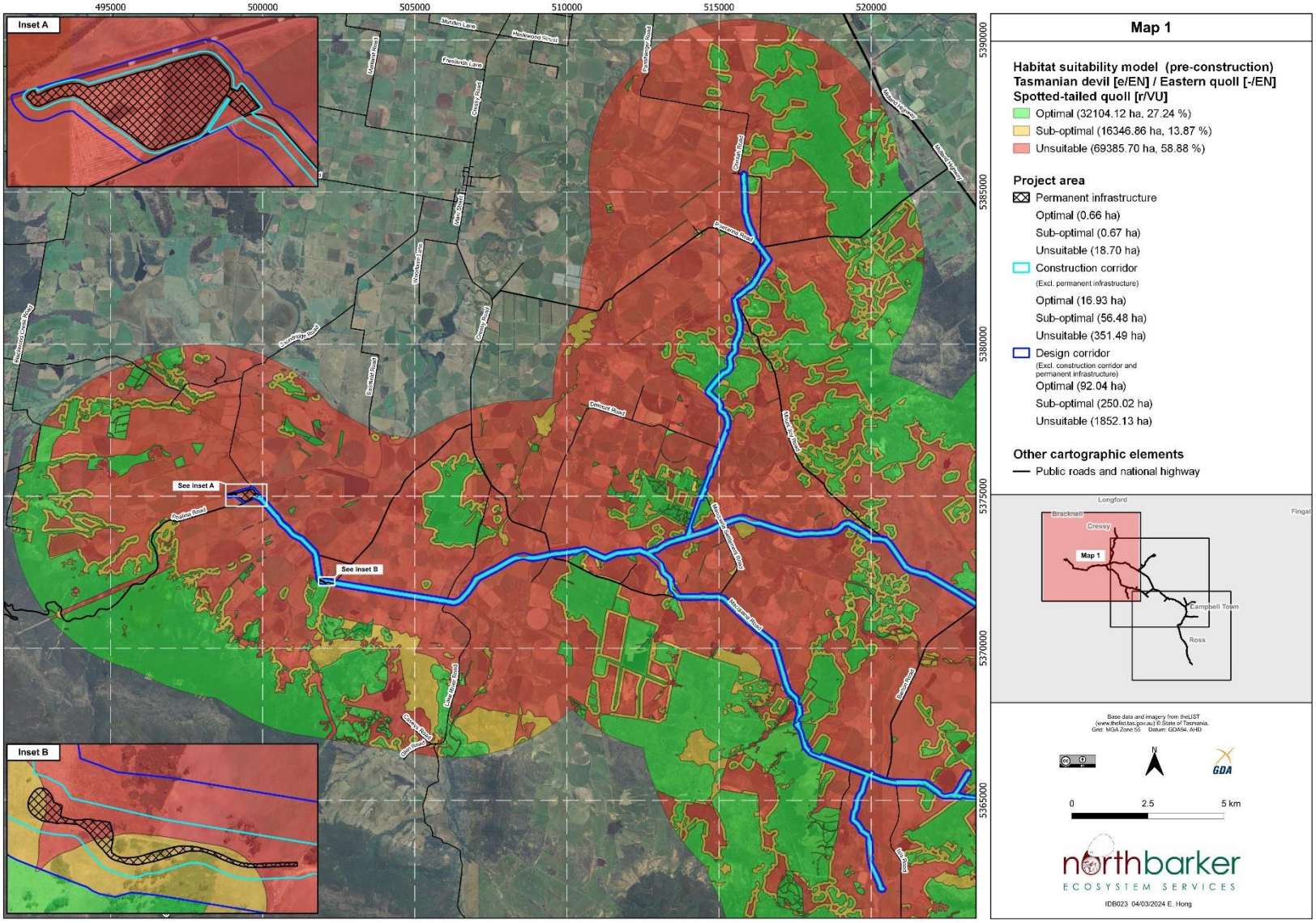


Figure 10a: Devil (and quoll) denning habitat suitability model pre-construction (noting all denning classes are considered potentially suitable foraging habitat)

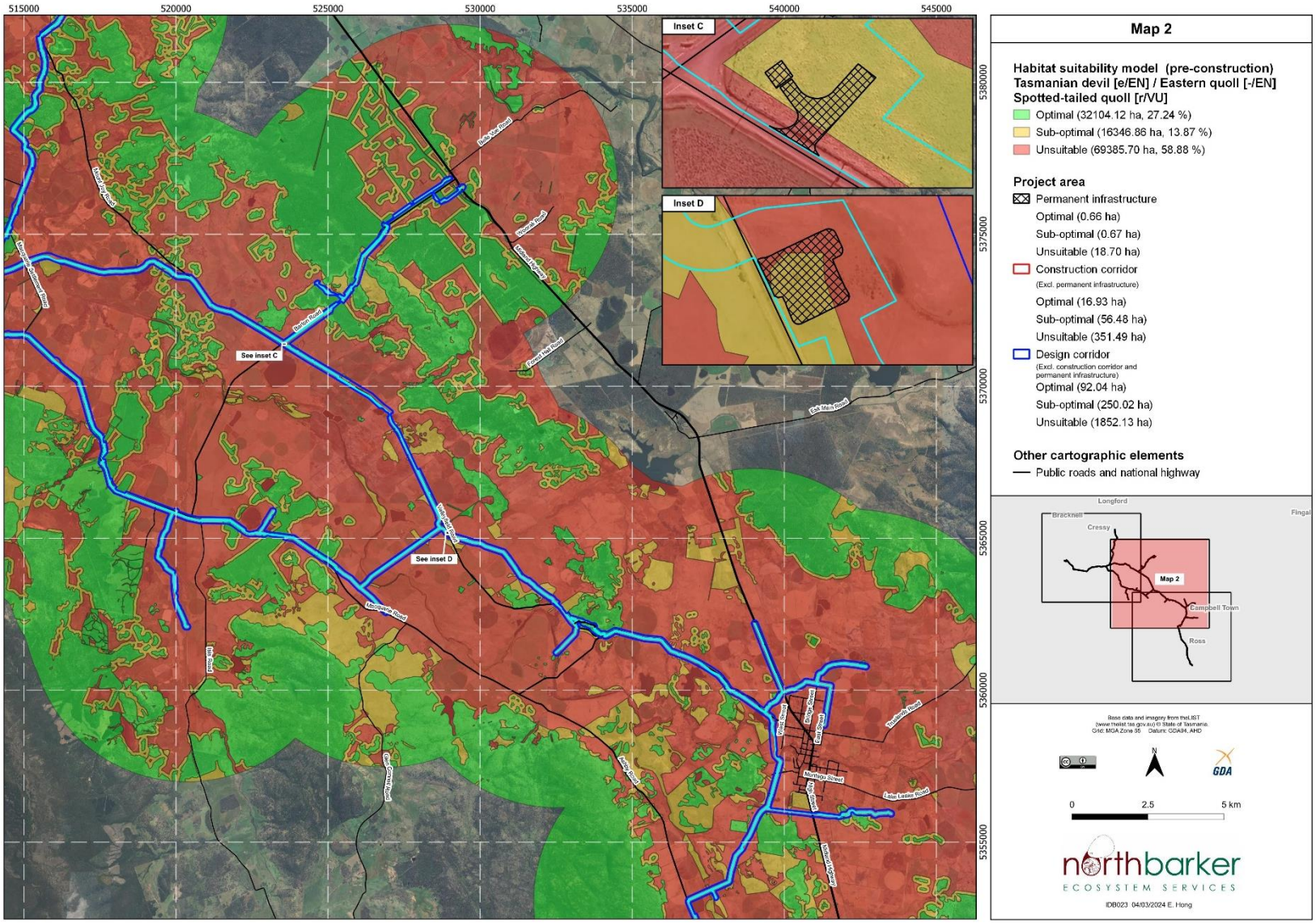


Figure 10b: Devil (and quoll) denning habitat suitability model pre-construction (noting all denning classes are considered potentially suitable foraging habitat)

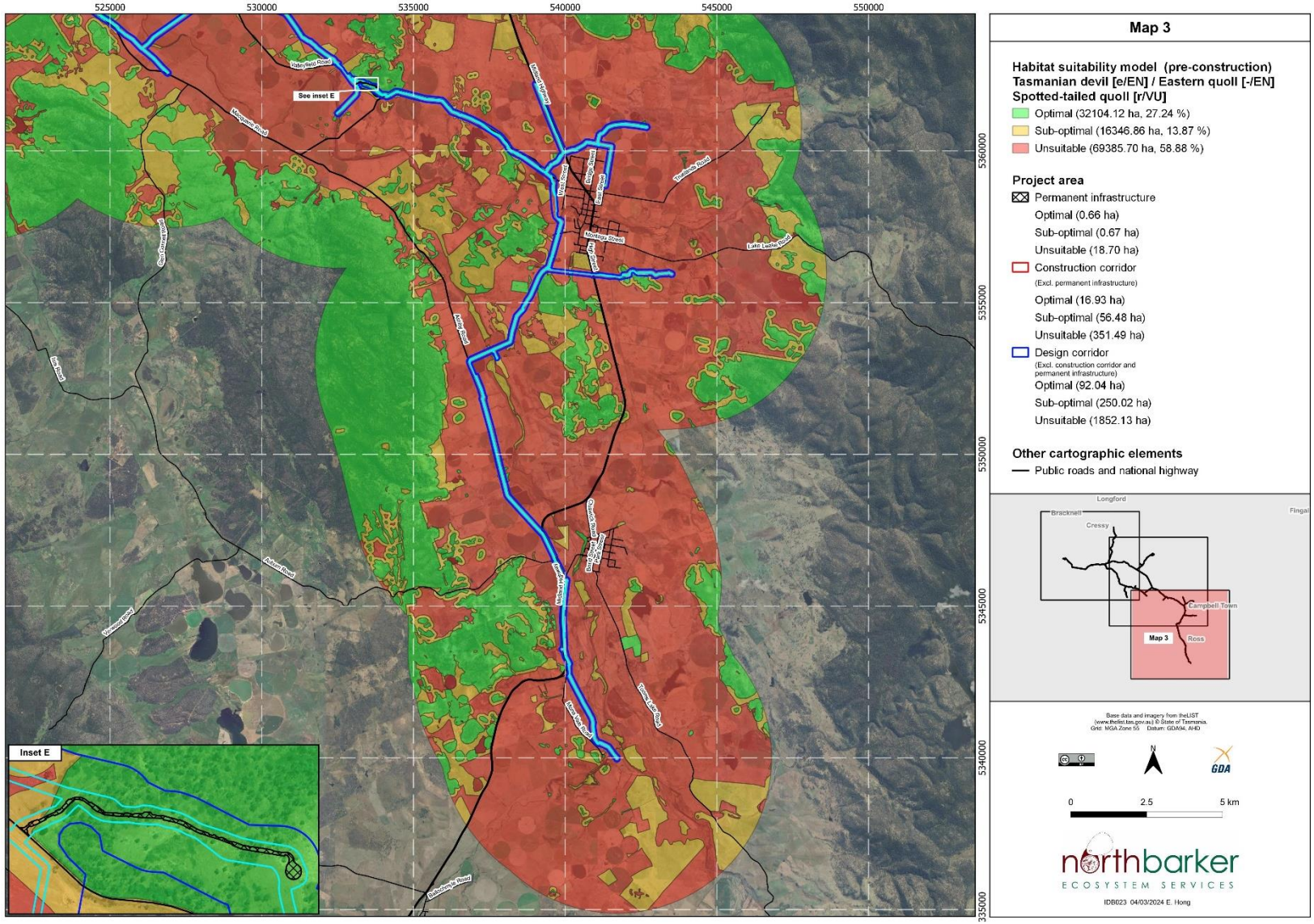


Figure 10c: Devil (and quoll) denning habitat suitability model pre-construction (noting all denning classes are considered potentially suitable foraging habitat)

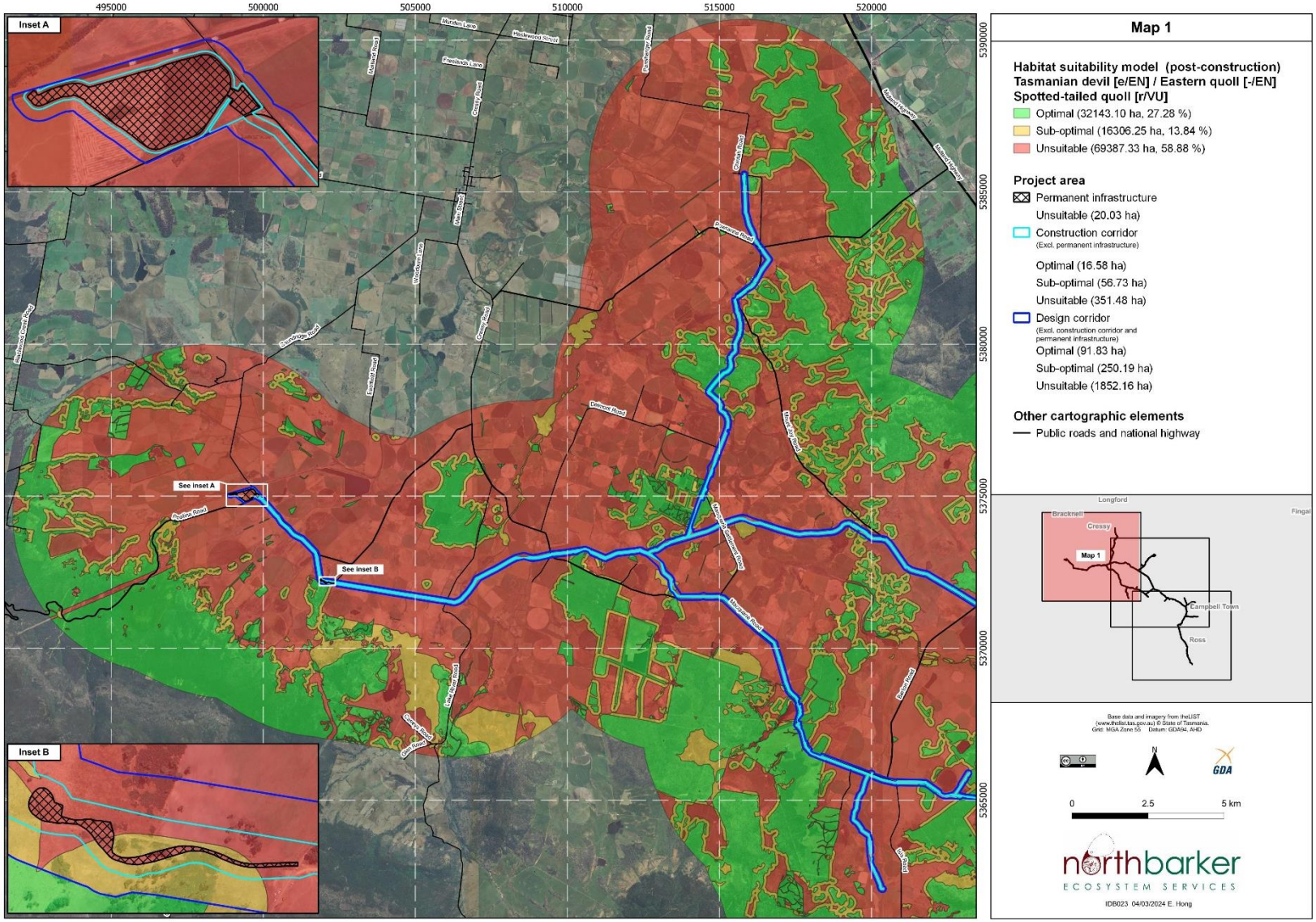


Figure 11a: Devil (and quoll) denning habitat suitability model post-construction (noting all denning classes are considered potentially suitable foraging habitat)

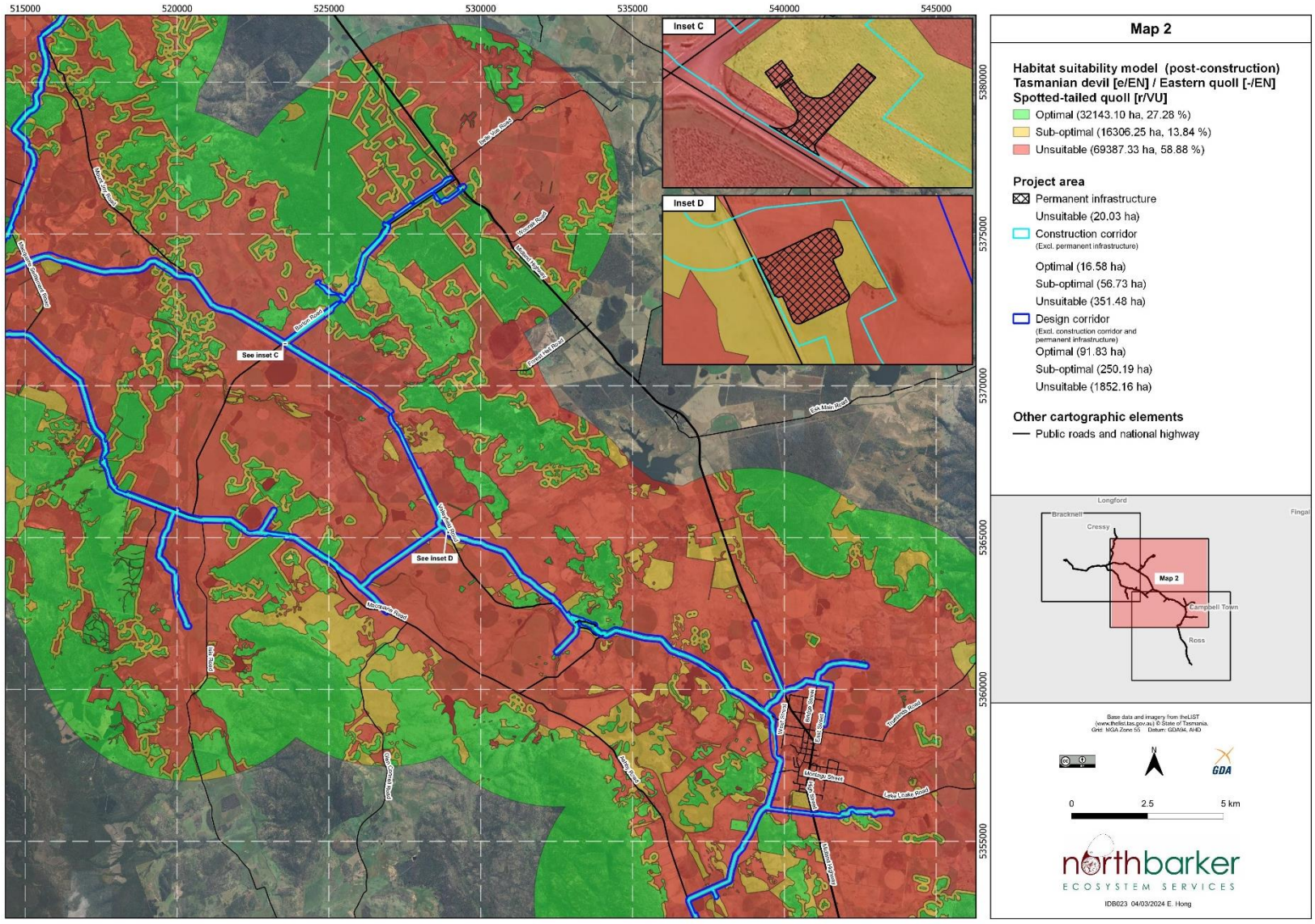


Figure 11b: Devil (and quoll) denning habitat suitability model post-construction (noting all denning classes are considered potentially suitable foraging habitat)

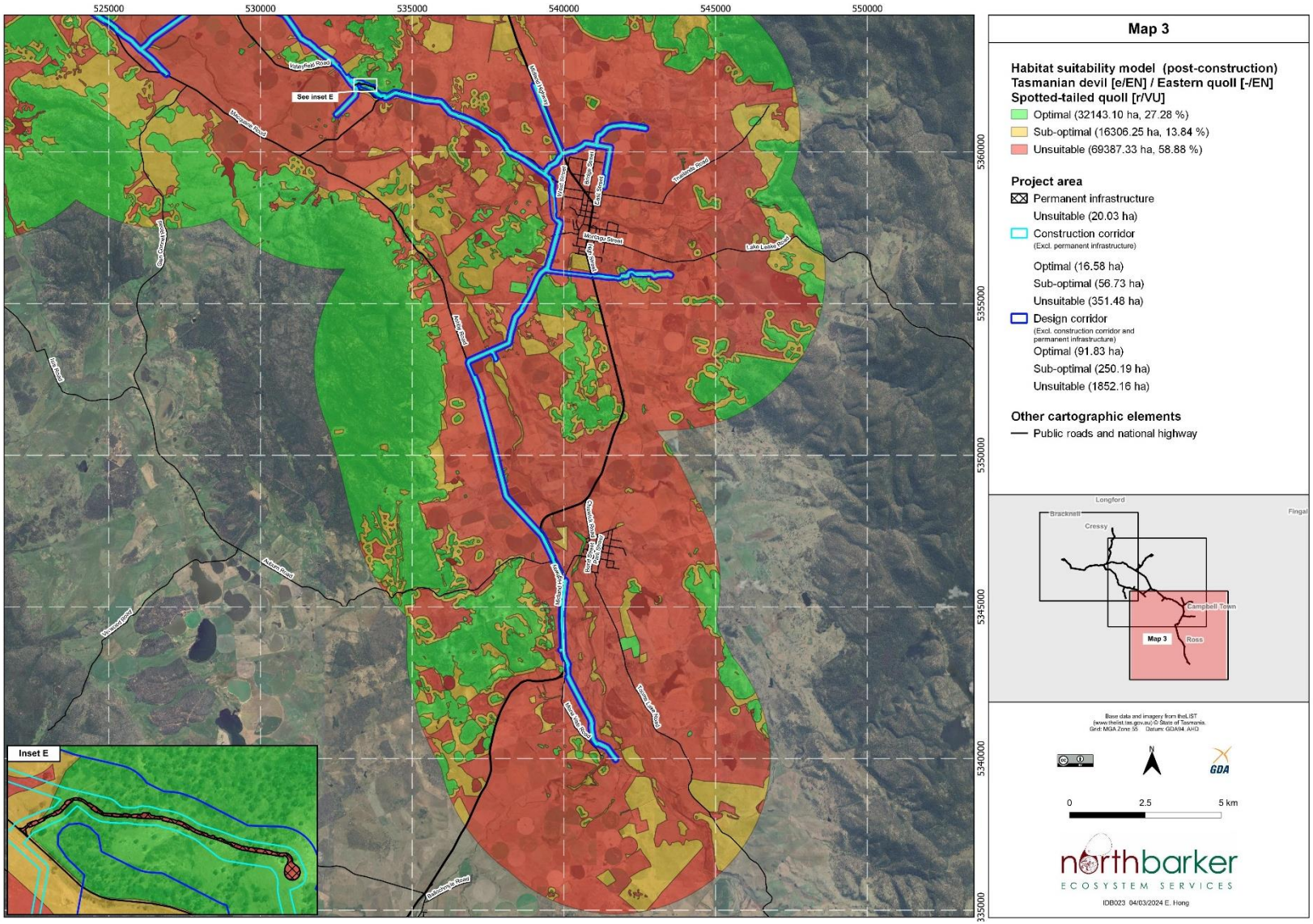


Figure11c: Devil (and quoll) denning habitat suitability model post-construction (noting all denning classes are considered potentially suitable foraging habitat)

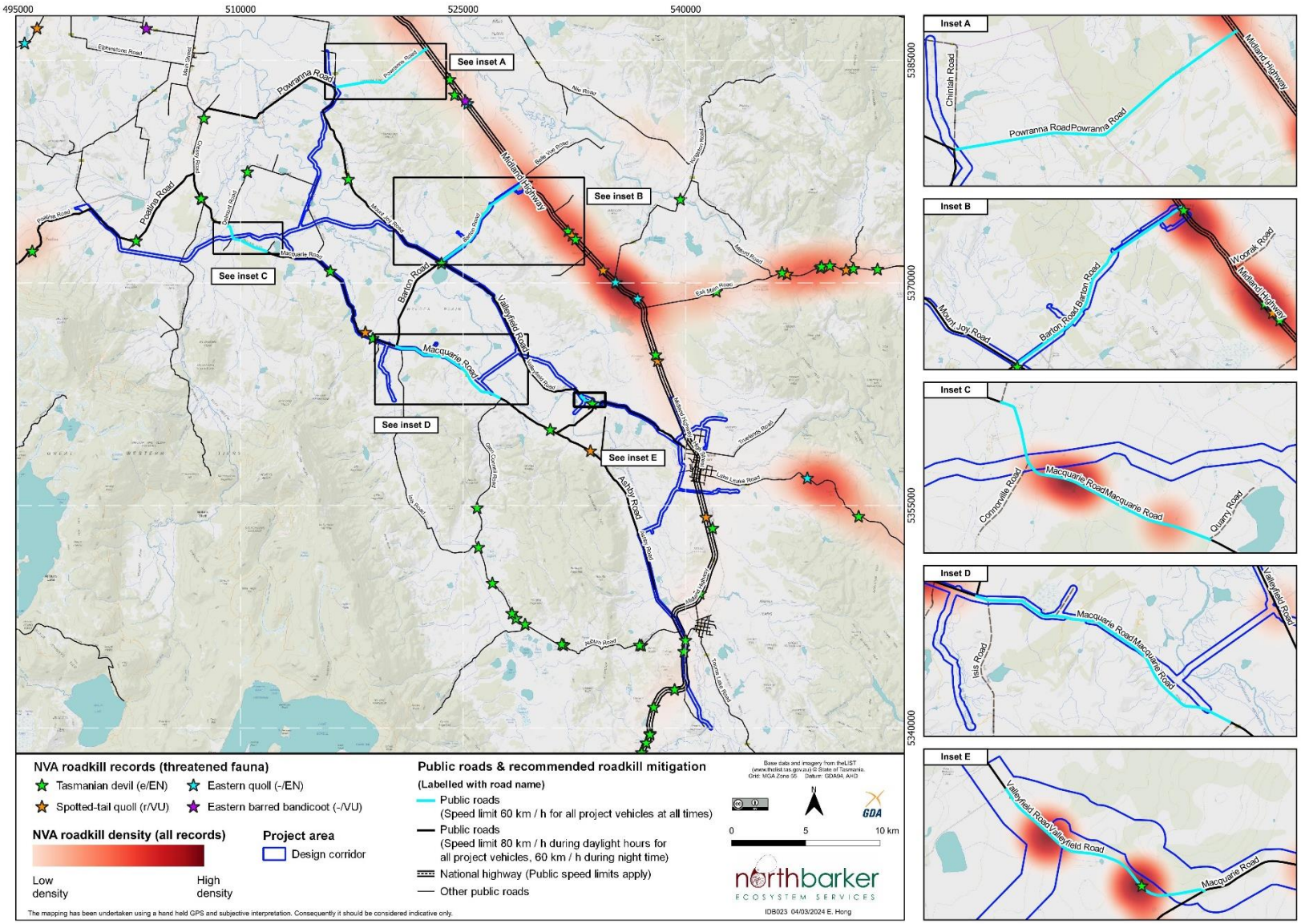


Figure 12: Distribution and density of roadkill records in the project area

3.2.2. EASTERN QUOLL (*DASYURUS VIVERRINUS*)

3.2.2.1. CONTEXT

The eastern quoll (EPBCA endangered) is a medium-sized marsupial carnivore listed under the EPBCA as endangered but not currently listed as threatened in Tasmania. Eastern quolls are widespread in Tasmania but recorded less frequently in the wettest third of the State (Figure 13). They are considered extinct on the mainland of Australia with the last wild sighting being in 1963 (though some reintroductions have since been undertaken).

Home ranges for this species are upwards of 35 to 44 ha (females and males respectively), with an extensive amount of overlap between individuals[101]. Suitable habitat includes dry grasslands and forest mosaics, including adjacent agricultural lands. No recovery plan has been developed for this species. As an endangered species, all populations are seen as important, although some areas might be considered as the primary strongholds for the species (e.g., Cradoc and North Bruny Island)[102].

The species has 8 observation records on the NVA attributed to within 500 m of the project area[103] and 38 within 5 km, the most recent being in 2019[104]. Distribution of quoll records in relation to the project area is shown in Figure 13.

3.2.2.2. SURVEY FINDINGS

Surveys were conducted during baseline natural values surveys across the duration of field assessments, following the general search techniques specified in the State guidelines[105], noting that these guidelines are accepted as an applicable standard for surveying for quolls. No evidence in the form of scats, carcasses, footprints, or other identifiable features were recorded during surveys, and no burrows suitable for denning were recorded within the project area over the duration of field surveys (40 person days, >250 hours targeted search effort within stratified habitat). This survey effort exceeded the minimum survey requirement for indirect searches for diurnal mammals defined in the *Survey guidelines for Australia's threatened mammals*[106]. The guidelines recommend a minimum day-time search effort of two hours for every one-hectare survey site of a stratified sampling program in a subject site up to 5 hectares. The surveys for this project concentrated on areas of native vegetation (totalling 146.31 ha) as these areas provide the highest suitability for denning structures and prey availability[107]. A search survey effort of >250 hours was spent within this habitat (**Attachment 3, Section 2.1**), equating to an average of around 1.7 hours of survey searching within every hectare of native vegetation, which far exceeds the recommendation of 2 hours of searching for 1 in every 5 hectares.

Potential den sites are likely widespread in the broader area and may extend into the vicinity of the of the development footprint. Rocky outcrops occur along the alignment which may be utilised by eastern quolls. Denning sites for this species, especially natal dens, are located in well concealed locations to provide protection from predators. No dens or evidence of eastern quolls (in the form of tracks, scats, carcasses etc.) was recorded during field assessments.

Despite the lack of direct evidence of eastern quolls in the project area, its presence is not discounted simply due to the species occurring throughout eastern Tasmania and varying locationally by frequency of occurrence and population density associated with habitat variables (including land use), and environmental traits. In areas with frequent occurrences and/or high densities of quolls, indicators

[101] Threatened Species Scientific Committee (2015)
[102] Threatened Species Scientific Committee (2015)
[103] Department of Natural Resources and Environment Tasmania (2023)
[104] Tasmanian Natural Values Atlas data – as of 23 November 2023
[105] Environment Strategic Business Unit (2023)
[106] Department of Sustainability, Environment, Water, Population and Communities (2011)
[107] Threatened Species Scientific Committee (2015); Jones & Barmuta (2000); Jones & Rose (1996)

of presence are readily encountered (tracks, scats, etc), which is why these are an accepted survey detection technique[108]; the absence of these indicators during surveys would thus indicate the project area is sparsely/infrequently utilised. Nonetheless, with the species having very broad habitat use and no factors ruling out its presence entirely, it can be expected that quolls traverse through the project area and may use parts of it while foraging or simply moving within their range, which is consistent with observations recorded on the Tasmanian Natural Values Atlas. Denning opportunities (which are important in habitat quality and for consideration of avoiding and mitigating impacts) are limited based on survey findings, with none being detected during ground surveys and the majority of the project area being modelled as unsuitable (83.22 %) or suboptimal (12.85 %) for the potential presence of dens and/or burrows (Table 16). Only 3.93 % of the design corridor has been identified as optimal potential denning habitat based upon habitat modelling (Figure 10, Table 16).

Given the species is relatively non-specific in relation to terrestrial habitat use, the entire design corridor is potential habitat for general foraging/dispersal (noting key aspects such as prey density and local use may vary within the area overall, favouring native vegetation, but this doesn't make other areas inherently unsuitable to the degree where they can be said to have no value)[109]. This is an important distinction as it relates to quality of habitat within the impact corridor following works (and to a lesser extent during).

3.2.2.3. IMPACTS

Habitat loss/change

Surveys and analysis conducted by NBES have established that impact to 416.68 ha of the design corridor footprint represents potential denning habitat (109.51 ha of which is classed as optimal, with the remaining 307.17 ha classed as sub-optimal) for the eastern quoll (Table 17). The remaining 2,222.31 ha of habitat is classed as unsuitable for denning and represents foraging habitat only.

The proposed construction corridor, which is the limit of impacts, contains 74.62 ha of potential denning habitat (consisting of 17.47 ha of optimal habitat and 57.15 ha of sub-optimal habitat). In contrast, a total of 370.19 ha of unsuitable denning habitat (potential foraging only) is present within the construction corridor (Table 17). The majority of impacts therefore and proposed within land determined to be unsuitable for denning and suitable for foraging only, noting foraging habitat is essentially ubiquitous due to the ecology of the eastern quoll.

In addition, 95.50 % of the impact footprint within the construction corridor (424.78 ha), from the long-term perspective of quoll habitat use, will merely be habitat disturbance, with the extent of the pipeline post-works once more becoming viable habitat for foraging, dispersal (and potentially denning but still less likely than foraging/dispersal based on pre-existing landscape attributes such as the extent of cleared land) (*i.e.* it will still meet the definitions within Table 16) – even during construction there will be scope for devils to move through areas in a relatively unfettered fashion and for the works area to still provide habitat value in that sense. Areas that currently support woody vegetation (12.46 ha, or 2.80 % of the construction corridor area) are expected to be the most altered, in that woody vegetation may be the slowest to recover and/or be rehabilitated, and the fact that forest will not return to forest, which is incompatible with the pipeline. However, as per the definitions in Table 8, an area does not need to remain as forest to remain as viable habitat, and these areas will remain adjacent to larger forested patches with all the inherent habitat values such as prey and shelter opportunities. Habitat viability (from a denning perspective) has been remodelled in Figure 11 from the perspective of post-works habitat changes, demonstrating that 99.70 % of the habitat (loss of 1.33 ha of denning habitat) in the construction corridor will be unchanged in terms of denning suitability, with the results displayed in Table 19.

[108] Department of Sustainability, Environment, Water, Population and Communities (2011)
[109] Jones & Barmuta (2000); Jones *et al.* (2023)

Table 16: Eastern quoll denning habitat suitability classes

Suitability class for quoll maternal natal den	Rationale
Optimal (Denning and Foraging) [Plate 1 & Plate 2]	This category contains areas deemed optimal for denning opportunities based on field observations and site attributes. Characteristics include: • All areas of dry forest TASVEG units (ideal soil and sheltering conditions)[110]. • Grasslands within 100 m of native forest units and/or with a dense layer of shrubs, rocks, and logs (ideal soil and sheltering conditions)[111]. • Silvicultural forest (FPH/FPS) areas (ideal soil and sheltering conditions, including the presence of windrows)[112]. • Regenerating cleared land (FRG) within a native mosaic and with optimal soil and sheltering characteristics (including the presence of log piles)[113].
Sub-optimal (Denning and Foraging) [Plate 3]	This category includes remaining areas of intermediate habitat, including (but not limited to) those with the following traits: • Seasonally inundated lagoons and other wetland habitats not classified as unsuitable (*i.e.* those that dry out in summer)[114]. • Exposed grassland (lacking shrub cover) distant (>100 m) from native forest[115]. • FAC vegetation (good shelter at canopy level, but less suitable at ground level)[116].
Unsuitable (Foraging Only) [Plate 4]	This class captures all areas that are deemed unsuitable for denning opportunities, based on field observations and site attributes. Characteristics include: • Permanently inundated areas denoted by OAQ and ASF on vegetation mapping[117]. • Areas of FAG or FUM > 100 m from native vegetation. These areas are likely too far separated from high prey densities for energetically efficient maternal denning. In addition to this, exposed sites make young quolls vulnerable to predation and are thus not selected by adults[118]. **Note -** FAG and FUM within 100 m of native forest considered suitable but sub-optimal; and noting that micro-siting during a den management protocol should overrule the classification of unsuitable if micro-habitats suitable for denning are present within the FAG and/or FUM > 100 m from native forest, including the presence of rock and log piles, or thickets of suitable vegetation within the broader cleared area – these areas should be elevated to consideration as suitable in such scenarios.

[110] Jones & Barmuta (2000); Jones *et al.* (2023); Godsell (1983)
[111] Fancourt (2016)
[112] Jones *et al.* (2023); Lyall (2017)
[113] Fancourt (2016)
[114] Environment Strategic Business Unit (2023)
[115] Jones & Barmuta (2000); Lyall (2017); Andersen *et al.* (2017)
[116] Lyall (2017)
[117] Environment Strategic Business Unit (2023)
[118] Jones *et al.* (2023); Andersen *et al.* (2017)

Areas of impact within forest units will remain treeless post works but will be rehabilitated with grassy and shrubby vegetation present in the local area under rehabilitation commitments. For the habitats that already lack woody vegetation, the installation of the pipeline will result in no habitat change post works and/or have a very rapid return to equivalent habitat value (e.g. less than 6 months) facilitated by revegetation commitments. During this period of rehabilitation, the recovering ground will still meet the viable habitat definitions within Table 14, as the temporary absence of vegetation will not preclude devils from using the area at a local or landscape scale, even if it is just for dispersal or opportunistic foraging on bare ground. The process of construction, consisting of excavation and re-filling, will be completed on a local scale within a one to three day period in most cases (with discrete sections open for up to a maximum of two weeks), meaning construction related disturbance timeframes are very low. Measures will be put in place such that if a quoll were to find its way into an open trench, there are a sufficient number of ramps placed within the trench to allow animals to readily vacate the trench. Trenches will typically be open for a length of 1-200 m, with a maximum trench length of 500 m.

The limited nature of the permanent works is such that permanent habitat loss is extremely minor in the context of the broader area (a total of 20.03 ha of total vegetation loss). Only areas proposed to contain balance tanks, pump stations, and a dam will constitute permanent habitat loss in that viable habitat will be converted to inviable habitat – these areas comprise 0.66 ha of optimal denning habitat, 0.67 ha of sub-optimal denning habitat, and 18.70 ha of unsuitable denning habitat – all of which constitute potential foraging habitat - as per the definitions in Table 16 and with the habitat loss outlined in Table 18).

The potential impact from the project applies to a greater extent to local individuals. At the scale of an individual, the proposal's area of impact is approximately 13 times an individual (female) quolls home range[119], with the permanent loss of habitat representing the loss of 50 % of a single (female) quolls range. Given the measured density of quolls in the broader area is extremely low[120], this scale of loss is extremely unlikely to lead to a significant decrease in population size nor result in any population fragmentation (noting quolls are effectively impervious to fragmentation for all but the largest geographic barriers (e.g. large expanses of deep permanent water such as Bass Strait).

[119] Threatened Species Scientific Committee (2015); Godsell (1983)
[120] Tasmanian Natural Values Atlas data – as of 23 November 2023

Table 17: Impacts to quoll and devil denning (and foraging) habitat prior to construction in context of the availability within 5 km (all areas in hectares)

	Potential Impact Area			Avoidance Area	
Denning Habitat Class (Note all classes are potential foraging habitat)	**Total Permanent Impacts** {% of class within construction corridor} [% of class within design corridor] (% of class within 5 km)	**Temporary Impacts** {% of class within construction corridor} [% of class within design corridor] (% of class within 5 km)	**Total Within Construction Corridor** [% of class within design corridor] (% of class within 5 km)	**Total Within Design Corridor (Excluding Construction Corridor)**	**Total Within 5 km**
Optimal	0.66 {3.78 %} [0.60 %] (0.002 %)	16.81 {96.22 %} [15.35 %] (0.05 %)	17.47 [15.95 %] (0.05 %)	109.51 (92.04)	32,144.20
Sub-optimal	0.67 {1.18 %} [0.22 %] (0.004 %)	56.48 {98.82 %} [18.39 %] (0.35 %)	57.15 [18.61 %] (0.35 %)	307.17 (250.02)	16,306.84
Unsuitable	18.70 {5.05 %} [0.84 %] (0.03 %)	351.49 {94.95 %} [15.82 %] (0.51 %)	370.19 [16.66 %] (0.53 %)	2,222.31 (1,852.13)	69,385.64
Total	**20.03**	**424.78**	**444.81**	**2,194.19**	**117,836.68**

Table 18: Summary of impacts to quoll and devil denning habitat suitability classes (all areas in hectares)

	Infrastructure Description			Impact Summary		
Habitat Class (Note all classes are potential foraging habitat)	**Pump Stations [% of Permanent Impacts] (% of Total Impacts)**	**Balance Tanks [% of Permanent Impacts] (% of Total Impacts)**	**Dam [% of Permanent Impacts] (% of Total Impacts)**	**Total Permanent Impacts (% of Total Impacts)**	**Temporary Impacts (% of Total Impacts)**	**Total**
Optimal	-	0.66 [100 %] (3.78 %)	-	0.66 (3.78 %)	16.81 (96.22 %)	**17.47 (3.93 %)**
Sub-optimal	0.21 [30.72 %] (0.36 %)	0.47 [69.28 %] (0.81 %)	-	0.67 (1.17 %)	56.48 (98.83 %)	**57.15 (12.85 %)**
Unsuitable	1.08 [5.77 %] (0.29 %)	0.31 [1.68 %] (0.08 %)	17.30 [92.55 %] (4.92 %)	18.70 (5.05 %)	351.49 (94.95 %)	**370.19 (83.22 %)**
Total	**1.28**	**1.44**	**17.30**	**20.03**	**424.78**	**444.81**

Table 19: Quoll and devil denning habitat modelling results comparing pre and post construction changes (all areas in hectares)

Denning Habitat Class (Note all classes are potential foraging habitat)	Total Within Construction Corridor (Pre-Construction)	Total Within Construction Corridor (Post-Construction)	Net Change in Area	Conversion Type
Optimal	17.47	16.58	-0.89	0.66 ha lost to permanent infrastructure (unsuitable) 0.23 ha converted to sub-optimal
Sub-optimal	57.15	56.73	-0.42	0.67 ha lost to permanent infrastructure (unsuitable) 0.23 ha gained from optimal 0.02 ha gained from vegetation changes
Unsuitable	370.19	371.51	1.34	0.66 ha gained from permanent infrastructure (optimal) 0.67 ha gained from permanent infrastructure (sub-optimal) 0.02 ha lost from vegetation changes
Total	**444.81**	**444.81**	**-**	

Roadkill

Analysis of the available traffic data[121] indicates that the major roads are expected to have an increase of night-time traffic (largely around dawn and dusk) on all major project roads (Figure 12), as indicated in **Attachment 11.** Given this expected increase in traffic, it can be expected that there will be an increased probability of roadkill incidence (proportional to traffic increases) without mitigation.

Proportional roadkill data[122] (Figure 12) suggests that the Midland Highway is three times as likely to have a collision impact with a dasyurid than on Macquarie Road (Table 20), which is one of the major C roads within the project area. No carcass records of the eastern quoll have been recorded from the smaller project roads since 19/06/2018. It is acknowledged that this roadkill data may not be an entirely accurate reflection of the collision rates more broadly. It is also understood that the Tasmanian Department of State Growth periodically conduct roadkill removal on State managed roads, which may skew the data toward roads that are surveyed at a higher frequency. Nonetheless,

[121] Provided by Pitt & Sherry for project roads – data collected in April and December 2022
[122] Data downloaded from the Tasmanian Roadkill Reporter app – available through the Tasmanian Natural Values Atlas

the proportion of traffic on the Midland Highway relative to the smaller project roads (Table 20), provides some insight into the scale of roadkill impacts to Tasmanian devils and quolls and can be taken as a proxy for baseline rates of mortalities.

Macquarie Road is expected to have increases in light vehicle traffic >40 % during night time hours, with heavy vehicle traffic expected to be limited to day time hours. Similar increases in light vehicle use across other projects roads is expected. With this in mind, mitigation measures are proposed in line with studies of roadkill in dasyurids across Tasmania[123].

Table 20: Summary of dasyurid roadkill on project roads since 19/06/2018[124], the Midland Highway, provided for additional context[125]

Road	Tasmanian devil	Spotted-tail quoll	Eastern quoll	Total
Midland Highway*	10	5	3	**18**
Macquarie Road	5	1	-	**6**
Cressy Road	1	-	-	**1**
Poatina Road^	1	-	-	**1**
Valleyfield Road	2	-	-	**2**
Barton Road	-	-	-	**0**
Ashby Road	0	1	-	**1**
Total	**19**	**7**	**3**	**29**

*** Recorded between Mona Vale Road and Powranna Road, within the project area**
^ Recorded between Poatina township and Macquarie Road, within the project area

3.2.2.4. MITIGATION MEASURES

The permanent loss of 20.03 ha of potential denning habitat is unlikely to result in a decrease to any local population, particularly in the context of the abundance of equivalent or better habitat in the broader landscape.

Despite the large area of unsuitable denning habitat across the NMIS project area (Figure 10) and the absence of any known potential burrows to support a den in the proposed footprint, a pre-clearance check and unanticipated den discovery protocol will be implemented throughout the construction phase of the project. This protocol is outlined in **Attachment 12**. The other key aspect of mitigation will be in relation to roadkill mitigation, as outlined below. An assessment of the project against the significant impact criteria for eastern quolls is provided in Table 22.

[123] Hobday and Minstrell (2008); Jones (2000)
[124] Data downloaded from the Tasmanian Roadkill Reporter app – available through the Tasmanian Natural Values Atlas
[125] Data downloaded from the Tasmanian Roadkill Reporter app – available through the Tasmanian Natural Values Atlas

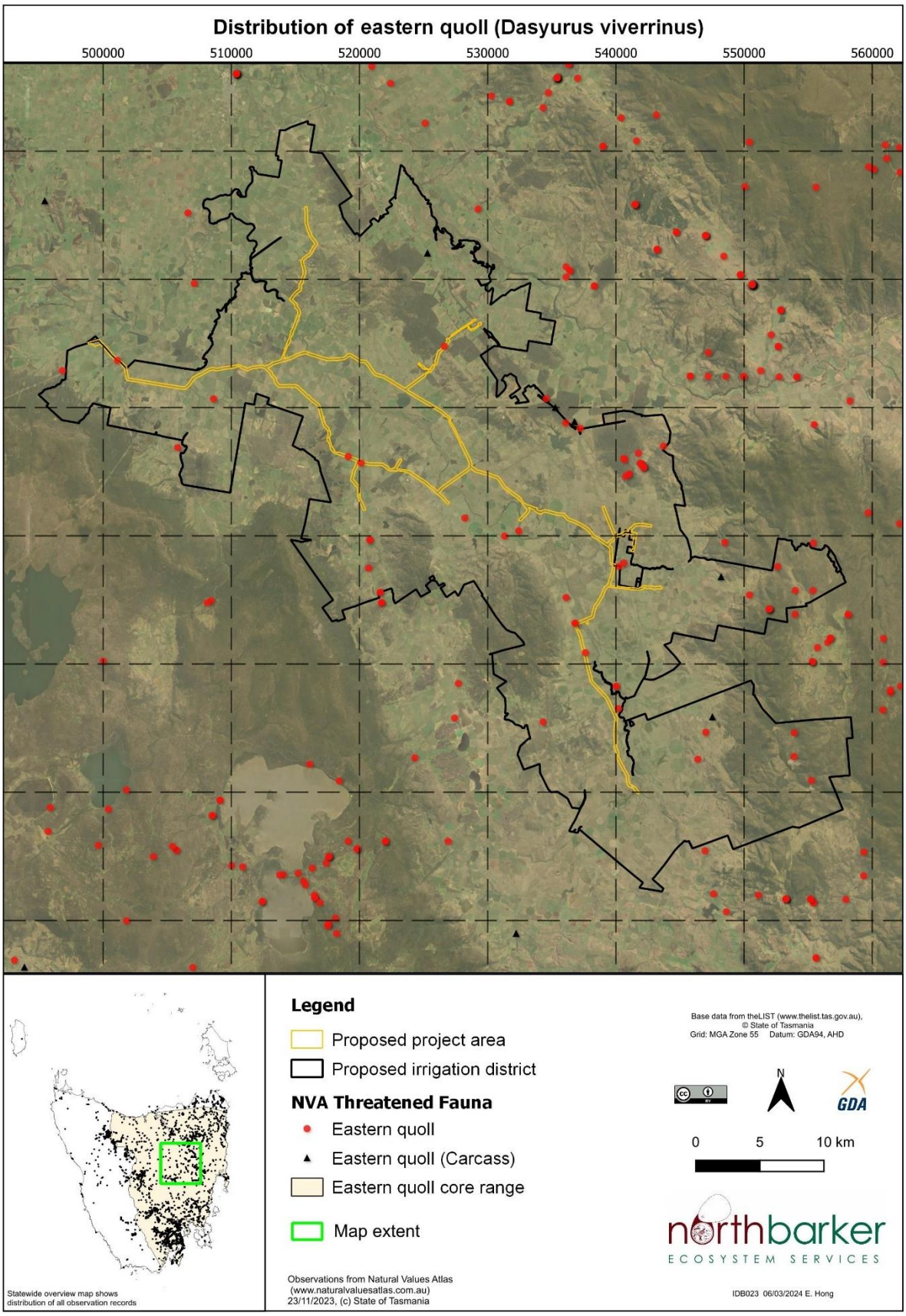


Figure 13: Distribution of the eastern quoll sightings and carcass records

Roadkill

There are no published quoll-specific roadkill impact mitigation guidelines available, however the '*Survey guidelines and management advice for development proposals that may impact on the Tasmanian Devil 2015*'[126] (the *Survey Guidelines*) outlines a process for assessing the potential impacts of developments requiring road usage on Tasmanian devils. This process focuses on identifying and mitigating impacts on devils, but the mitigation measures are also suitable for reducing road mortalities for other native fauna, including quolls. The process involves completing a traffic impact assessment, then, if eastern quoll roadkill mortalities are expected to increase by more than 10 % (based on equivalent predicted rise in night-time traffic for existing roads, and general increase in traffic on new roads), a roadkill assessment and roadkill mitigation plan must be completed. Mitigation measures for the current project therefore will focus on existing roads expected to surpass the 10 % night-time threshold based on being identified as having an estimated > 10 % traffic increase during the construction of the proposed development (particularly based on predictions much higher than 10 % increase during peak hours, which are the most likely to overlap with the definition of night-time in the *Survey Guidelines*).

Traffic data (baseline and predicted) is available for the major roads proposed to be used during the duration of the project – this data is displayed in **Attachment 11**. The roads proposed to be utilised during construction are as follows:

- Cressy Road (Dam construction and pipeline installation)
- Poatina Road (Dam construction and pipeline installation)
- Powranna Road (Dam construction and pipeline installation)
- Mount Joy Road (Pipeline construction)
- Barton Road (Pipeline construction)
- Valleyfield Road (Pipeline construction)
- Macquarie Road between Valleyfield Road and Midland Highway (Pipeline construction)
- Macquarie Road between Valleyfield Road and Poatina Road (Pipeline construction)
- Ashby Road (Pipeline construction)

Given the relatively low existing traffic volumes on all of these roads, it is expected that in most cases, roads will see increases in traffic volumes around the dawn and dusk periods greater than 10 % and thus warrant mitigation. Baseline roadkill data is available in the form of data present on the Tasmanian Natural Values Atlas (Figure 12) and LISTmap[127] - it is probable that this data does not accurately quantify the level of vehicle strike on these roads due to incomplete reporting, but it may nonetheless reflect the pattern of roadkill distribution. The data has thus been utilised to identify high-risk roads in the project area without necessarily drawing conclusions or providing a basis to measure specific increases in roadkill frequency. Nonetheless, due to the predicted increase in traffic alone, the following mitigation measures will be implemented across the project (referred to as the roadkill mitigation protocol/strategy). With these mitigation measures in place (summarised in Table 21), we anticipate project-specific roadkill mortalities can be minimised, with regular monitoring and periodic data review in place to trigger contingency measures if needed.

Traffic times

- As per the *Survey Guidelines,* the definition of night-time to apply to all subsequent mitigation measures includes an hour before dusk and an hour after dawn[128] – noting it will be a requirement of the contractor to define the variation in this period in relation to the

[126] Environment Strategic Business Unit (2023)
[127] Lands Tasmania – available at https://maps.thelist.tas.gov.au/listmap/app/list/map
[128] Environment Strategic Business Unit (2023)

various requirements on a week-by-week basis as part of their construction environment management practices.

- Heavy rigid vehicles or larger will be limited to daylight hours as much as is practicable – special circumstances may require transport outside of daylight hours only in accordance with the conditions defined in the following subclauses:
    - Special purpose heavy vehicles moving large plant and equipment may operate outside the above times when it is a road traffic requirement to minimise impact on other traffic, and/or comply with any other road authority permits – in such cases these vehicles will have a lead escort vehicle and be limited to a maximum speed of 60 km/h whilst on project roads.
    - In the event that general cartage heavy vehicles are prevented from operating during daylight hours, such as due to weather events, these vehicles will be limited to a maximum speed of 60 km/h during night-times on all project roads – in such cases, these vehicles will travel in a convoy of a minimum of 2 vehicles, with convoys to be separated by at least 15 minutes – by travelling in a convoy, the frequency of individual heavy vehicles will be reduced, thus reducing roadkill opportunities.

Speed limits

- Road speed limits for project vehicles (to be mandated by the responsible Contractor and their requirement to enforce) will be set at a maximum of 80 km/h across the specified project roads (Figure 12) during daylight hours and at 60 km/h during night time[129].
- In addition, areas identified as adjacent to optimal potential denning habitat (based on devil and quoll habitat modelling in Figure 10) and thus seen as the most likely areas to support fauna in general, will be further limited to 60 km/h at all times for project vehicles. These identified areas are as follows (Figure 12):
    - Barton Road (Midland Highway to Mt Joy Road)
    - Powranna Road (Midland Highway to Mt Joy Road)
    - Macquarie Road (Glen Connell Road to Barton Road)
    - Macquarie Road (Quarry Road to Delmont Road)
    - Valleyfield Road (Macquarie Road to 200 m beyond balance tank access)
- These limits will be advertised using semi-permanent project specific signage and enforced under contract requirements.

Additional measures

- Project vehicles will be fitted with a basic, high-frequency animal repellent device (which emits an ultra-sonic sound wave at speeds above 50 km/h). The installation and operation of these devices will be audited periodically as part of the Contractors construction environmental management requirements (to be linked to contract commitments).

Monitoring

- During the construction phase, all internal roads within the current works or commute routes shall be monitored daily for roadkill (with documentation recording inspection was completed along with noting when, where and species of any roadkill), with mortalities removed from the road surface immediately upon location (to limit likelihood of predators being attracted to the carcass). The same shall apply to selected arterial roads that will be subject to increased use as project staff commute to the site from places of accommodation. Roadkill will be noted as a project vehicle collision or if it is found incidentally (and not already reported) assumed to be the result of collision from a non-project vehicle.

[129] Precluding situations where the speed limits may be less than these amounts under existing conditions and/or under temporary conditions applied for other road traffic management.

- The project roadkill data will be periodically independently reviewed (minimum every 6 months through construction), with scope to assess collision rates and determine if site access measures will require reassessment and further mitigation implemented where applicable.

As further conditions of TI's Environmental Protection Requirements (contractual obligations for contractors):

- Wildlife hit by project vehicles must be recorded, including details of when, where, and species if identifiable. These records will be reported to TI along with the monthly report. Mortalities must also be reported to NRE through the Roadkill Reporter app[130]. Roadkill attributed to non-project vehicles will be tallied separately. Data collected throughout the construction phase of the project be submitted to the Department of Climate Change, Energy, the Environment and Water upon the completion of works.
  No animals are to be deliberately killed with vehicles.
- If any injured wildlife is found, WIRES Wildlife Rescue (1300 094 737) will be contacted immediately, and arrangements made for transferring injured wildlife to specialist carers at an animal hospital, vet, or refuge. If rehabilitation is not possible, animals are to be dealt with humanely in accordance with the *Best Practice Guidelines for Wildlife Rehabilitation Version 2 (2021)* set out by the Department of Natural Resources and Environment Tasmania.

[130] Available at https://nre.tas.gov.au/wildlife-management/living-with-wildlife/tasmanian-wildlife-roadkill/tasmanian-roadkill-reporter-app

3.2.2.5. SUMMARY OF MITIGATION AND AVOIDANCE MEASURES

Table 21: Summary of mitigation and avoidance measures for the eastern quoll

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
Pre-clearance check and unanticipated den discovery protocol	Prior to the commencement of the action, the civil contractor must implement the pre-clearance check and unanticipated den discovery protocol as detailed in **Attachment 12**. This protocol will require approvals under the Tasmanian *Nature Conservation Act 2002* should dens be required to be decommissioned. The application of this protocol must: d) Be conducted within two weeks of the commencement of any vegetation clearance and must be applied to a 50 m buffer of the works area. e) If dens are located, they must be subject to a den monitoring assessment as detailed in Section B of the protocol. Comply with the reporting and regulation components of Section C of the protocol.	Tasmanian Irrigation Civil Contractor	Two weeks prior to any vegetation clearance, including a 50 m buffer.	**Very high** The application of this protocol is consistent with the management advice given in the *Survey Guidelines and Management Advice for Development Proposals that may impact on the Tasmanian Devil* [131], however the mitigation measures are also suitable for reducing road mortalities for other native fauna, including quolls. These guidelines were developed in 2015 with the input from several experts in the management and ecology of Tasmanian dasyurids. While the effectiveness of the pre-clearance checks are difficult to define, the process is designed in such a manner that the potential for direct impacts to individuals is removed through a thorough search and monitoring program.
Roadkill mitigation	During the construction phase of the action, the civil contractor must comply with roadkill mitigation measures as detailed in **Section 3.2.1.4**. Roadkill mitigation measures include: a) Reduction of speed across all project roads for project vehicles. b) Centralising transport of key infrastructure to	Tasmanian Irrigation Civil Contractor	All project roads. Ongoing throughout construction phase of the project.	**Very high** The application of this protocol is consistent with the management advice given in the *Survey Guidelines and Management Advice for Development Proposals that may impact on the Tasmanian Devil* [132], however the mitigation measures are also suitable for reducing road

[131] Environment Strategic Business Unit (2023)
[132] Environment Strategic Business Unit (2023)

	core roads. c) Restricting use of roads outside of daylight hours as much as is practicable. d) Project vehicles will be fitted with a basic, high-frequency animal repellent device. e) Specific mitigation for special purpose vehicles, including travel convoys, escort vehicles, and further speed reduction.			mortalities for other native fauna, including quolls. These guidelines were developed in 2015 with the input from several experts in the management and ecology of Tasmanian dasyurids. The strategies proposed in this roadkill mitigation plan are somewhat tested, with reduction of driver speed likely to be an effective in reducing overall collision numbers[133], and limiting vehicles from night-time use is also likely to reduce collision risk as the majority of species likely to be at risk from collision are crepuscular or nocturnal[134] The effectiveness of high-frequency animal repellent devices is challenging to assess, with trials of virtual fencing yielding mixed results[135].
Roadkill monitoring	Collision data must be reviewed at a minimum of every 6 months. Data must be submitted to the Department of Natural Resources and Environment Tasmania and the Department of Climate Change, Energy, the Environment and Water.	Tasmanian Irrigation Civil Contractor	All project roads. Ongoing throughout construction phase of the project.	**Very high** The monitoring and review component of the roadkill mitigation plan has a very high likelihood of effectiveness as the roadkill plan allows for adaptive management on project roads in the event that project vehicles lead to an increase in roadkill beyond the baseline levels.

[133] Hobday & Minstrell (2008); Hobday (2010)
[134] Lester (2015); Hobday & Minstrell (2008)
[135] Fox *et al.* (2019); Magnus *et al.* (2004)

3.2.2.6. SIGNIFICANT IMPACT ASSESSMENT

Table 22: Significant impact criteria with regards to the eastern quoll

Significant Impact Criteria	Likelihood of Significant Impact	Comments
1. Lead to a long-term decrease in the size of a population.	None	As this species is not considered extinct on the mainland of Australia, all populations are considered 'important' in Tasmania, consistent with its status as endangered. No sub-populations have been defined within Tasmania and given the apparent distribution we take the entire range within the State as one population, thus covering over 50,000 km^2 (Figure 13). The permanent loss of 20.03 ha of potential habitat is thus unlikely to result in a decrease to any local population purely in the tiny amount of habitat compared to the population level, particularly in the context of the abundance of equivalent or better habitat in the broader landscape even at the local level, and the fact that most of the impacts from the project will be temporary habitat alteration only. Despite the large area of unsuitable denning habitat across the NMIS project area, a pre-clearance check and unanticipated den discovery protocol will be implemented throughout the construction phase of the project to protect against the unlikely scenario an active den could be impacted at the time of construction. Thus, the action will not lead to a long-term decrease in the size of a population.
2. Reduce the area of occupancy of the species.	None	The largely temporary nature of the proposed action and the very small permanent impact footprint will not meaningfully reduce the area of occupancy of this species given its range of occurrence of several tens of thousands of square kilometres. Thus, the proposal will not reduce the area of occupancy of the species.
3. Fragment an existing population into two or more populations.	None	We are not aware of land clearance and modification of this scale or nature resulting in fragmentation of habitat for this species as it occurs typically within a mosaic of cleared land and open habitats. In addition, at the population level, the proposed impacts occupy a miniscule strip of land compared to the vast range covering much of Tasmania (Figure 11). The largely temporary nature of the proposed action and the very small permanent footprint changes in any one area thus will not fragment the existing population into two or more populations and is unlikely even to have a noticeable impact on individual movements at a local scale.
4. Adversely affect habitat critical to the survival of a species.	None	The proposed action has a permanent infrastructure footprint of 20.03 ha. All other impacts are temporary only and will not reduce the extent of available foraging and denning habitat beyond the permanent impact areas. All impacts are subject to a pre-clearance check and unanticipated den discovery protocol to protect breeding events in any potential

Significant Impact Criteria	Likelihood of Significant Impact	Comments
		dens, which is seen as the most effective way to protect critical seasonal habitat elements. With this measure in place, the action will not adversely affect habitat critical to the survival of this species.
5. Disrupt the breeding cycle of a population.	None	All impacts are subject to a pre-clearance check and unanticipated den discovery protocol. Should a den be located during this check, measures are put in place to ensure that there is no impact to breeding quolls. With this measure in place, the action will not disrupt the breeding cycle of a population (or individuals),
6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	None	The proposed action has a permanent infrastructure footprint of 20.03 ha. All other impacts are temporary only and will not reduce the extent of available foraging and denning habitat beyond the permanent impact areas. All impacts are subject to a pre-clearance check and unanticipated den discovery protocol. With this measure in place, the action will not modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.
7. Result in invasive species that are harmful to the species becoming established in the species' habitat.	None	There is no likelihood that the action will result in and invasive species that are harmful to the species (such as foxes) becoming established in the species' habitat as the landscape suitability for invasion of such species will not change as a result of works and there is no conceivable reason the projects works will result in a direct introduction of such a species as the project will operate under weed and hygiene management practices. In addition, the surrounding landscape (see **Section 2**) already continues numerous introduced plants and animals that co-occur with the quoll throughout its range with no apparent detrimental impacts.
8. Introduce disease that may cause the species to decline.	None	Disease is seen as a potentially severe threat to the species (particularly on Bruny Island) based on a historical episode of rapid mortality in which the causative pathogen is unknown[136]. Disease is considered less of a threat to the mainland Tasmanian population however on account of the size of the range of the population, population density (relatively low) and genetic diversity. The action will not conceivably introduce any diseases that may cause the species to decline and is thus not considered to be a risk for this project. Numerous similar projects have been undertaken in suitable habitat for the eastern quoll with no known incidences of a disease resulting from the projects.

[136] Threatened Species Scientific Committee (2015)

Significant Impact Criteria	Likelihood of Significant Impact	Comments
9. Interfere with the recovery of the species.	None	Recovery Plan not considered to be required, as the approved conservation advice for the species provides sufficient direction to implement priority actions and mitigate against key threats[137]. Key recovery actions in the conservation advice are listed as: feral predator control, captive breeding, quarantining island population, translocations/insurance populations/reintroductions, and community engagement. The proposed action will not conceivably interfere with any of these actions nor exacerbate associated threats intended to be addressed by the actions. Thus, the action will not interfere with the recovery of the species.
Summary		
The proposed action will not have a significant impact on the eastern quoll.		

[137] Department of Climate Change, Energy, the Environment and Water (2023h)

3.2.3. SPOTTED-TAIL QUOLL (*DASYURUS MACULATUS MACULATUS*)

3.2.3.1. CONTEXT

The spotted-tail quoll (EPBCA Vulnerable) is a forest dependent species that occupies a large range of habitats. It forages and hunts on farmland and pasture, travelling up to 20 km at night, and shelters in logs, rocks, or thick vegetation. Spotted-tail quolls are solitary with home ranges that vary typically between 100 ha and 5,000 ha with females tending to have smaller ranges and male ranges overlapping several female ranges[138]. Continuous habitat patches (denning and hunting) totalling more than 15,000 ha may be required to sustain a minimum viable population of 50 spotted–tailed quolls based on an exclusive home range of 300 ha for a female[139].

The National Recovery Plan[140] identifies "important populations" for the spotted-tail quoll in Tasmania. These are identified in Table 23. Key sites for the spotted-tail quoll in Tasmania according to the Tasmanian Threatened Fauna Handbook[141] include:

- northern forested areas bounded by Wynyard, Gladstone, and the central and north-eastern highlands;
- the north-western wet forests; including the catchments of the Arthur and Montagu Rivers;
- the dry eucalypt forests in the central north coastal regions bounded by the Tamar, Devonport, and Western Tiers;
- patches between the King River and Strahan, the Gordon River and Huon River Catchments as well as the coastal strip from Strahan to Temma.

Figure 14 presents a composite map of the likely areas occupied by the above definitions of key sites and important populations, used here to indicate the core range of this species, in relation to the location of the project area. Figure 15 displays the distribution of spotted-tail quoll records listed on the Tasmanian Natural Values Atlas[142] in relation to the project area.

Table 23: Important populations of Spotted-tail quolls identified in the Draft National Recovery Plan

Population	Basis for 'importance' classification
Freycinet National Park	Research Population
Central-north Tasmania (including Great Western Tiers to Narawntapu)	Stronghold and Research Population
Cradle Mountain National Park	Stronghold and Research Population
Far north-western Tasmania (including the Smithton and Marrawah regions)	Stronghold and Research Population
Eastern Tiers/northern Midlands (including Nugent and Ross regions)	Stronghold Population
Southern forests/South Coast (including the Hastings region)	Stronghold Population
Gordon River system	Stronghold Population
South-west Cape	Stronghold Population

[138] Long & Nelson (2010)
[139] Public Land Use Commission (1996)
[140] Department of Environment, Land, Water, and Planning (2016)
[141] Bryant & Jackson (1999)
[142] Tasmanian Natural Values Atlas data – as of 23 November 2023

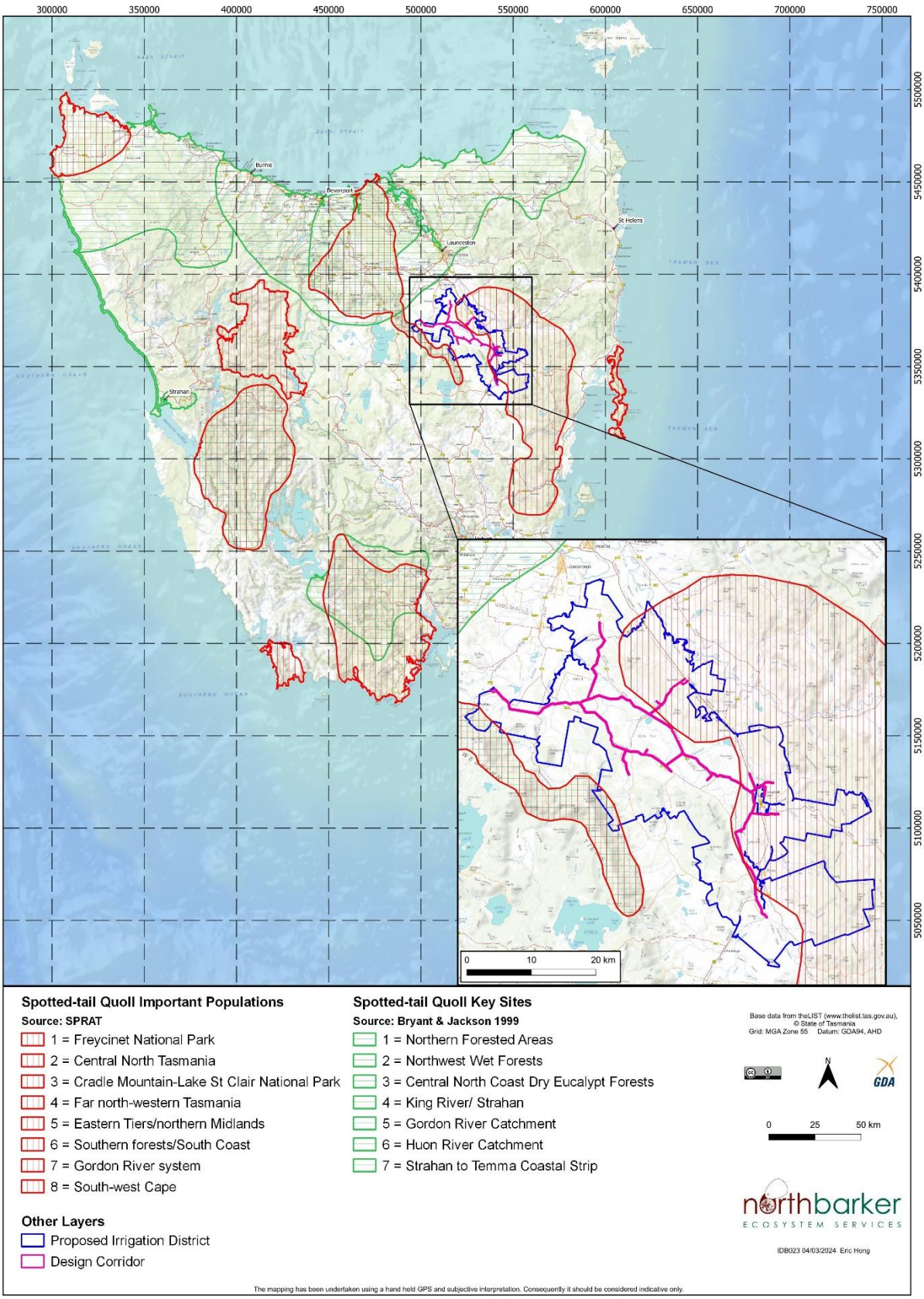


Figure 14: Spotted-tail quoll key sites and important populations

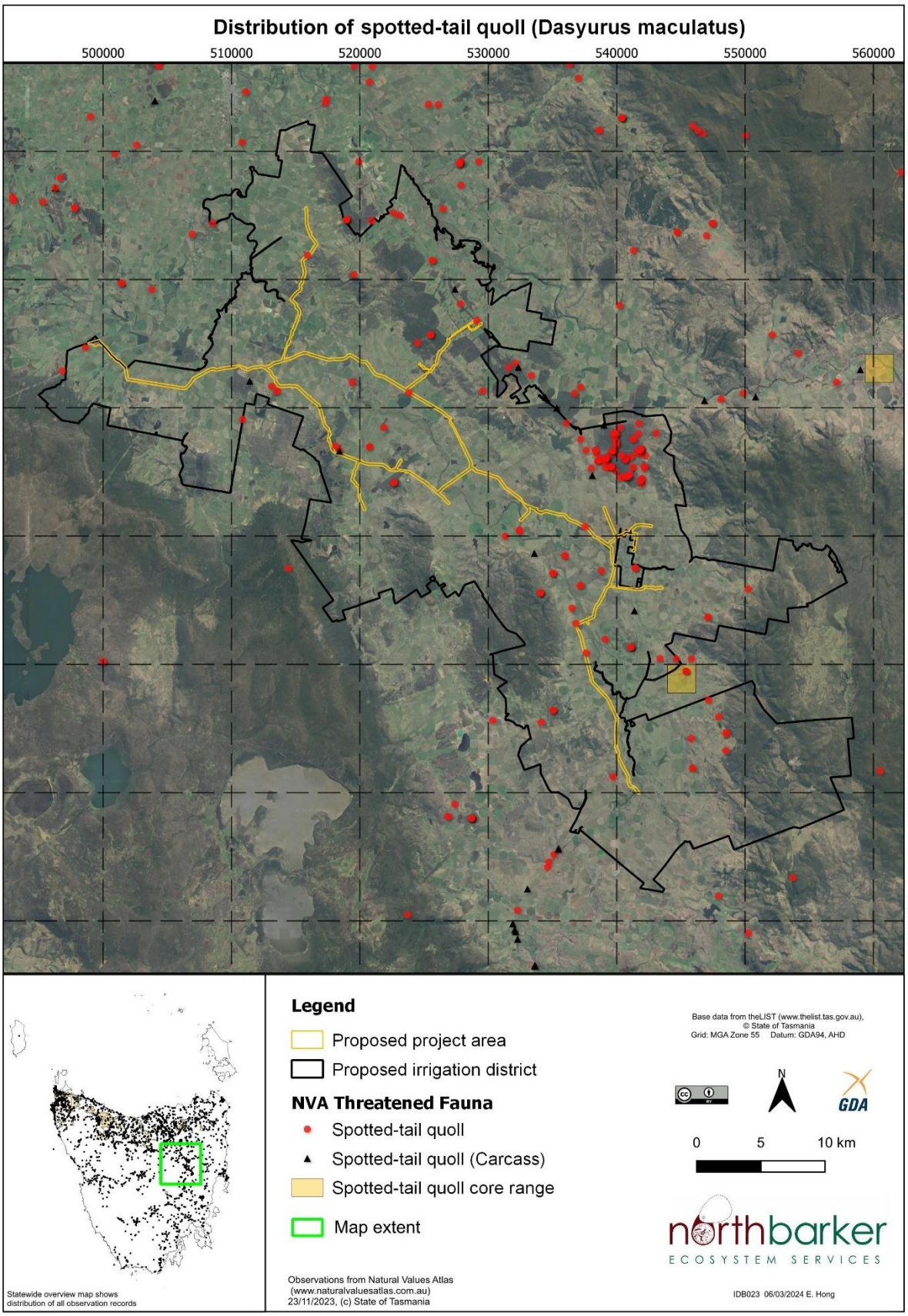


Figure 15: Distribution of the spotted-tail quoll sightings and carcass records

3.2.3.2. SURVEY FINDINGS

Surveys were conducted during baseline natural values surveys across the duration of field assessments, following the general search techniques specified in the State guidelines[143]. No evidence in the form of scats, carcasses, footprints, or other identifiable features were recorded during surveys, and no burrows suitable for denning were recorded within the project area over the duration of field surveys (40 person days, >250 hours targeted search effort within stratified habitat), noting ground level visibility was very high and visual search effort in excess of the NRE guidelines for devil den management[144]. Survey effort also exceeded the minimum survey requirement for indirect searches for diurnal mammals defined in the *Survey guidelines for Australia's threatened mammals*[145]. The guidelines recommend a minimum day-time search effort of two hours for every one-hectare survey site of a stratified sampling program in a subject site up to 5 hectares. The surveys for this project concentrated on areas of native vegetation (totalling 146.31 ha) as these areas provide the highest suitability for denning structures and prey availability[146]. A search survey effort of >250 hours was spent within this habitat (**Attachment 3, Section 2.1**), equating to an average of around 1.7 hours of survey searching within every hectare of native vegetation, which far exceeds the recommendation of 2 hours of searching for 1 in every 5 hectares.

The project area is not within the core range for this species according to NVA ranges; however, the eastern extent of the project area is within an area identified as an important population area, and thus is considered as part of the core range. Hundreds of hectares of equally suitable (or better) habitat for this species is present in the local area, with areas of mosaic habitats becoming more suitable further east and west of the project area as human occupation decreases. These areas to the east and west are considered to have 'important populations' of this species (Figure 14). Given that the habitat present within the important population areas is largely modified, the likelihood of the design corridor containing habitat critical for an important population is very low.

Potential den sites are likely widespread in the broader area and may extend into the vicinity of the of the development footprint. Rocky outcrops occur along the alignment which may be utilised by eastern quolls. Denning sites for this species, especially natal dens, are located in well concealed locations to provide protection from predators.

Despite the lack of direct evidence of spotted-tail quolls in the project area, its presence is not discounted simply due to the species occurring throughout Tasmania and varying locationally by frequency of occurrence and population density associated with habitat variables (including land use), and environmental traits. In areas with frequent occurrences and/or high densities of quolls, indicators of presence are readily encountered (tracks, scats, etc), which is why these are an accepted survey detection technique[147]; the absence of these indicators during surveys would thus indicate the project area is sparsely/infrequently utilised. Nonetheless, with the species having very broad habitat use and no factors ruling out its presence entirely, it can be expected that quolls traverse through the project area and may use parts of it while foraging or simply moving within their range, which is consistent with observations recorded on the Tasmanian Natural Values Atlas. Denning opportunities (which are important in habitat quality and for consideration of avoiding and mitigating impacts) are limited based on survey findings, with none being detected during ground surveys and the majority of the project area being modelled as unsuitable (83.22 %) or suboptimal (12.85 %) for the potential presence of dens and/or burrows (Table 25). Only 3.93 % of the design corridor has been identified as optimal potential denning habitat based upon habitat modelling (Figure 10, Table 24).

[143] Environment Strategic Business Unit (2023)
[144] Environment Strategic Business Unit (2023)
[145] Department of Sustainability, Environment, Water, Population and Communities (2011)
[146] Andersen *et al.* (2017); Andersen *et al.* (2020); Jones & Rose (1996); Troy (2014)
[147] Department of Sustainability, Environment, Water, Population and Communities (2011)

Table 24: Spotted-tail quoll denning habitat suitability classes

Suitability class for quoll maternal natal den	Rationale
Optimal (Denning and Foraging) [Plate 1 & Plate 2]	This category contains areas deemed optimal for denning opportunities based on field observations and site attributes. Characteristics include: • All areas of dry forest TASVEG units (ideal soil and sheltering conditions)[148]. • Grasslands within 100 m of native forest units and/or with a dense layer of shrubs (ideal soil and sheltering conditions)[149]. • Silvicultural forest (FPH/FPS) areas (ideal soil and sheltering conditions, including the presence of windrows)[150]. • Regenerating cleared land (FRG) within a native mosaic and with optimal soil and sheltering characteristics (including the presence of log piles)[151].
Sub-optimal (Denning and Foraging) [Plate 3]	This category includes remaining areas of intermediate habitat, including (but not limited to) those with the following traits: • Seasonally inundated lagoons and other wetland habitats not classified as unsuitable (*i.e.* those that dry out in summer)[152]. • Exposed grassland (lacking shrub cover) distant (>100 m) from native forest[153]. • FAC vegetation (good shelter at canopy level, but less suitable at ground level)[154].
Unsuitable (Foraging Only) [Plate 4]	This class captures all areas that are deemed unsuitable for denning opportunities, based on field observations and site attributes. Characteristics include: • Permanently inundated areas denoted by OAQ and ASF on vegetation mapping[155]. • Areas of FAG or FUM > 100 m from native vegetation. These areas are likely too far separated from high prey densities for energetically efficient maternal denning. In addition to this, exposed sites make young devils vulnerable around their dens and are thus not selected by adults[156]. **Note -** FAG and FUM within 100 m of native forest considered suitable but sub-optimal; and noting that micro-siting during a den management protocol should overrule the classification of unsuitable if micro-habitats suitable for denning are present within the FAG and/or FUM > 100 m from native forest, including the presence of rock and log piles, or thickets of suitable vegetation within the broader cleared area – these areas should be elevated to consideration as suitable in such scenarios.

Given the species is relatively non-specific in relation to terrestrial habitat use, the entire design corridor is potential habitat for general foraging/dispersal (noting key aspects such as prey density and local use may vary within the area overall, favouring native vegetation, but this doesn't make

[148] Jones & Barmuta (2000); Jones *et al.* (2023)
[149] Jones & Barmuta (2000); Lyall (2017); Troy (2014)
[150] Jones *et al.* (2023); Lyall (2017)
[151] Jones *et al.* (2023); Lyall (2017)
[152] Environment Strategic Business Unit (2023)
[153] Troy (2014); Jones & Barmuta (2000); Lyall (2017); Andersen *et al.* (2017)
[154] Troy (2014); Lyall (2017)
[155] Environment Strategic Business Unit (2023)
[156] Jones *et al.* (2023); Andersen *et al.* (2017)

other areas inherently unsuitable to the degree where they can be said to have no value)[157]. This is an important distinction as it relates to quality of habitat within the impact corridor following works (and to a lesser extent during).

3.2.3.3. IMPACTS

Habitat loss/change

Surveys and analysis conducted by NBES have established that impact to 416.68 ha of the design corridor footprint represents potential denning habitat (109.51 ha of which is classed as optimal, with the remaining 307.17 ha classed as sub-optimal) for the eastern quoll (Table 25). The remaining 2,222.31 ha of habitat is classed as unsuitable for denning and represents foraging habitat only.

The proposed construction corridor, which is the limit of impacts, contains 74.62 ha of potential denning habitat (consisting of 17.47 ha of optimal habitat and 57.15 ha of sub-optimal habitat). In contrast, a total of 370.19 ha of unsuitable denning habitat (potential foraging only) is present within the construction corridor (Table 25). The majority of impacts therefore and proposed within land determined to be unsuitable for denning and suitable for foraging only, noting foraging habitat is essentially ubiquitous due to the ecology of the spotted-tail quoll.

In addition, 95.50 % of the impact footprint within the construction corridor (424.78 ha), from the long-term perspective of quoll habitat use, will merely be habitat disturbance, with the extent of the pipeline post-works once more becoming viable habitat for foraging, dispersal (and potentially denning but still less likely than foraging/dispersal based on pre-existing landscape attributes such as the extent of cleared land) (*i.e.* it will still meet the definitions within Table 24) – even during construction there will be scope for devils to move through areas in a relatively unfettered fashion and for the works area to still provide habitat value in that sense. Areas that currently support woody vegetation (12.46 ha, or 2.80 % of the construction corridor area) are expected to be the most altered, in that woody vegetation may be the slowest to recover and/or be rehabilitated, and the fact that forest will not return to forest, which is incompatible with the pipeline. However, as per the definitions in Table 24, an area does not need to remain as forest to remain as viable habitat, and these areas will remain adjacent to larger forested patches with all the inherent habitat values such as prey and shelter opportunities. Habitat viability (from a denning perspective) has been remodelled in Figure 11 from the perspective of post-works habitat changes, demonstrating that 99.70 % of the habitat (loss of 1.33 ha of denning habitat) in the construction corridor will be unchanged in terms of denning suitability, with the results displayed in Table 27.

Areas of impact within forest units will remain treeless post works but will be rehabilitated with grassy and shrubby vegetation present in the local area under rehabilitation commitments. For the habitats that already lack woody vegetation, the installation of the pipeline will result in no habitat change post works and/or have a very rapid return to equivalent habitat value (e.g. less than 6 months) facilitated by revegetation commitments. During this period of rehabilitation, the recovering ground will still meet the viable habitat definitions within Table 24, as the temporary absence of vegetation will not preclude devils from using the area at a local or landscape scale, even if it is just for dispersal or opportunistic foraging on bare ground. The process of construction, consisting of excavation and re-filling, will be completed on a local scale within a one to three day period in most cases (with discrete sections open for up to a maximum of two weeks), meaning construction related disturbance timeframes are very low. Measures will be put in place such that if a quoll were to find its way into an open trench, there are a sufficient number of ramps placed within the trench to allow animals to readily vacate the trench. Trenches will typically be open for a length of 1-200 m, with a maximum trench length of 500 m.

[157] Jones & Barmuta (2000); Jones *et al.* (2023)

The limited nature of the permanent works is such that permanent habitat loss is extremely minor in the context of the broader area (20.03 ha of total vegetation loss). Only areas proposed to contain balance tanks, pump stations, and a dam will constitute permanent habitat loss in that viable habitat will be converted to inviable habitat – these areas comprise 0.66 ha of optimal denning habitat, 0.67 ha of sub-optimal denning habitat, and 18.70 ha of unsuitable denning habitat – all of which constitute potential foraging habitat - as per the definitions in Table 24 and with the habitat loss outlined in Table 26).

The potential impact from the project applies to a greater extent to local individuals. At the scale of an individual, the proposal's area of impact is approximately 1.5 times an individual (female) quolls home range[158], with the permanent loss of habitat representing the loss of 6.68 % of a single (female) quolls range[159]. Given the measured density of quolls in the broader area is extremely low (with the exception of a known population near Conara – Figure 15)[160], this scale of loss is extremely unlikely to lead to a significant decrease in population size nor result in any population fragmentation (noting quolls are effectively impervious to fragmentation for all but the largest geographic barriers (e.g. large expanses of deep permanent water such as Bass Strait).

Table 25: Impacts to quoll and devil denning habitat in context of the availability within 5 km (all areas in hectares)

	Potential Impact Area			Avoidance Area	
Denning Habitat Class (note all classes are potential foraging habitat)	**Total Permanent Impacts {% of class within construction corridor} [% of class within design corridor] (% of class within 5 km)**	**Temporary Impacts {% of class within construction corridor} [% of class within design corridor] (% of class within 5 km)**	**Total Within Construction Corridor [% of class within design corridor] (% of class within 5 km)**	**Total Within Design Corridor (Excluding Construction Corridor)**	**Total Within 5 km**
Optimal	0.66 {3.78 %} [0.60 %] (0.002 %)	16.81 {96.22 %} [15.35 %] (0.05 %)	17.47 [15.95 %] (0.05 %)	109.51 (92.04)	32,144.20
Sub-optimal	0.67 {1.18 %} [0.22 %] (0.004 %)	56.48 {98.82 %} [18.39 %] (0.35 %)	57.15 [18.61 %] (0.35 %)	307.17 (250.02)	16,306.84
Unsuitable	18.70 {5.05 %} [0.84 %] (0.03 %)	351.49 {94.95 %} [15.82 %] (0.51 %)	370.19 [16.66 %] (0.53 %)	2,222.31 (1,852.13)	69,385.64
Total	**20.03**	**424.78**	**444.81**	**2,194.19**	**117,836.68**

[158] Public Land Use Commission (1996)
[159] Based on an exclusive home range of 300 ha for a female - Public Land Use Commission (1996)
[160] Tasmanian Natural Values Atlas data – as of 23 November 2023

Table 26: Summary of impacts to quoll and devil denning habitat suitability classes (all areas in hectares)

	Infrastructure Description			Impact Summary		
Habitat Class (Note all classes are potential foraging habitat)	**Pump Stations [% of Permanent Impacts] (% of Total Impacts)**	**Balance Tanks [% of Permanent Impacts] (% of Total Impacts)**	**Dam [% of Permanent Impacts] (% of Total Impacts)**	**Total Permanent Impacts (% of Total Impacts)**	**Temporary Impacts (% of Total Impacts)**	**Total**
Optimal	-	0.66 [100 %] (3.78 %)	-	0.66 (3.78 %)	16.81 (96.22 %)	**17.47 (3.93 %)**
Sub-optimal	0.21 [30.72 %] (0.36 %)	0.47 [69.28 %] (0.81 %)	-	0.67 (1.17 %)	56.48 (98.83 %)	**57.15 (12.85 %)**
Unsuitable	1.08 [5.77 %] (0.29 %)	0.31 [1.68 %] (0.08 %)	17.30 [92.55 %] (4.92 %)	18.70 (5.05 %)	351.49 (94.95 %)	**370.19 (83.22 %)**
Total	**1.28**	**1.44**	**17.30**	**20.03**	**424.78**	**444.81**

Table 27: Quoll and devil denning habitat modelling results comparing pre and post construction changes (all areas in hectares)

Denning Habitat Class (Note all classes are potential foraging habitat)	Total Within Construction Corridor (Pre-Construction)	Total Within Construction Corridor (Post-Construction)	Net Change in Area	Conversion Type
Optimal	17.47	16.58	-0.89	0.66 ha lost to permanent infrastructure (unsuitable) 0.23 ha converted to sub-optimal
Sub-optimal	57.15	56.73	-0.42	0.67 ha lost to permanent infrastructure (unsuitable) 0.23 ha gained from optimal 0.02 ha gained from vegetation changes
Unsuitable	370.19	371.51	1.34	0.66 ha gained from permanent infrastructure (optimal) 0.67 ha gained from permanent infrastructure (sub-optimal) 0.02 ha lost from vegetation changes
Total	**444.81**	**444.81**	**-**	

Roadkill

Analysis of the available traffic data[161] indicates that the major roads are expected to have an increase of night-time traffic (largely around dawn and dusk) on all major project roads (Figure 12), as indicated in **Attachment 11.** Given this expected increase in traffic, it can be expected that there will be an increased probability of roadkill incidence (proportional to traffic increases) without mitigation.

Proportional roadkill data[162] (Figure 12) suggests that the Midland Highway is three times as likely to have a collision impact with a dasyurid than on Macquarie Road (Table 28), which is one of the major C roads within the project area. It is acknowledged that this roadkill data may not be an entirely accurate reflection of the collision rates more broadly. It is also understood that the Tasmanian Department of State Growth periodically conduct roadkill removal on State managed roads, which may skew the data toward roads that are surveyed at a higher frequency. Nonetheless, the proportion of traffic on the Midland Highway relative to the smaller project roads (Table 28), provides some insight into the scale of roadkill impacts to Tasmanian devils and quolls and can be taken as a proxy for baseline rates of mortalities.

Macquarie Road is expected to have increases in light vehicle traffic >40 % during night time hours, with heavy vehicle traffic expected to be limited to day time hours. Similar increases in light vehicle use across other projects roads is expected. With this in mind, mitigation measures are proposed in line with studies of roadkill in dasyurids across Tasmania[163].

Table 28: Summary of dasyurid roadkill on project roads since 19/06/2018[164], the Midland Highway, provided for additional context[165]

Road	Tasmanian devil	Spotted-tail quoll	Eastern quoll	Total
Midland Highway*	10	5	3	**18**
Macquarie Road	5	1	-	**6**
Cressy Road	1	-	-	**1**
Poatina Road^	1	-	-	**1**
Valleyfield Road	2	-	-	**2**
Barton Road	-	-	-	**0**
Ashby Road	0	1	-	**1**
Total	**19**	**7**	**3**	**29**

*** Recorded between Mona Vale Road and Powranna Road, within the project area**
^ Recorded between Poatina township and Macquarie Road, within the project area

3.2.3.4. MITIGATION MEASURES

The permanent loss of 20.03 ha of potential denning habitat is unlikely to result in a decrease to any local population, particularly in the context of the abundance of equivalent or better habitat in the broader landscape.

[161] Provided by Pitt & Sherry for project roads – data collected in April and December 2022
[162] Data downloaded from the Tasmanian Roadkill Reporter app – available through the Tasmanian Natural Values Atlas
[163] Hobday and Minstrell (2008); Jones (2000)
[164] Data downloaded from the Tasmanian Roadkill Reporter app – available through the Tasmanian Natural Values Atlas
[165] Data downloaded from the Tasmanian Roadkill Reporter app – available through the Tasmanian Natural Values Atlas

Despite the large area of unsuitable denning habitat across the NMIS project area (Figure 10) and the absence of any known potential burrows to support a den in the proposed footprint, a pre-clearance check and unanticipated den discovery protocol will be implemented throughout the construction phase of the project. This protocol is outlined in **Attachment 12**. The other key aspect of mitigation will be in relation to roadkill mitigation, as outlined below. An assessment of the project against the significant impact criteria for spotted-tail quolls is provided in Table 30.

Roadkill

There are no published quoll-specific roadkill impact mitigation guidelines available, however the '*Survey guidelines and management advice for development proposals that may impact on the Tasmanian Devil 2015*'[166] (the *Survey Guidelines*) outlines a process for assessing the potential impacts of developments requiring road usage on Tasmanian devils. This process focuses on identifying and mitigating impacts on devils, but the mitigation measures are also suitable for reducing road mortalities for other native fauna, including quolls. The process involves completing a traffic impact assessment, then, if spotted-tail quoll roadkill mortalities are expected to increase by more than 10 % (based on equivalent predicted rise in night-time traffic for existing roads, and general increase in traffic on new roads), a roadkill assessment and roadkill mitigation plan must be completed. Mitigation measures for the current project therefore will focus on existing roads expected to surpass the 10 % night-time threshold based on being identified as having an estimated >10 % traffic increase during the construction of the proposed development (particularly based on predictions much higher than 10 % increase during peak hours, which are the most likely to overlap with the definition of night-time in the *Survey Guidelines*).

Traffic data (baseline and predicted) is available for the major roads proposed to be used during the duration of the project – this data is displayed in **Attachment 11**. The roads proposed to be utilised during construction are as follows:

- Cressy Road (Dam construction and pipeline installation)
- Poatina Road (Dam construction and pipeline installation)
- Powranna Road (Dam construction and pipeline installation)
- Mount Joy Road (Pipeline construction)
- Barton Road (Pipeline construction)
- Valleyfield Road (Pipeline construction)
- Macquarie Road between Valleyfield Road and Midland Highway (Pipeline construction)
- Macquarie Road between Valleyfield Road and Poatina Road (Pipeline construction)
- Ashby Road (Pipeline construction)

Given the relatively low existing traffic volumes on all of these roads, it is expected that in most cases, roads will see increases in traffic volumes around the dawn and dusk periods greater than 10 % and thus warrant mitigation. Baseline roadkill data is available in data present on the Tasmanian Natural Values Atlas (Figure 12) and LISTmap[167] - it is probable that this data does not accurately quantify the level of vehicle strike on these roads due to incomplete reporting, but it may nonetheless reflect the pattern of roadkill distribution. The data has thus been utilised to identify high-risk roads in the project area without necessarily drawing conclusions or providing a basis to measure specific increases in roadkill frequency. Nonetheless, due to the predicted increase in traffic alone, the following mitigation measures will be implemented across the project (referred to as the roadkill mitigation protocol/strategy). With these mitigation measures in place (summarised in Table 29), we anticipate project-specific roadkill mortalities can be minimised, with regular monitoring and periodic data review in place to trigger contingency measures if needed.

[166] Environment Strategic Business Unit (2023)
[167] Lands Tasmania – available at https://maps.thelist.tas.gov.au/listmap/app/list/map

Traffic times

- As per the *Survey Guidelines,* the definition of night-time to apply to all subsequent mitigation measures includes an hour before dusk and an hour after dawn[168] – noting it will be a requirement of the contractor to define the variation in this period in relation to the various requirements on a week-by-week basis as part of their construction environment management practices.
- Heavy rigid vehicles or larger will be limited to daylight hours as much as is practicable – special circumstances may require transport outside of daylight hours only in accordance with the conditions defined in the following subclauses:
    - Special purpose heavy vehicles moving large plant and equipment may operate outside the above times when it is a road traffic requirement to minimise impact on other traffic, and/or comply with any other road authority permits – in such cases these vehicles will have a lead escort vehicle and be limited to a maximum speed of 60 km/h whilst on project roads.
    - In the event that general cartage heavy vehicles are prevented from operating during daylight hours, such as due to weather events, these vehicles will be limited to a maximum speed of 60 km/h during night-times on all project roads – in such cases, these vehicles will travel in a convoy of a minimum of 2 vehicles, with convoys to be separated by at least 15 minutes – by travelling in a convoy, the frequency of individual heavy vehicles will be reduced, thus reducing roadkill opportunities.

Speed limits

- Road speed limits for project vehicles (to be mandated by the responsible Contractor and their requirement to enforce) will be set at a maximum of 80 km/h across the specified project roads (Figure 12) during daylight hours and at 60 km/h during night time[169].
- In addition, areas identified as adjacent to optimal potential denning habitat (based on devil and quoll habitat modelling in Figure 10 and thus seen as the most likely areas to support fauna in general, will be further limited to 60 km/h at all times for project vehicles. These identified areas are as follows (Figure 12):
    - Barton Road (Midland Highway to Mt Joy Road)
    - Powranna Road (Midland Highway to Mt Joy Road)
    - Macquarie Road (Glen Connell Road to Barton Road)
    - Macquarie Road (Quarry Road to Delmont Road)
    - Valleyfield Road (Macquarie Road to 200 m beyond balance tank access)
- These limits will be advertised using semi-permanent project specific signage and enforced under contract requirements.

Additional measures

- Project vehicles will be fitted with a basic, high-frequency animal repellent device (which emits an ultra-sonic sound wave at speeds above 50 km/h). The installation and operation of these devices will be audited periodically as part of the Contractors construction environmental management requirements (to be linked to contract commitments).

Monitoring

- During the construction phase, all internal roads within the current works or commute routes shall be monitored daily for roadkill (with documentation recording inspection was completed

[168] Environment Strategic Business Unit (2023)

[169] Precluding situations where the speed limits may be less than these amounts under existing conditions and/or under temporary conditions applied for other road traffic management.

along with noting when, where and species of any roadkill), with mortalities removed from the road surface immediately upon location (to limit likelihood of predators being attracted to the carcass). The same shall apply to selected arterial roads that will be subject to increased use as project staff commute to the site from places of accommodation. Roadkill will be noted as a project vehicle collision or if it is found incidentally (and not already reported) assumed to be the result of collision from a non-project vehicle.

- The project roadkill data will be periodically independently reviewed (minimum every 6 months through construction), with scope to assess collision rates and determine if site access measures will require reassessment and further mitigation implemented where applicable.

As further conditions of TI's Environmental Protection Requirements (contractual obligations for contractors):

- Wildlife hit by project vehicles must be recorded, including details of when, where, and species if identifiable. These records will be reported to TI along with the monthly report. Mortalities must also be reported to NRE through the Roadkill Reporter app[170]. Roadkill attributed to non-project vehicles will be tallied separately. Data collected throughout the construction phase of the project be submitted to the Department of Climate Change, Energy, the Environment and Water upon the completion of works.
  No animals are to be deliberately killed with vehicles.

If any injured wildlife is found, WIRES Wildlife Rescue (1300 094 737) will be contacted immediately, and arrangements made for transferring injured wildlife to specialist carers at an animal hospital, vet, or refuge. If rehabilitation is not possible, animals are to be dealt with humanely in accordance with the *Best Practice Guidelines for Wildlife Rehabilitation Version 2 (2021)* set out by the Department of Natural Resources and Environment Tasmania.

[170] Available at https://nre.tas.gov.au/wildlife-management/living-with-wildlife/tasmanian-wildlife-roadkill/tasmanian-roadkill-reporter-app

3.2.3.5. SUMMARY OF MITIGATION AND AVOIDANCE MEASURES

Table 29: Summary of mitigation and avoidance measures for the spotted-tail quoll

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
Pre-clearance check and unanticipated den discovery protocol	Prior to the commencement of the action, the civil contractor must implement the pre-clearance check and unanticipated den discovery protocol as detailed in **Attachment 12**. This protocol will require approvals under the Tasmanian *Nature Conservation Act 2002* should dens be required to be decommissioned. The application of this protocol must: f) Be conducted within two weeks of the commencement of any vegetation clearance and must be applied to a 50 m buffer of the works area. g) If dens are located, they must be subject to a den monitoring assessment as detailed in Section B of the protocol. Comply with the reporting and regulation components of Section C of the protocol.	Tasmanian Irrigation Civil Contractor	Two weeks prior to any vegetation clearance, including a 50 m buffer.	**Very high** The application of this protocol is consistent with the management advice given in the *Survey Guidelines and Management Advice for Development Proposals that may impact on the Tasmanian Devil* [171], however the mitigation measures are also suitable for reducing road mortalities for other native fauna, including quolls. These guidelines were developed in 2015 with the input from several experts in the management and ecology of Tasmanian dasyurids. While the effectiveness of the pre-clearance checks are difficult to define, the process is designed in such a manner that the potential for direct impacts to individuals is removed through a thorough search and monitoring program.
Roadkill mitigation	During the construction phase of the action, the civil contractor must comply with roadkill mitigation measures as detailed in **Section 3.2.1.4**. Roadkill mitigation measures include: a) Reduction of speed across all project roads for project vehicles. b) Centralising transport of key infrastructure to	Tasmanian Irrigation Civil Contractor	All project roads. Ongoing throughout construction phase of the project.	**Very high** The application of this protocol is consistent with the management advice given in the *Survey Guidelines and Management Advice for Development Proposals that may impact on the Tasmanian Devil* [172], however the mitigation measures are also suitable for reducing road

[171] Environment Strategic Business Unit (2023)
[172] Environment Strategic Business Unit (2023)

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
	core roads. c) Restricting use of roads outside of daylight hours as much as is practicable. d) Project vehicles will be fitted with a basic, high-frequency animal repellent device. e) Specific mitigation for special purpose vehicles, including travel convoys, escort vehicles, and further speed reduction.			mortalities for other native fauna, including quolls. These guidelines were developed in 2015 with the input from several experts in the management and ecology of Tasmanian dasyurids. The strategies proposed in this roadkill mitigation plan are somewhat tested, with reduction of driver speed likely to be an effective in reducing overall collision numbers[173], and limiting vehicles from night-time use is also likely to reduce collision risk as the majority of species likely to be at risk from collision are crepuscular or nocturnal[174] The effectiveness of high-frequency animal repellent devices is challenging to assess, with trials of virtual fencing yielding mixed results[175].
Roadkill monitoring	Collision data must be reviewed at a minimum of every 6 months. Data must be submitted to the Department of Natural Resources and Environment Tasmania and the Department of Climate Change, Energy, the Environment and Water.	Tasmanian Irrigation Civil Contractor	All project roads. Ongoing throughout construction phase of the project.	**Very high** The monitoring and review component of the roadkill mitigation plan has a very high likelihood of effectiveness as the roadkill plan allows for adaptive management on project roads in the event that project vehicles lead to an increase in roadkill beyond the baseline levels.

[173] Hobday & Minstrell (2008); Hobday (2010)
[174] Lester (2015); Hobday & Minstrell (2008)
[175] Fox *et al.* (2019); Magnus *et al.* (2004)

3.2.3.6. SIGNIFICANT IMPACT ASSESSMENT

Table 30: Significant impact criteria with regards to the spotted-tail quoll

Significant Impact Criteria	Likelihood of Significant Impact	Comments
1. Lead to a long-term decrease in the size of an important population.	None	The National Recovery Plan[176] identifies eight "important populations" for the spotted-tail quoll in Tasmania (Table 23). The permanent loss of 20.03 ha of potential habitat is unlikely to result in a decrease to any local population, particularly in the context of the abundance of equivalent or better habitat in the broader landscape. Despite the large area of unsuitable denning habitat across the NMIS project area, a pre-clearance check and unanticipated den discovery protocol will be implemented throughout the construction phase of the project. Thus, the action will not lead to a long-term decrease in the size of an important population.
2. Reduce the area of occupancy of an important population.	None	The largely temporary nature of the proposed action and the very small permanent impact footprint will not meaningfully reduce the area of occupancy of this species given its range of occurrence of several tens of thousands of square kilometres. Thus, the proposal will not reduce the area of occupancy of the species.
3. Fragment an existing important population into two or more populations.	None	We are not aware of land clearance and modification of this scale or nature resulting in fragmentation of habitat for this species as it occurs typically within a mosaic of cleared land and open habitats. In addition, at the population level, the proposed impacts occupy a miniscule strip of land compared to the vast range covering much of Tasmania (Figure 15). The largely temporary nature of the proposed action and the very small permanent footprint changes in any one area thus will not fragment the existing population into two or more populations and is unlikely even to have a noticeable impact on individual movements at a local scale.
4. Adversely affect habitat critical to the survival of a species.	None	The proposed Action has a permanent infrastructure footprint of 20.03 ha. All other impacts are temporary only and will not reduce the extent of available foraging and denning habitat beyond the permanent impact areas. All impacts are subject to a pre-clearance check and unanticipated den discovery protocol. With this measure in place, the action will not adversely affect habitat critical to the survival of this species.
5. Disrupt the breeding cycle of a	None	All impacts are subject to a pre-clearance check and unanticipated den discovery protocol. Should a den be located

[176] Department of Environment, Land, Water, and Planning (2016)

Significant Impact Criteria	Likelihood of Significant Impact	Comments
(important) population.		during this check, measures are put in place to ensure that there is no impact to breeding quolls. With this measure in place, the action will not disrupt the breeding cycle of a population (or individuals),
6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	None	The proposed Action has a permanent infrastructure footprint of 20.03 ha. All other impacts are temporary only and will not reduce the extent of available foraging and denning habitat beyond the permanent impact areas. All impacts are subject to a pre-clearance check and unanticipated den discovery protocol. With this measure in place, the action will not modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.
7. Result in invasive species that are harmful to the species becoming established in the species' habitat.	None	There is no likelihood that the action will result in and invasive species that are harmful to the species (such as foxes) becoming established in the species' habitat as the landscape suitability for invasion of such species will not change as a result of works and there is no conceivable reason the projects works will result in a direct introduction of such a species as the project will operate under weed and hygiene management practices. In addition, the surrounding landscape (see **Section 2**) already continues numerous introduced plants and animals that co-occur with the quoll throughout its range with no apparent detrimental impacts.
8. Introduce disease that may cause the species to decline.	None	The action will not conceivably introduce any diseases that may cause the species to decline and is thus not considered to be a risk for this project. Numerous similar projects have been undertaken in suitable habitat for the spotted-tail quoll with no known incidences of a disease resulting from the projects.
9. Interfere substantially with the recovery of the species.	None	With the proposed mitigation measures in place, the action will not interfere with the approved recovery plan[177] for this species.
Summary		
The proposed action will not have a significant impact on the spotted-tail quoll.		

[177] Department of Environment, Land, Water, and Planning (2016)

3.2.4. TASMANIAN WEDGE-TAILED EAGLE (*AQUILA AUDAX FLEAYI*)

3.2.4.1. CONTEXT

The Tasmanian wedge-tailed eagle is listed as endangered under the EPBCA. Wedge-tailed eagles' nest in a range of old growth native forests and are dependent on forest for nesting. This species requires large, sheltered trees for nesting and is highly sensitive to anthropogenic disturbances during the breeding season. Territories can contain up to five alternate nests usually close to each other but may be up to 1 km apart where habitat is locally restricted. They hunt and scavenge on a wide variety of fauna including fish, reptiles, birds, and mammals. The eagle breeding season[178] spans from the beginning of July until the end of January, and is extended into February in seasons where breeding progress is later than normal, which is determined annually by the Forest Practices Authority around November (also noting the breeding season can be taken to start as early as June 1st for white-bellied sea eagles, which are not thought to occupy any of the known nests in proximity to the design corridor, but which could nest in the area).

Nesting habitat within the Northern Midlands is considered low when using the eagle habitat suitability model developed by the Forest Practices Authority due to the lack of dense forest patches and sheltered gullies and valleys. The Northern Midlands landscape is relatively flat, dry, and heavily modified for agriculture. Despite this sub-optimal landscape, a number of eagles still nest in the limited forest patches available and likely thrive off using the open plains of farmland for foraging.

Thirty eagle nests are known from within 5 km of the proposed pipeline, with 11 of these within 1 km and 7 within 500 m[179] (noting that one nest record is within 500 m however recent surveys confirmed this nest as fallen) (Figure 16, **Attachment 8 - Figure 1**). These 11 nests are within the Forest Practices Authorities 500 m direct distance or 1,000 m line-of-sight recommended seasonal constraint zone (for active nests) for forestry related development during the breeding season. It has been well documented that the wedge-tailed eagle is a very timorous nester, particularly in Tasmania[180]. Their low tolerance to disturbance means they are likely to abandon their nest if distressed, even when their nest contains an egg or chick, resulting in an unsuccessful breeding season[181]. While individual responses vary, disturbance occurring even many hundreds of meters away can cause breeding birds to temporarily leave eggs or chicks at risk, or even to desert their nest site for years[182]. Disturbances involving people tend to be more serious when the disturbance is atypical and directed at the nest[183].

It should be noted though that as favoured nesting sites become scarcer due to habitat loss, eagles are known to nest in sub-optimal locations and as a result may have become more habituated to disturbances[184] - this has been observed in Tasmania, particularly in the Midlands[185]. It should not therefore be ruled out that eagles may use the project area for nesting in the future prior and post construction (which is supported by the proportion of nests found to be active during the nest checks undertaken for this study – see below). Indeed, the eagles in the Midlands are likely subject to anthropogenic pressures and disruption daily. It is therefore quite possible the eagles in the Midlands have a higher threshold to disturbance than eagles in a more protected and undisturbed landscape.

Ongoing maintenance during the operational phase of the scheme is expected to be minimal, with operations and maintenance typically restricted to 1 light vehicle (operating in daylight hours,

[178] Forest Practices Authority (2023); Environment Protection Authority (2023)
[179] Tasmanian Natural Values Atlas data – as of 8 July 2023
[180] Mooney & Holdsworth (1991)
[181] Mooney & Holdsworth (1991); Threatened Species Section (2006); Bekessy *et al.* (2009); Wiersma (2010); O'Sullivan (2014); Munks & Crane (2017)
[182] Threatened Species Section (2006a); Bekessy *et al.* (2009); Wiersma (2010); O'Sullivan (2014).
[183] Bekessy et al. (2009); O'Sullivan (2014)
[184] Debus et al. (2014); Debus *et al.* (2007)
[185] Nick Mooney (2021) *pers. comms.*

weekdays only). The scope of maintenance will vary from scheme-wide to single sites. Major maintenance will be periodic at the primary asset sites (pump stations, balance tanks, and dams). This will include the use of light and heavy vehicles over a period of up to a week, in daylight hours. Pump stations will typically have annual maintenance with 2 or 3 light vehicles, and significant maintenance involving some heavy vehicles (1 to 2) every 5-10 years. Balance tanks and the dam will typically require additional vehicles every 10 years, which may include heavy vehicles and heavy plant for up to a week. All of these factors can be managed with seasonal constraints (selectively informed by activity assessments where applicable).

An additional risk of this development on the wedge-tailed eagle is the disturbance created during the development stage. This will be avoided through the completion of all works during the non-breeding season and outside 500 m of 1,000 m line of sight of any nest that is active.

Aerial Nest Search

Six eagle nests were known to occur within 1 km of the original alignment (Figure 16, **Attachment 8 - Figure 1**) based on data within the NVA. Several of the nest records were old enough to warrant verification (of whether they were still present) and the likelihood of additional undocumented nests was considered to be high based on the Tasmanian Forest Practices Authority (FPA) potential eagle nesting habitat model[186].

The prevalence of potentially suitable nesting habitat and known nest locations with potential line of sight (and/or direct distance < 500 m) to the alignment precipitated the need for an aerial nest search, which was undertaken on the 5-6/5/2021 to a buffer of 1,200 m around the alignment. The nest search was undertaken according to Forest Practices Authority standards by two NBES ecologists, with an additional spotter. Both ecologists are experienced in aerial and ground eagle nest surveying and the identification of suitable habitats. Flights were conducted using Helicopter Resources Pty Ltd., with pilot Chris Keller, who has flown eagle nest surveys in the past.

A total of 6 hours was spent searching the surrounds of the project area. The weather was optimal for the duration of the survey, with winds trending from light to moderate. The survey involved slow flying (5-10 knots) above the tree canopy or, where possible, below the adjacent canopy level, such as through gullies. In large areas of suitable nesting habitat, transects were flown to ensure complete coverage of the area. Marginal potential habitat was also checked. All known nests (with locations extracted from the NVA database) within the survey area were visited to verify condition and presence. Any previously reported nest(s) that could not be found were searched for using both their reported position and spatial accuracy as a guide, in addition to surrounding suitable trees and habitat. Further suitable habitat and trees in the broader vicinity of the reported nest position were also checked until it was considered that continued searching was futile.

Once a nest was located, its condition and features were described in-situ, including with the assistance of 10 x 40-50 mm binoculars where this enabled the observers to remain distant from the nest. Due to the nature of the task sometimes involving hovering near the canopy, which presents risks to local birds and the observers, nest checks were limited to the time necessary to verify presence and condition (typically less than 1-2 minutes in an area). To further reduce potential disturbance, all nest observations were photographed using an Olympus E-M10 MarkII with a manual optical zoom and only GPS recorded (using a handheld non-differential GPS, Garmin GPSMap 64s) if the previously reported position had low reported spatial accuracy and had evident scope for improvement when relocated.

To support the in-situ observations, images of each nest were later examined to further inform the condition assessment. Characteristics of the nest to determine its condition included: fresh green leaves, stick tone (brown or grey), white-wash, algal smears, nest shape (flat-topped or bowl),

[186] Forest Practices Authority (2014a)

down/feathers, and prey remains. The integrity of the nest was then given a classification based on it being prime, viable, derelict or remnant. These factors essentially represent the viability of the nest for breeding.

A second aerial nest search was conducted on 28/06/2023 using the same methods to maintain currency of the nest search in accordance with best practice guidelines[187]. A ground search for nests not located during this survey was conducted on 08/08/2023.

Nest Viewshed Analysis

Following the aerial survey, a viewshed analysis was undertaken for all newly observed and previously reported nest locations. The viewshed analysis was undertaken in GIS using the following steps:

- A 1 m Digital Elevation Model (DEM) was obtained for the area (supplied in 1 km^2 tiles from ELVIS https://elevation.fsdf.org.au/) and these tiles were merged into a single dataset;
- A series of regular points (10 m apart) were created within the project area;
- These points were converted into viewpoints using the create viewpoint function in qGIS (setting the observer height as 1.6 m off the ground and the target height as 20 m);
- Create viewshed tool in qGIS was then run using the viewpoint locations;
- The resulting raster was converted to polygons (Vector Creation > Raster pixels to polygons), and polygons were combined and assigned values of 0 = no visible, all others = visible.

This process defined the extent of land within a 1 km radius of the alignment that was visible from the proposed area of disturbance, both with and without context of intervening vegetation (i.e. with the most conservative model relying only on topographic obstructions and hypothetically removing all vegetation from the landscape). The results of this viewshed analysis is displayed in **Attachment 8**.

Nest Activity Assessment

Based on the need for geo-technical surveys and thus potential disturbance within viewsheds in that breeding season, 4 nests were selected for a 2021/22 seasonal activity assessment (see discussion for lack of implications from only conducting activity assessments on a subset of nests). Nest activity assessments for the 2021/22 breeding season were conducted for nests 964, 1880, 1880, and 2842 via helicopter on 27/10/2021, undertaken by the Forest Practices Authority. The weather was optimal for the duration of the survey, with winds trending from light to moderate.

On approach of a nest, within 2 km, all observers including the pilot undertook a full sky sweep for any eagles in flight in the vicinity. Eagles are particularly territorial during the breeding season, with numerous records of eagles aggressively defending their territories from intruders, including helicopters[188]. If an eagle was spotted, its behaviour was observed. Behaviours such as 'pot-hooking'[189], extended talons, or flying in the direction of the helicopter would be taken as indications of aggression from the eagle(s), which meant that the nest was not approached for an activity assessment and that the nest was considered active by default.

In the absence of such behaviour, each assessment involved a quiet approach passing the nest at a speed of >40 knots. The assessment process overall does not involve hovering and is used to ensure the helicopter is not within the vicinity of a nest for any longer than 30 seconds, thus reducing disturbance as much as possible. When circling the nest, the helicopter always remained at a distance where rotor-wash (*i.e.* the wind created from the propellers) did not rustle the leaves or branches of any of the trees immediately surrounding the nest.

[187] Forest Practices Authority 2023
[188] Forest Practices Authority (2023)
[189] Pot-hooking is a behaviour where an eagle dives at a fast pace before pulling up and then repeating this pattern.

The activity assessment was stratified into five categories, with three outcomes (active, not active, manage as active):

- Productive – Chicks present (if so, chicks were counted, and age estimated).
    - **Nest considered 'active'**.
- Maintained – Any eggs, adult, or fresh lining material present on the nest.
    - **Nest considered 'active'**.
- Not used – Nest found but had old nesting material, was bleached, or degraded.
    - **Nest considered 'not active'**.
- Unknown – Poor view of the nest (*e.g.* under dense canopy) or not found.
    - **Nest considered 'manage as active' <u>unless otherwise specified</u>**.
- Other – Adult eagle flushed, or adult in the area around nest, but nest could not be observed due to risk to eagle (including in cases of eagle aggression).
    - **Nest considered 'active'**.

3.2.4.2. SURVEY FINDINGS

<u>Aerial Nest Search</u>

An initial aerial nest search (undertaken in May 2021) established that nine eagle nests are located within 1.2 km of the proposed alignment, with five of these being confirmed previously known nests (with one not being relocated and considered to be a duplicate observation) and four being newly located nests (no previous recorded observations). Nest 1880, nest 2943, and nest 2950 are located within 500 m of the alignment (Table 31), while nests 964, 1490 (duplicated observation) and 2949 have line-of-sight within 1 km. Nest 2944 is located outside of a 1 km buffer. Viewshed analysis of the nests is in **Attachment 8**.

For the 5 pre-existing nests relocated in the May 2021 survey, nests 964, 886, 1880 and 2842 exhibited evidence of recent activity and/or nest maintenance in the form of fresh leaves and branches, and whitewash. Nest 1664 showed no evidence of recent activity at the time of survey but was nonetheless classed as a viable nest. All the nests are considered to be viable for future use.

It should be noted that aerial nest searches are considered to be current for a duration of two years[190]. A second aerial nest search was conducted on the 28th of June 2023, as the May 2021 survey had expired. This nest search recorded four new nests, however it also noted that nest 2943 had fallen (but was replaced by a new nest in a nearby tree), and nest 1490 and 1880 were not relocated. An additional new NVA nest record (nest 3135) was not relocated during these surveys. A summary all surveyed nests is in Table 31. For the three nests that were not located during aerial surveys, an additional ground survey was conducted on the 8th of August. Nest 1880 was relocated, however nests 1490 and 3135 were confirmed as absent.

The details of the new nests recorded in the 2023 surveys are as follows:

- Nest 3218 – Located south of Mount Joy and Powranna Roads. The nest is located in a large *Eucalyptus obliqua*, with signs of recent use including fresh green leaves and brown sticks. An adult wedge-tailed eagle was perched within 100 m of this nest. This nest is within 500 m direct distance of the construction corridor.

[190] Forest Practices Authority Threatened Species Advisor – available at https://www.fpa.tas.gov.au/Planning/biodiversity/threatened_species_adviser

- Nest 3219 – Located within 500 m of the Poatina balance tank site. Nest is located in a medium-sized *Eucalyptus amygdalina*. Eagles were present on the nest at the time of survey; thus, a detailed assessment was not possible.
- Nest 3220 – Located on the southern edge of a farm dam, near the Leverington property. The nest is in a large *Eucalyptus viminalis*, with some fresh brown sticks present.
- Nest 3221 – Located within 20 m of the fallen nest 2943. The nest is in the fork of a dead tree and was not observed with any leaves lining the nest. This nest is within 500 m direct distance of the Valleyfield balance tank.

Nest Activity Assessment

In the 2021/22 breeding season, nests 964, 886 and 1644 were found to be inactive, while nest 1880 was active only for the brood to fail later in the season (Jason Wiersma, FPA, pers. comm.). In the 2023/24 breeding season, nests 964, 1644, 2842, 2849, 2950, and 3218 were found to be active (Table 31). Nest 3219 was not relocated in this survey; however, it is best practice to treat this nest as active until a survey can be conducted to establish whether the nest has fallen.

Nest activity assessments are only a seasonal tool for the prevention of disturbance within a single breeding season, hence the nests selected for activity assessments in that year were only those that were at risk of disturbance from geo-tech investigations that season. At the time of the 2021/21 survey, nest 2950 was outside of the 1 km line-of-sight, however subsequent realignment now places the pipeline closer to this nest. The absence of a nest activity assessment undertaken in the 21/22 breeding season has no implications for the assessment of impact nor future management around that nest (or others in which an activity assessment wasn't undertaken) as an activity assessment provides information for one breeding season only. This nest (as for others) will be assessed for activity on an as needs basis, along with each of the other nests within 500 m direct distance and/or 1,000 m line-of-sight, only if works cannot be undertaken outside of the breeding season within their vicinity (with the mitigation hierarchy outlined below stipulation that works can only occur around a nest within the breeding season if an activity assessment has proven it is inactive for that season).

3.2.4.3. IMPACTS

This species uses the surrounding areas for both nesting and foraging. It is likely the site extends over a number of territories based on the distance between nests and the size of the proposed pipeline. Given the ubiquity of land for flying over (including while searching for food) and the proposal not proposing any aerial obstructions, the proposal does not present any potential impact pathways in relation to collisions nor flight obstructions.

Direct clearance of nests is also not a potential impact pathway. Due to the nature of the pipeline being laid underground and the pipeline avoiding all known eagle nests (*i.e.* not requiring direct clearance/removal of nest trees) there are no expected direct impacts to eagles.

Disruption of an active nest within a particular breeding season is a possible impact pathway for nests within 500 m direct distance or 1 km line-of-sight of the proposed works. The primary approach to mitigation for this aspect will be to conduct works within these radii outside of the eagle breeding season. Failing that a process informed by annual activity assessments will apply. For nests that are inactive in a given year or beyond the specific constraints radii, disruption of a breeding event will not be a potential impact pathway.

Impacts due to the presence of permanent infrastructure are not considered to present a disturbance to eagles, with audible impacts expected to be negligible. The only sites within 500 m of a nest that could conceivably pose an audible disturbance is the balance tanks on Valleyfield Road and Billop Hill (in the vicinity of nest 3221 and 3219). The balance tanks will have no audible sound during operations. The tanks are designed so water enters and exits from the base of the tank which causes the water entering the tank to be baffled by the water already in the tank. In terms of visual

disturbance from new infrastructure in the landscape, such passive infrastructure as far as we are aware is not specified as a potential impact pathway or threat. Indeed, in the context of current equivalent objects within the local landscape, taking the subset of nests that were known to be active in the 21/22 season (2/3 of which raised fledglings successfully), these nests have multiple examples of buildings within their viewsheds, with no apparent impacts on breeding attempts within the season assessed (noting the failed nesting attempt was informally reported to be a result of unregulated works (unrelated to the current project and by an unrelated party) within the immediate vicinity of the nest and the nest was noted to have been successful in the past – J. Wiersma, FPA, pers. comm.) (Table 32).

The scope of maintenance will vary from scheme-wide to single sites, and from routine and scheduled to emergency. Maintenance within 500 m or 1 km line-of-sight of an active nest within a given season may be a potential impact pathway as breeding disruption. Ongoing (routine) maintenance is expected to be minimal, with operations and maintenance typically restricted to 1 light vehicle (operating in daylight hours, weekdays only), and typically occurring once a fortnight (up to weekly in some situations). As this may need to occur within the breeding season, and potentially when a nest in the vicinity has been confirmed active, or within the period from the beginning of the breeding season up until a nest check can be conducted, the exceptional circumstances mitigation measure will apply in those scenarios to minimise the potential for impacts.

Major maintenance will be periodic at the primary asset sites (pump stations, balance tanks, and dams). This will include the use of light and heavy vehicles over a period of up to a week, in daylight hours. Pump stations will typically have annual maintenance with 2 or 3 light vehicles, and significant maintenance involving some heavy vehicles (1 to 2) every 5-10 years. Balance tanks and the dam will typically require additional maintenance every 10-20 years, which may include heavy vehicles and heavy plant for up to a week. For sites that are within 500 m direct distance and/or 1,000 m line-of-sight of active eagle nests, major maintenance work will be scheduled to be conducted outside of the breeding season to the extent possible. Where this is not possible, a nest activity assessment will be undertaken to advise if works can occur within the breeding season without disrupting a nest. In a situation where maintenance is required (either emergency or routine) within the breeding season in the vicinity of a nest that is active (or assumed to be active, such as in the absence of a nest activity assessment that season) the exceptional circumstances mitigation measure will apply to minimise the potential for impacts.

Changes in land use and land clearance, the potential for the introduction of weeds and disease, and changes to water quality and flow regimes, are not considered to be a risk to the persistence of wedge-tailed eagles throughout the broader landscape (nor significant impacts in general), as their existing ranges within the local landscape already include a multitude of variations within these variables and the scope for change is simply too small in the context of eagle home range and population size (see discussion above of minor changes in vegetation extents and concentration of works in already cleared agriculture land), as well as in the context of over-arching project mitigation measures such as weed and hygiene management and aquatic crossing protocols (see **Section 3.5**).

Table 31: Summary of nest locations, survey effort, and activity status (2021/22 breeding season).

RND	Easting	Northing	Within 500 m Direct Distance	Within 1 km Line-of-sight	Activity Assessment Completed (2021/22 Breeding Season Only)	Activity Status (2021/22)	Activity Status (2023/24)	Located May 2021 Survey	Located June/August 2023 Survey	Additional Notes
886	522813	5367105	No	No	No	-	Inactive	Yes	Yes	Large, bleached nest in dead tree.
964	524119	5365943	No	Yes	Yes	Inactive	Active	Yes	Yes	Moderate sized nest with a bowl with green lining at the time of the June 2023 survey. Eagles observed nearby.
1490	523814	5365796	No	Yes	No	-	-	No	No	Not located in either the May 2021 or June/August 2023 surveys.
1644	518470	5369160	No	No	No	-	Active	Yes	Yes	Nest deemed viable, with new material present in the nest at the time of June 2023 surveys.
1880	514485	5374463	Yes	Yes	Yes	Active (Failed)	Inactive	Yes	Yes	Breeding failed at this nest in the 2021/22 season.
2842	496910	5373534	No	Yes	No	-	Active	Yes	Yes	Small nest with very few sticks left however adult eagles were observed within 400 m of the nest during the June 2023 surveys.
2943	533830	5362366	Yes	Yes	Yes	Active	-	Yes	Yes	The stag containing this nest has fallen, evidence of the fallen nest still present on the ground. Confirmed fallen in June 2023 surveys.
2944	517956	5386111	No	No	No	-	-	Yes	Not within survey area	Not resurveyed in June 2023. Outside of search area.

RND	Easting	Northing	Within 500 m Direct Distance	Within 1 km Line-of-sight	Activity Assessment Completed (2021/22 Breeding Season Only)	Activity Status (2021/22)	Activity Status (2023/24)	Located May 2021 Survey	Located June/August 2023 Survey	Additional Notes
2949	539905	5355229	No	Yes	-	Active	Active	Yes	Yes	Small nest hidden in the canopy.
2950	515038	5379229	Yes	Yes	No	-	Active	Yes	Yes	Large nest spread across two levels. Fresh material observed in the nest during the June 2023 surveys.
3135	514387	5374571	Yes	Yes	No	-	-	No	No	New NVA nest, first recorded in February 2023. Not relocated during June/August 2023 surveys.
3218	516555	5381709	Yes	Yes	No	-	Active	No	Yes	Located south of Mount Joy and Powranna Roads. The nest is located in a large *Eucalyptus obliqua*, with signs of recent use including fresh green leaves and brown sticks. An adult wedge-tailed eagle was perched within 100 m of this nest.
3219	501896	5371899	Yes	Yes	No	-	Manage as Active	No	Yes	Located within 500 m of the Poatina balance tank site. Nest is located in a medium-sized *Eucalyptus amygdalina*. Eagles were present on the nest at the time of survey; thus, a detailed assessment was not possible.
3220	518897	5373215	No	Yes	No	-	Inactive	No	Yes	Located on the southern edge of a farm dam. The nest is in a large *Eucalyptus viminalis*, with some fresh brown sticks present at the time of survey.
3221	533816	5362370	Yes	Yes	No	-	Inactive	No	Yes	New nest 20 m west of the fallen nest 2943.

3.2.4.4. MITIGATION MEASURES

Due to the number of nests throughout the landscape, it was not possible to completely avoid areas within 500 m and/or 1,000 m line-of-sight from known eagle nests. Although complete avoidance hasn't been possible, realignments have ensured that the number of known nests immediately adjacent (or within viewshed) to the works area is the minimum that can be achieved with the spatial requirements of the project, and importantly no nests require direct removal from the proposed alignment.

The primary need for mitigation is in relation to the risk of disrupting a breeding event by undertaking works around an active nest within a given breeding season. To minimise the risk of disturbing an active nest, Tasmanian Irrigation have committed to prioritising undertaking all works that occur within 500 m or 1,000 m line-of-sight of a known active eagle nest outside of the eagle breeding season (which spans from the beginning of July until the end of January, unless advice surrounding a lengthened breeding season into February is provided by the Forest Practices Authority through their annual update in November).

To inform this process through construction, annual eagle nest activity assessments (utilising assessment methods supported by the Forest Practices Authority) will be carried out on as a needs basis if the works schedule may benefit from works within a breeding season in the vicinity (500 m direct distance or 1 km line-of-sight) of specific nests – if an activity assessment conclusively shows that a nest is not active for that season, then works can be undertaken within the breeding season without risk of disrupting a breeding event. If a nest is found to be active, then no works will occur until the end of that given breeding season, which will eliminate the potential for disturbance. As annual nest activity can only be assessed through surveys undertaken in the breeding season (typically around October/November - to establish if the constraints can be lifted for the remainder of that season around inactive nests), activity in the vicinity of nests will by default not be undertaken from the commencement of any season (July 1st) until an activity assessment proves a nest is inactive for that season (i.e. each nest will be assumed to be active for a season until proven otherwise, and constraints applied accordingly until an activity assessment is undertaken).

For situations during operations, where maintenance (routine or otherwise) may be required within the vicinity of an eagle nest, annual activity assessments following the same process will inform the proponent as to which nests are inactive and can thus be worked around without the risk of disturbance. In a situation where maintenance is required (either emergency or routine) within the breeding season in the vicinity of a nest that is active (or assumed to be active, such as in the absence of a nest activity assessment that season) it will be considered to be exceptional circumstances and a specific set of mitigation measure will apply to minimise the potential for impacts – these measures are broadly consistent with Forest Practices Authority guidelines for conducting browser management and planting during the eagle management constraint period around potentially active nests, and thus have been tried and tested for this kind of scenario[191]; the exceptional circumstances measures are as follows:

- All workers must be aware of the nest location but take care not to actively spend too much time observing the nest while they are within 500 m or 1 km line of sight – i.e., the eagle/s are likely to be less disturbed if they can be seen but are not actively observed.
- **No activity to be conducted within 200 m of the nest.**
- **Within 500 m or 1 km line of sight, a maximum of 2 light vehicles are permitted for up to 30 minutes and a maximum of 2 visits per week.**
- If safety requirements allow, discreet colours rather than hi-visibility clothing should be worn.
- Parked vehicles will not be within line-of-sight of the nest.

[191] Forest Practices Authority (2023)

- Workers will remain in close proximity to each other as much as possible as this is less threatening to eagles than people being spread out over large distances.
- Any worker breaks must be conducted outside of the eagle nest vicinity (500 m and 1 km line of sight).
- In the event that the either of the bold clauses, or all of those not in bold, are not achievable, and/or one or more eagles are noted on or around a nest during works (or the nest is already known or assumed to be active when the exceptional circumstances have been triggered), NRE as a State regulator must be notified immediately and a nest-specific management plan prepared by the proponent to the satisfaction of the regulator, with further mitigation measures to be implemented to the degree practicable on a case-by-case basis. These measures may include:
    - If possible/deemed necessary, the works to cease immediately – until the nesting season is finished and/or the nest is deemed inactive.
    - If the nature of the works are such that they cannot cease, suitably qualified ecologist/s must be present to observe and monitor the eagle(s) for signs of distress and disruption of breeding activity and advise the contractors accordingly of periods when work can occur.
    - Further advice from the regulator will be sought in the event of eagle distress/disturbance.

Where possible, routine maintenance will be scheduled outside of the breeding season, or within the breeding season only in the vicinity of nests proven to be inactive for that season. Failing this, the exceptional circumstances principles will apply.

A summary of proposed mitigation is provided in Table 33, and an assessment of the project against the significant impact criteria for the Tasmania wedge-tailed eagle is provided in Table 34. As the process of avoidance, seasonal constraints, annual activity assessments and limits around active nests mirrors the nest management techniques applied extensively within the Tasmanian forest practices system, they can be taken with a high confidence to be effective.

Table 32: Passive infrastructure elements in 21/22 season

Nest Number	Status 2021/22	Location	500 m Buffer	1,000 m Buffer
1880	Active (Failed)	Macquarie Settlement Road	No buildings, softwood plantation	5 building visible excluding vegetation. 8 buildings visible including vegetation. Numerous driveways and fences.
2943	Active	Valleyfield	No buildings, Valleyfield Rd (~225 m in length)	Transformer station - visible excluding vegetation. Valleyfield & Macquarie Roads visible. Numerous driveways and fences.
2949	Active	South of the Campbell Town golf course	Rifle range bunkers – visible including vegetation	Rifle club - 3 buildings - visible including vegetation. Numerous fences.

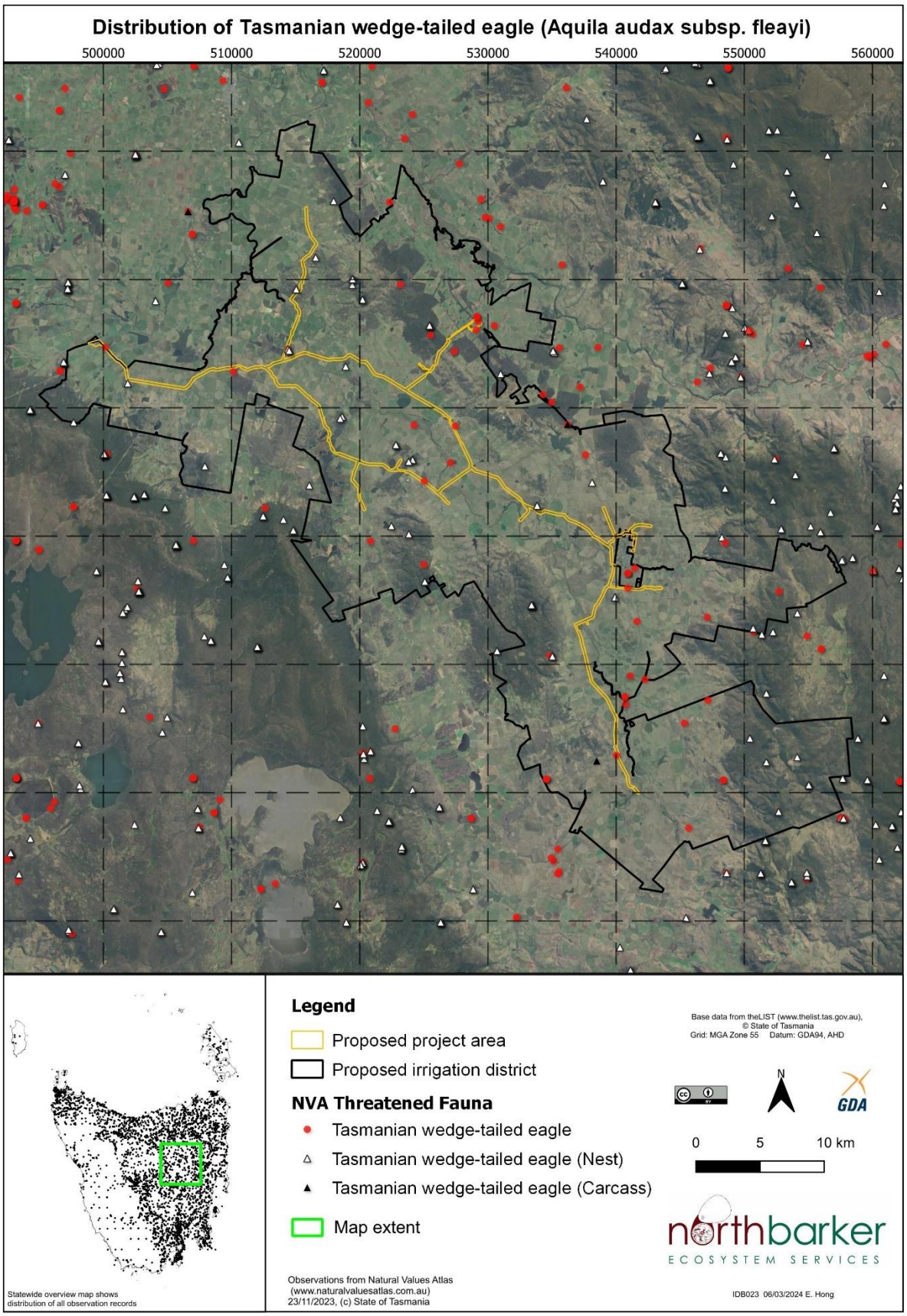


Figure 16: Distribution of Tasmanian wedge-tailed eagle nest records

3.2.4.5. SUMMARY OF MITIGATION AND AVOIDANCE MEASURES

Table 33: Summary of mitigation and avoidance measures for the Tasmanian wedge-tailed eagle

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
Prioritising construction outside of breeding season	The civil contractor will not conduct any works within 500 m direct distance and/or 1,000 m line-of-sight of an active eagle nest during the breeding season (defined as the beginning of July to the end of January, unless advice surrounding shortened or lengthened breeding season is provided by the Forest Practices Authority).	Tasmanian Irrigation Civil Contractors	Applicable to nests within 500 m direct distance and/or 1 km line-of-sight from construction areas. February – June (inclusive) designated as the period outside of the breeding season, other than following seasons in which breeding extends into February (which gets identified annually around November by the FPA and NRE.	**Very high** By eliminating works around active eagle nests during the breeding season, all potential impacts relating to the disruption of nesting activities will be avoided. This is consistent with the prescriptions of the Forest Practices Authority breeding season guidelines, which have been in operation within Tasmania for over 20 years, and are supported by NRE, with the same management prescriptions published on the threatened species profile for this species[192].
Aerial nest search	Commitment to undertake periodic aerial nest search/es outside of the eagle breeding season to detect any new nests within proximity of any active project construction areas – noting that any new nests will be subject to the same avoidance principles and seasonal constraints.	Tasmanian Irrigation	Applicable to area within 500 m direct distance and 1 km line of sight of works area. Every 2 years for the duration of the construction phase. February – June (inclusive) designated as	**Very high** Aerial nest searches (current for a maximum of 2 years) are a survey method developed by the Forest Practices Authority to document nest locations to aid management of disturbance to eagles in a dynamic landscape. These search methods are supported by NRE[193] and the EPA[194] and can be taken to have a high likelihood of success.

[192] Threatened Species Section (2023a)
[193] Threatened Species Section (2023a)
[194] Environment Protection Authority (2023)

			the period outside of the breeding season, other than following seasons in which breeding extends into February.	
Using annual eagle nest activity assessment to inform seasonal constraints around active nest sites	Survey conducted during the eagle breeding season to establish the activity status of known eagle nests within 500 m direct distance and/or 1 km line-of-sight of parts of the project area in which works may be required/desired during the eagle breeding season. Nests must be assumed to be active from the commencement of the season until a nest activity assessment proves otherwise. Works can be undertaken around inactive nests with no risk of disturbance. If a nest is active, no construction will occur (within 500 m or 1 km line of sight) for the remainder of the breeding season unless emergency principles must apply.	Tasmanian Irrigation Assessments conducted by the Forest Practices Authority or qualified practitioners	Applicable to nests within 500 m direct distance and/or 1 km line-of-sight from construction areas. Annually (for duration of construction) during breeding season, July – January (inclusive) (extended into February in late years). As required (for scheduled maintenance).	**Very high** Eagle nest activity assessments and associated constraints according to these principles (applicable to a single season only) are a mitigation method developed by the Forest Practices Authority to manage disturbance to eagles in a dynamic landscape. These search methods are supported by NRE[195] and can be considered to have a high likelihood of success.
Future planning	Forward planning of scheduled routine maintenance to occur outside of the eagle breeding season.	Tasmanian Irrigation	Applicable to nests within 500 m direct distance and/or 1 km line-of-sight from construction areas. February – June (inclusive) designated as the period outside of the breeding season, other than following seasons in which breeding extends	**Very high** Seasonal avoidance of routine maintenance around eagle nests (in conjunction with regular nest searches to identify new nest locations) will be effective at preventing nests from being disturbed by maintenance activities. As a contingency, the emergency works mitigation measure can apply around active (or not definitively inactive) nests.

[195] Threatened Species Section (2023a)

			into February.	
Exceptional circumstances	In exceptional circumstances (see **Section 3.2.4.4**) where works are required in the vicinity of any nest which is active that season, the following measures will be put in place within 500 m direct distance and/or 1 km line of sight of the respective nest (consistent with Forest Practices Authority guidelines for conducting browser management and planting during the eagle management constraint period[196]): • No activity to be conducted within 200 m of the nest. • A maximum of 2 light vehicles are permitted for up to 30 minutes, and a maximum of 2 visits per week between 200 m and 1,000 m radius from the nest. • If safety requirements allow, discreet colours rather than hi-visibility clothing should be worn. • Efforts should be made to ensure parked vehicles are not within line-of-sight of the nest. • Workers should remain in close proximity to each other as much as possible. This is less threatening to eagle than people being spread out over large distances. • Any worker breaks must be conducted outside of the eagle nest management zone. • In the event that eagles are observed on or around a nest during emergency works (or the nest is known to be active when the emergency procedure commences), the regulator must be notified immediately and a nest-specific management plan prepared by the proponent,	Tasmanian Irrigation Civil Contractors	Applicable to nests within 500 m direct distance and/or 1 km line-of-sight from operational areas.	**Very high** Limited interaction with nests during the breeding season may be necessary in the event of an emergency, however with these measures in place (consistent with those used within the forestry industry[197]), potential nest disturbance due to emergency works can confidently be mitigated

[196] Forest Practices Authority (2023)
[197] Forest Practices Authority (2023)

	with further mitigation measures to be implemented to the degree practicable on a case-by-case basis. These measures may include: ○ If possible, the works to cease immediately – until the nesting season is finished and/or the nest is deemed inactive. ○ If the nature of the emergency is such that works cannot cease, suitably qualified ecologist/s must be present to observe and monitor the eagle(s) for signs of distress and disruption of breeding activity and advise the contractors accordingly. ○ Further advice from the regulator will be sought in the event of eagle distress.			

3.2.4.6. SIGNIFICANT IMPACT ASSESSMENT

Table 34: Significant impact criteria with regards to the Tasmanian wedge-tailed eagle

Significant Impact Criteria	Likelihood of Significant Impact	Comments
1. Lead to a long-term decrease in the size of a population.	None	The Tasmanian subspecies of the wedge-tailed eagle occurs only in Tasmania and as a single population[198]. The scale of the proposed works will not lead to the long-term decrease in the size of a population. The commitment to limiting construction within 1 km line-of-sight of known nests to outside of the breeding season will mitigate the risk of nest abandonment in the area and eliminate any potential impacts of the project on local recruitment and breeding productivity – noting that even if these nests were impacted it would not necessarily constitute an impact at the population level.
2. Reduce the area of occupancy of the species.	None	The small scale of permanent vegetation clearance will not reduce the area of occupancy for this species in any meaningful way as the entirety of the footprint will still be viable habitat after works. No nesting trees will be removed nor impacted, ample foraging habitat will remain post-construction, and all of the habitat will remain equally suitable for flying over, hunting, dispersal, etc.

[198] Threatened Species Section (2006a)

Significant Impact Criteria	Likelihood of Significant Impact	Comments
3. Fragment an existing population into two or more populations.	None	The proposed works will not fragment an existing population into two or more populations. As this species is a strong flyer and has the capacity to fly between habitat patches; as such it can be expected to be less vulnerable to habitat fragmentation than sedentary and terrestrial species. Indeed, no equivalent project has ever been documented to have a fragmentation effect and an extremely large barrier (such as Bass Strait) would be required to fragment a population into two or more populations.
4. Adversely affect habitat critical to the survival of a species.	None	No habitat critical to the survival of this species will be impacted due to the proposed works. As there will be no impact to mature trees likely to support a nest of this species and the project has a commitment to protect potential breeding activity with seasonal constraints on works around nests.
5. Disrupt the breeding cycle of a population.	None	Limiting works to outside of the breeding season around active nests for the wedge-tailed eagle eliminates the possibility of disrupting the breeding cycle of this species.
6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	None	The application of the scheme will not facilitate a change in land use that will affect foraging habitat for this species to a meaningful degree as essentially any habitat can be searched for prey and flown over in search of prey – nor will it lead to the clearing of potential nesting habitat, as any potential areas would be on land that is unsuitable for irrigation. Thus, the proposed works will not modify, destroy, remove, isolate, or decrease the availability of habitat such that this species is likely to decline.
7. Result in invasive species that are harmful to the species becoming established in the species' habitat.	None	No likelihood that the project will result in invasive species that are harmful to the species becoming established in the species' habitat – numerous invasive species already present in the area (see **Section B**) provide prey opportunities or merely have a benign presence in relation to eagles.
8. Introduce disease that may cause the species to decline.	None	There is no likelihood that the proposed works will introduce disease that may cause this species to decline, and no disease is considered to be a risk to the species in the context of the proposed action.
9. Interfere with the recovery of the species.	None	Recovery of this species is primarily dependent upon the protection of existing critical habitat and breeding opportunities. The habitat within the footprint is not considered critical and the suboptimal habitat in the area will only be impacted temporarily and thus will not affect recovery.
Summary		
Thus, with the commitment to complete works outside of the breeding season wherever possible, and with annual eagle nest activity assessments conducted during the construction phase to inform potential construction exclusion areas, the proposed action will not have a significant impact on the Tasmanian wedge-tailed eagle.		

3.2.5. TASMANIAN MASKED OWL (*TYTO NOVAEHOLLANDIAE CASTANOPS*)

3.2.5.1. CONTEXT

The Tasmanian masked owl (EPBCA Vulnerable) is a vertebrate predator that is most active at night, and roosts during the day. It feeds predominantly on introduced birds, rodents and rabbits in agricultural landscapes, and arboreal marsupials, terrestrial mammals, and native birds in less disturbed habitats. The subspecies' diet can vary greatly between sites, and individuals can switch between prey items depending on availability and prey size[199]. The subspecies is generally found in territorial pairs, or as solitary individuals that are most likely juveniles[200]. Pair bonds are lifelong, and pairs appear to occupy a permanent home range or territory[201].

The subspecies inhabits a diverse range of forests and woodlands, including agricultural and forest mosaics. Forests with relatively open understoreys, particularly when these habitats adjoin areas of open or cleared land, are particularly favoured [202]. Breeding is reported to be highly seasonal in Tasmania[203], with most females laying in mid-October to early November[204], though in May 2006 a nest was found containing a small chick (Bell, *pers. comm.*). Nesting occurs in large tree hollows of living or dead trees, but sometimes in vertical spouts or limbs[205].

The core range of the Tasmanian masked owl is forest that occurs at low elevation (<600 m above sea level) with mature forest elements[206]. Potential habitat for the masked owl is all areas in Tasmania with trees with large hollows (≥15 cm entrance diameter); remnants and paddock trees (in any dry or wet forest type) in agricultural areas may also constitute potential habitat[207]. Tree size is frequently used as a substitute for hollow availability due to the difficulty of detecting suitable hollows from the ground, as trees with >100 cm diameter at breast height (DBH) have a higher probability of containing hollows suitable for masked owls than smaller diameter trees[208]. Significant habitat for the masked owl is any area of native dry forest, within the core range, with trees with large hollows (≥15 cm entrance diameter) and can include remnants and paddock trees in agriculture areas if they contain large old hollow-bearing trees[209].

The project area is within the core range for this species and there are a number of records of masked owls in the broader area (Figure 18), with 2 recorded on the NVA attributed to within 500 m of the project area[210] (with the most recent occurring in 2015) and 30 records within 5 km of the project area[211]. There are however no known nests within the irrigation district, with the nearest being around 15 km north from the boundary[212].

3.2.5.2. SURVEY FINDINGS

The project area on the whole doesn't meet the definition of significant habitat as it is primarily an agricultural landscape with scattered remnant habitat elements, as opposed to a broad area of native forest supported by surrounding modified landscape and remnant trees, which would be more akin to

[199] Green (1982); Green and Rainbird (1985); Mooney (1992); Mooney (1993)
[200] Higgins (1999)
[201] Hill (1955); Kavanagh and Murray (1996)
[202] Debus (1993); Bell *et al.* (1997); Higgins (1999)
[203] Mooney (1997)
[204] Green (1982); Mooney (1997)
[205] Bell *et al.* (1997); Higgins (1999)
[206] Forest Practices Authority (2014b); Threatened Species Section (2023b)
[207] Forest Practices Authority (2014b); Threatened Species Section (2023b)
[208] Forest Practices Authority (2014b)
[209] Forest Practices Authority (2014b); Threatened Species Section (2023b)
[210] Department of Natural Resources and Environment Tasmania (2023)
[211] Tasmanian Natural Values Atlas data – as of 23 November 2023
[212] Tasmanian Natural Values Atlas data – as of 23 November 2023

significant habitat[213]. The project area is potential habitat nonetheless, with the area as a whole representing foraging habitat (although this would be expected to be much less frequent in the larger sections of cleared land away from forest margins) and scattered potential nesting/roosting elements. There are several large trees and stags with the potential of supporting viable hollows for this species (roosting or nesting) within the survey area. The project area includes 93 potential roost/nesting trees (15 of which are stags) for this species (>70 cm DBH), noting this is a very conservatively low threshold for a potential masked owl habitat tree, which are more typically >100 cm DBH – we have taken a conservatively low threshold as a rapid assessment method only, noting smaller trees can sometimes contain viable roosting or nesting elements[214]. The location of these trees is displayed in Figure 17 and Table 35, with the highest concentration of trees shown in Inset A and Inset B.

Table 35: Location of potential habitat trees within the construction corridor

Tree ID	Species	Diameter at Breast Height (m)	Tree Protection Zone (m)	Easting	Northing	Location
5	Black gum	0.9	10.8	513401	5371963	East of Quarry Rd
13	Black peppermint	1.2	14.4	513433	5372099	East of Quarry Rd
15	Black peppermint	0.9	10.8	513421	5372098	East of Quarry Rd
21	Black peppermint	1.0	12.0	526907	5375292	Barton Rd
22	Black peppermint	1.0	12.0	526917	5375280	Barton Rd
23	Black peppermint	1.2	14.4	526926	5375289	Barton Rd
28	Black peppermint	1.0	12.0	527780	5375989	Barton Rd
54	Cabbage gum	0.9	10.8	525945	5373506	Barton Rd
84	Stag	1.0	12.0	528450	5376390	Barton Rd
89	Black peppermint	1.0	12.0	502033	5372178	Billop Rd BT
94	Black peppermint	1.3	15.0	502187	5372161	Billop Rd BT

Outlined in Table 36, the construction corridor contains 12.46 ha of forested vegetation that represents the highest quality habitat in terms of foraging opportunities for the masked owl, and only 0.30 ha (0.40 % of the total in the design corridor) is expected to be permanent loss of habitat. All remaining habitat may see the removal of trees and shrubs, but the site will remain viable as a foraging resource both during and post construction – indeed as per the definition in **Section 3.2.5.1**

[213] Forest Practices Authority (2014b); Threatened Species Section (2023b)
[214] Forest Practices Authority (2014b)

in relation to forest edges being used disproportionately [215], the new edge may function as better quality foraging habitat post-works. All non-forest vegetation remains as viable foraging habitat as per the definitions of viable habitat in **Section 3.2.5.1** and on the basis that habitat structure and composition will be reverted to equivalent to its original state with rehabilitation commitments.

For contextual purposes, further to the known trees and forested vegetation within the design and construction corridors, an estimation of the availability of trees within the broader area has been modelled using the Forest Practices Authorities mature habitat layer[216]. The stratification of mature habitat is provided in

Table 37, and is habitat classes from within 5 km of the design corridor are displayed in Figure 17. According to the Forest Practice Authority field-verified assessment criteria (

Table 37), due to the mapped availability of mature habitat within 5 km, it can be expected that at a minimum, there are a further 161,767 mature trees (>70 cm DBH) present in the local landscape. This estimate does not take into account the potential for paddock trees, or sporadic large trees within low maturity forest, so is a minimum estimate of available habitat trees (noting the scattered trees recorded within the project area do not even register as viable mature forest habitat in this modelling). Of these 161,767 trees, approximately 29,975 (at a minimum) would be expected to be greater than 1 m DBH and thus in the optimal size range suitable for the habitat requirements for the Tasmanian masked owl for roosting or nesting[217] (

Table 37).

[215] Debus (1993); Bell *et al.* (1997); Higgins (1999)
[216] Forest Practices Authority (2016) Mature Habitat Layer
[217] Forest Practices Authority (2014b)

Table 36: Forest/mature habitat[218] elements in relation to the project area (all areas in hectares)

	Within Construction Corridor	Within 5 km
NBES Forested Vegetation	12.46	N/A
TASVEG 4.0 *Eucalypt* Forest Extent	11.95	24,776.65
Mature Forest Availability- High	0.37	3,746.97
Mature Forest Availability - Medium	0.68	5,004.64
Mature Forest Availability - Low	1.98	11,469.37

Table 37: Mature habitat availability[219] within local landscape

Mature Habitat Availability Class	Field-based Assessment Criteria*	Availability within 5 km (ha)	Predicted Number of Trees Within 5 km
High	At least 8 trees per hectare >100 cm DBH	3,746.97	29,975 trees > 1m dbh (not withstanding additional trees > 70 cm DBH)
Medium	At least 8 trees per hectare >70 cm DBH	5,004.64	40,037 trees > 70 cm dbh (notwithstanding that this could include trees > 1 m DBH)
Low	Trees >70 cm DBH are present, but less than 8 trees per hectare	11,469.37	Up to 91,755 trees > 70 cm DBH (notwithstanding that this could include trees > 1 m DBH)
Negligible	No eucalypt trees >70 cm DBH	-	-

[218] Forest Practices Authority (2016) Mature Habitat Layer
[219] Forest Practices Authority (2016) Mature Habitat Layer

Total (High and Medium Class minimum estimate plus upper estimate for Low Class)	**Estimated 161,767**

3.2.5.3. IMPACTS

Avoidance of most of the viable masked owl habitat trees has been achieved with realigning the corridor in earlier design iterations, but pinch points in the required alignment and the distribution of trees in some areas means that complete avoidance has not been achievable. Thus, some of the potential habitat trees recorded are likely to require removal for the pipeline (up to 11 trees) or could simply be exposed to compromising root impacts. There may also be impacts to the tree protection zone of trees outside of the construction corridor, but this will not conceivably impact the main habitat trait relevant to the masked owl, that being large hollows, generally within the main stem, which can function as habitat independent of tree health and marginal root impacts (non-structural) at such distance (outside of the tree protection zone).

Proportional to the minimum number of equivalent trees within the broader landscape of 5 km (Table 36 and Table 37) noting 5 km would be expected to be well within the home range of any resident individuals[220], the loss of up to 11 potential habitat trees represents a maximum loss of 0.006 % of the equivalent potential habitat trees available within 5 km. Thus, this does not represent a significant loss of potential habitat trees at even the local landscape level as opposed to the population level (which covers tens of thousands of hectares). In terms of loss of dry forest habitat as a primary foraging resource, the loss of 0.30 ha to the permanent impact footprint represents only less than 0.001 % of the equivalent dry forest habitat available within 5 km, noting over 20,000 ha of this is modelled as containing mature forest elements (Table 36 and Table 37). This proportional loss thus cannot be seen as significant at even the most local level for any resident masked owls, let alone at a population level which covers tens of thousands of hectares.

Given the available records from the irrigation district indicate nesting occurrences are very rare in the region, and yet viable trees suitable for nesting/roosting are ostensibly not particularly uncommon (based on the number documented in this present study and the number modelled with the local area to a 5 km radius), the probability of a viable tree being in use by an owl at the time of works would by default be very low. Furthermore, given pairs of owls can occupy multiple hollows within a range[221], and have seasonality in moving between these hollows and using them as roosts and/or nests[222], it would seem even less unlikely that the small number of trees at risk of potential impacts would contain all of the habitat trees required by a pair of owls to persist within the area even if it was part of their core range. In addition, in a landscape in which viable hollow-bearing trees do not appear to be limited, given that owls can move around from hollow to hollow, establishing occupancy (presence/absence) at a habitat tree location prior to the point of works is not considered to have merit. Instead, assuring that an occupied tree is not impacted during works is a more direct and useful method. With these aspects considered, whilst it may be very unlikely the project will impact a nest or roost tree while in use by a masked owl (which would conceivably warrant consideration as a significant impact), a process of pre-clearance mitigation is nonetheless warranted to minimise the potential disruption of a breeding event should it be happening at the time of works. With this process ensuring no occupied tree will be impact, and potentially viable trees numerous in the local area (as well as equivalent or better potential foraging habitat), the project can avoid the potential for significant impacts on the species.

3.2.5.4. MITIGATION MEASURES

The priority mitigation strategy is to avoid the need for the removal of large trees with potential to support hollows wherever it is feasible. Designs have been modified to reduce potential impacts to

[220] Young *et al.* (2021)
[221] Young *et al.* (2021)
[222] Young *et al.* (2021)

habitat trees by excising as many as possible from the potential alignment; however, not all were able to be avoided in the process due to pinch points in the required alignment and the distribution of the potential habitat trees. A total of 11 trees remain in the proposed construction corridor – there may be further scope to avoid some of these through strategic alignment and further narrowing of the construction corridor at the key points, however this cannot be guaranteed as the extent of avoidance available from such fine-scale measures is not known at this stage and is largely dependent on the on-ground conditions at the time of works. Thus, for the current purposes the potential impacts to up to 11 trees are considered, and the significant impact assessment will assume that all trees will be removed.

If there are potential habitat trees within the construction corridor that cannot be avoided (*i.e.* require removal or structural root damage that would risk treefall), these trees will be subject to a habitat tree management protocol (**Attachment 13**) involving targeted hollow use inspections, which may in some cases involve tree climbing. An arborist assessment that determines the viability of retention for trees that are outside of the direct impact footprint will also be conducted for any potential masked owl habitat tree (as reported in the natural values assessment) that has a tree protection zone incursion > 10 % (as per the Australian Standard Protection of Trees on Development Sites AS 4970-2009). Trees that are determined as viable for retention must be marked as exclusions (including a tree protection zone buffer) on civil contracts and on the ground.

A summary of proposed mitigation is provided in Table 38, and an assessment of the project against the significant impact criteria for the Tasmania masked owl is provided in Table 39.

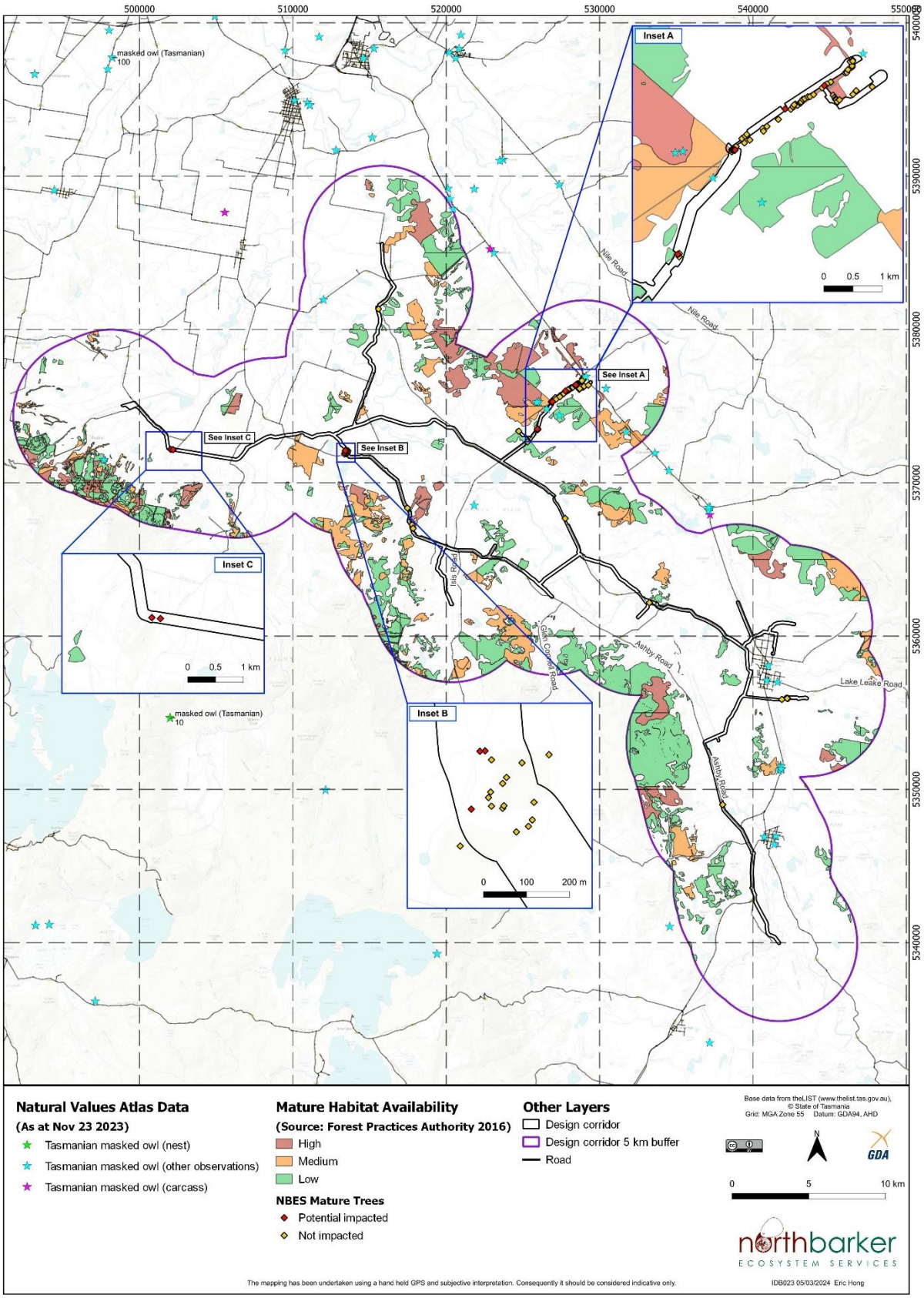


Figure 17: Location of trees within the project area, and availability of habitat from within 5 km (see tree density classes for habitat availability types within Table 29)

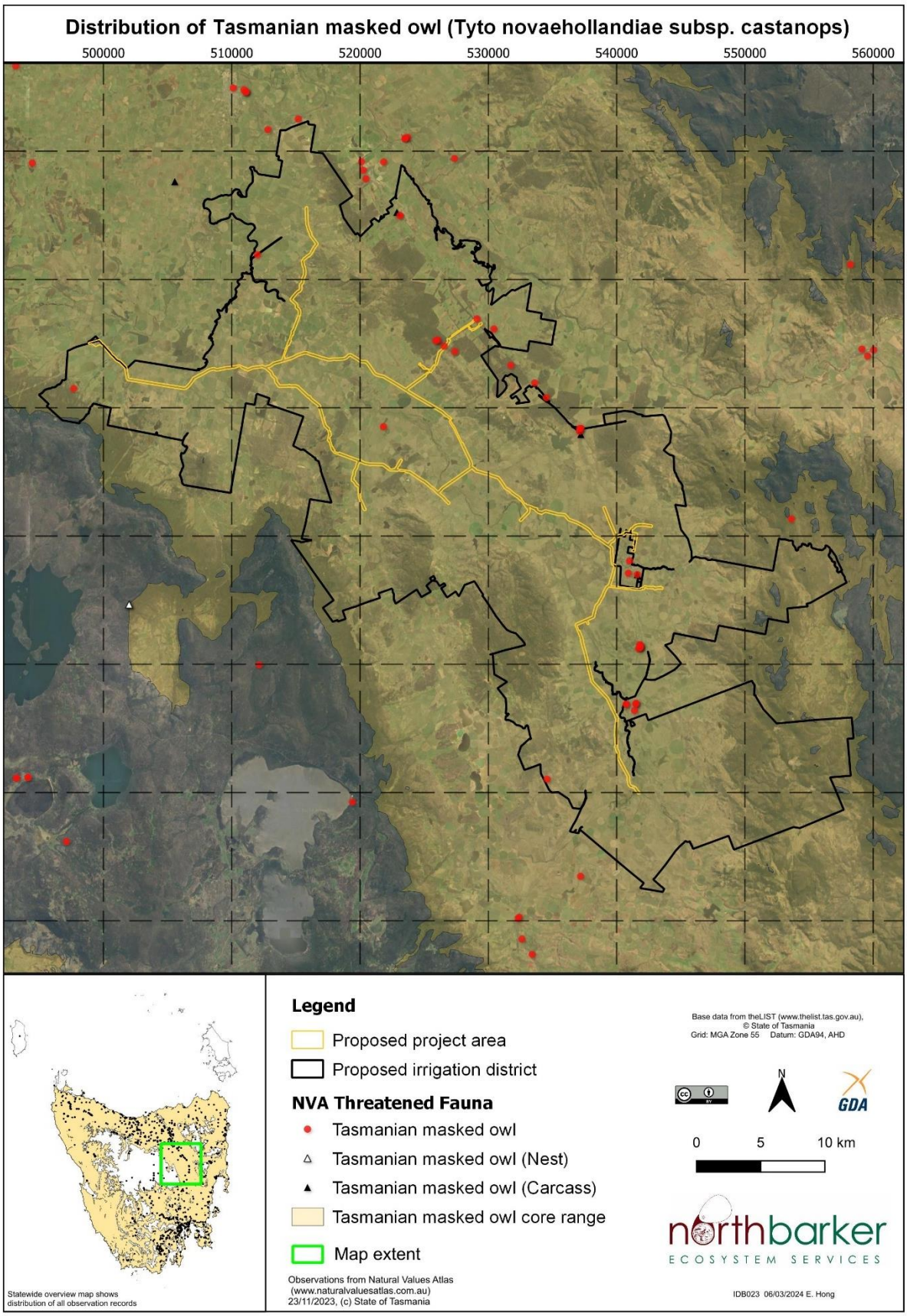


Figure 18: Distribution and core range of the Tasmanian masked owl

3.2.5.5. SUMMARY OF MITIGATION AND AVOIDANCE MEASURES

Table 38: Summary of mitigation and avoidance measures for the Tasmanian masked owl

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
Avoidance	Reduction of the design corridor to remove sections with higher densities of large, potential hollow-bearing trees. Design area boundaries are to be clearly marked on the CEMP.	Tasmanian Irrigation	Prior to referral and up to the point of works.	**Very high** This has been the preferred option and primary mitigation measure in all locations where potential habitat trees were recorded. The construction corridor has been narrowed and realigned to avoid 82 out of 93 trees identified during field surveys. Further avoidance may be possible in the final pinch point; however, this is dependent on the on-ground conditions at sites of impact, so impact consideration has been done on the worst-case scenario of none of these 11 being further avoidable. Where possible, avoidance ensures (with guaranteed effectiveness), that there is no loss of habitat or direct impact to individuals. Where is it not possible the supporting mitigation measure of individual tree management will have to apply.
Habitat tree protocol	The civil contractor must avoid the removal of potential habitat trees to the extent that is practicable. Trees that are identified as unavoidable impacts will be subject to a habitat tree management protocol (**Attachment 13**). If a tree is confirmed/likely to be a masked owl breeding tree, it will be excluded from clearance. A 150 m exclusion zone where no works will occur must be applied until fledging has completed (up to 18 weeks), breeding has failed, or additional evidence is available to refute the	Tasmanian Irrigation Department of Natural Resources and Environment (Permits)	Applicable locations marked on Protocol Application Area map (**Attachment 13**) Prior to tree removal (between March 1st and July 31st is preferred to reduce likelihood of nesting masked owls)	**Very high** The protocol considers the Australian Standard AS4970-2009 Protection of Trees on Development Sites and thus can be relied on to have captured all potential trees at risk of indirect or direct impacts. The method includes a multi-faceted survey method for determining use and occupancy at the time of proposed clearance and given the survey

	suspected breeding evidence. A monitoring program will be required to inform this process and will need to be determined by the ecologist as to what is most suitable for the particular nesting tree. Alignment deviation works can commence within this buffer area upon determination of absence from the ecologist.			techniques include direct observation there is effectively no chance occupation of a hollow could be overlooked. The method relies on a permit from the State regulators, thus providing scope for their further input and conditions of permit approval. The protocol specifies avoidance of works occupied hollows (no clearance) for a period of time until nesting has commenced, after which works can occur within the specified radius (but the tree will be retained). With these measures in place, we are confident the method can be effective in mitigation impacts to the masked owl.

3.2.5.6. SIGNIFICANT IMPACT ASSESSMENT

Table 39: Significant impact criteria with regards to the Tasmanian masked owl

Significant Impact Criteria	Likelihood of Significant Impact	Comments
1. Lead to a long-term decrease in the size of an important population.	None	No important populations have been formally identified[223], and although little is known of the local population density we have accepted the possibility that this should be classified as important, noting that a population for this species could either be defined as the entire State of Tasmania, or at the very least a huge regional area such as all lowland areas of the Midlands, east, south and north of Tasmania combined (grouped based on environmental similarity and evident occupation of owls across the area based on Natural Values Atlas records). A maximum total of 11 mature potential hollow-bearing trees suitable for the masked owl (12 % of the potential nesting trees recorded across the broader project area) may require to be removed under the proposed development. Although it is considered extremely unlikely (and effectively impossible from the ecological standpoint of this highly territorial species) that every single one of these trees is utilised for nesting and/or roosting by this species, it is assumed to be possible in this case for the purposes of assessment and mitigation. Any clearance of a potential hollow-bearing masked owl habitat tree will be subject to a habitat tree protocol (**Attachment 13**). The application of this protocol will ensure that there will be no direct impacts to masked owls due to the removal of potential habitat trees and no potential interruption of a breeding event. The availability of viable habitat trees does not appear to be limiting in the local landscape and therefore the potential loss of one or more (very unlikely)

[223] Department of Climate Change, Energy, the Environment and Water (2023b)

Significant Impact Criteria	Likelihood of Significant Impact	Comments
		trees used for roosting or nesting is likely to be available for replacement in the surrounding landscape, noting that a species that occupies inherently old and potentially unstable trees can be taken to have some internal resilience to occupying new hollows as an adaptation to when their hollows are lost through natural attrition. In addition, potential impacts in this scenario are restricted to a pair or birds at most (given the species is territorial and has very large home ranges[224]) and could not possibly be extrapolated to equal a significant impact on the size of the population as a whole. Therefore, the proposed action is not considered to have the potential to lead to a long-term decrease in the size of the population of this species.
2. Reduce the area of occupancy of an important population.	None	No important populations have been formally identified[225], and although little is known of the local population density we have accepted the possibility that this should be classified as important, noting that a population for this species could either be defined as the entire State of Tasmania, or at the very least a huge regional area such as all lowland areas of the Midlands, east, south and north of Tasmania combined (grouped based on environmental similarity and evident occupation of owls across the area based on Natural Values Atlas records). Given the highly mobile nature of this species, their large home range and the fact any impacts from the project will not render habitat inviable for use after works (at worst a cleared area will still constitute viable foraging and dispersal habitat, as evidenced by all the observations in cleared land shown in Figure 17), the species will still have the same potential for local occupancy after the completion of works. With this applicable at even the local level, it cannot conceivably be considered to have a risk of reducing the area of occupancy for the species at a population level.
3. Fragment an existing important population into two or more populations.	None	Because of the ecology of this species (highly nomadic, highly mobile and found in a range of environments including modified land and habitat mosaics), they are resilient to fragmentation, with no evidence we know of that fragmentation has ever been reported for the species. Thus, there is no risk of fragmenting an existing population into two or more populations (noting also that a population of the species can only be taken to cover a much greater area than that at risk of impacts from this proposal).
4. Adversely affect habitat critical to the survival of a species.	None	Disruption of the use of breeding and roosting habitat elements from the proposal will be prevented via the application of the habitat tree management protocol. Given the extensive availability of equivalent potential habitat trees recorded for the project and not at risk of impacts (with only 12 % of the potential habitat trees remaining in the project area), the project is not considered to have a risk of impacting critical habitat in a way that adversely affects the likely survival of

[224] Young *et al.* (2021)
[225] Department of Climate Change, Energy, the Environment and Water (2023b)

Significant Impact Criteria	Likelihood of Significant Impact	Comments
		even a local resident pair of birds, let alone the species as a whole.
5. Disrupt the breeding cycle of an important population.	None	No important populations have been formally identified[226], and although little is known of the local population density; we have accepted the possibility that this should be classified as important. Provided that the habitat tree protocol is applied, there will be no disruption of the breeding cycle of the population and no risk of significant impacts from this aspect – noting that even without the protocol in place the risk of breeding occurring within one of the habitat trees at risk at the same time as works are occurring is considered to be very low.
6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	None	Given that the 11 trees that may be impacted represents only 12 % of the potential habitat trees across the broader project area (and the availability of potential habitat in the wider landscape), the action will not modify, destroy, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline. Indeed, all impacted areas following works will still constitute viable habitat for the species, and no limited habitat elements are at risk of being lost from the works.
7. Result in invasive species that are harmful to the species becoming established in the species' habitat.	None	There is no likelihood that the project will result in invasive species that are harmful to the species becoming established in the species' habitat. The species uses introduced species extensively as prey items and no introduced species are currently listed as a threat[227].
8. Introduce disease that may cause the species to decline.	None	There are no diseases applicable to the nature of works that are listed as threats to the species[228] and no likelihood that the project will introduce disease that may cause the species to decline.
9. Interfere (substantially) with the recovery of the species.	None	There is no recovery plan for this species. Given the action is not anticipated to have even an effect on the likelihood of local persistence of the species, it cannot conceivably be seen to have a likelihood of interfering with the recovery of this species overall.
Summary		
The proposed action will not have a significant impact on the Tasmanian masked owl.		

[226] Department of Climate Change, Energy, the Environment and Water (2023b)
[227] Department of Climate Change, Energy, the Environment and Water (2023b)
[228] Department of Climate Change, Energy, the Environment and Water (2023b)

3.2.6. SWAN GALAXIAS (*GALAXIAS FONTANUS*)

3.2.6.1. CONTEXT

This EPBCA endangered listed species is known only from the Swan River and Macquarie River catchments of eastern Tasmania[229]. It is known to only inhabit areas not colonised by the introduced brown trout (*Salmo trutta*) and redfin perch (*Perca fluviatilis*), as well as the native jollytail (*Galaxias maculatus*), which has become a threat to populations in the Macquarie River catchment[230]. There are 9 known core populations, which occupy approximately 11 km of stream, all of which have brown trout populations downstream[231], thus restricting movement of this species. These populations all occur in forested country, of low gradient, contain downstream barriers that prevent predator movement, and range from small spring-fed streams to larger rivers[232]. Populated streams are generally shallow with rocky bottoms, and abundant instream and streamside vegetation[233]. The populations are known from the foothills of the Eastern Tiers, in Snaky Creek, Coghlan's Creek, Blue Tier Creek, and Green Tier Creek.

The spawning season for this species occurs between August and October, which produces between 150 and 500 relatively large eggs (2.2 – 2.5 mm) [234].

One of the major threats to this species is the construction of water storages in or near populations, which may lead to inundation of habitat, introduction of predator species, destruction of existing barriers that prevent predator invasion, and the alteration of flow regimes[235].

Around the project area, potential habitat for this species is restricted to smaller streams that flow into the Macquarie River, with the smaller streams considered to have more potential as they have more protection from the brown trout, which are known from the Macquarie River (from Natural Values Atlas data). The pipeline route broadly follows the Macquarie River with at least 5 crossings. The species has been recorded 11 times within 5 km of the project area, with the most recent record in 2021[236] (Figure 19). A natural population of this species occurs in Dairy Creek and a small tributary near Macquarie Tier, for both of which the status of the population is unknown[237] and occur outside the project area. The pipeline route crosses Dairy Creek and Woodside Rivulet south of Poatina Road; this crossing sites are within modified drainage channels in agricultural land, which is unlikely to support this species based upon habitat descriptions[238] (i.e. the crossing lacks the rocky bottom and requisite aquatic vegetation, and the surrounds are inconsistent with the preferred forest environment) (Plate 5). Indeed, none of the crossings are considered to be consistent with the habitat descriptions presented above and were not considered as habitat viable enough to undertake targeted surveys for the species (Plate 5 and Plate 6), consistent with the first principle of recommended survey techniques for EPBCA threatened fish, which is to identify target species including through consideration of habitat suitability[239].

3.2.6.2. SURVEY FINDINGS

Targeted surveys were not conducted for this species based on the overall lack of suitable habitat due to the largely agricultural matrix and the presence of brown trout in the major waterways. In addition,

[229] Department of Climate Change, Energy, the Environment and Water (2023c)
[230] Threatened Species Section (2006b)
[231] Threatened Species Section (2006b)
[232] Threatened Species Unit (1998)
[233] Threatened Species Unit (1998)
[234] Threatened Species Section (2006b)
[235] Threatened Species Section (2006b)
[236] Tasmanian Natural Values Atlas data – as of 23 November 2023
[237] Threatened Species Section (2006b)
[238] Threatened Species Unit (1998)
[239] Commonwealth of Australia (2011)

it was considered due to the marginal suboptimal locations that establishing presence/absence at a particular time in the planning phase of the project would not necessarily accurately reflect the local distribution at the time of works in a way that would impact construction mitigation measures (nor would avoidance of a particular crossing point be viable in a sense that the crossing points are only 30 m wide and the species could be expected to move around at such a local scale where present).

In addition, in the unlikely event the species may move through areas proposed for aquatic crossing as part of the project, the environmental management commitments require that the crossing of waterways are subject to a watercourse crossing protocol, which allows for the potential presence of this species by addressing all potential impact pathways should it be present, thus eliminating the need for targeted surveys.

Plate 5: Dairy Creek crossing point, downstream of a known population

Plate 6: Example of a typical farm drain in the project area

3.2.6.3. IMPACTS

No known populations will be impacted by the proposed works and all crossings are not considered to be likely habitat/locations for the species to occur at, however the potential presence of the species has been allowed for on the basis of not having definitively been ruled out (to the degree that this is even possible for fauna species, given they can move around) and the project area being in the catchment of a known population.

Potential impact pathways for this species in relation to construction crossings are limited to the introduction of predator species, alteration of water flow and the removal of streamside vegetation (which may alter water flow and quality) [240], all of which will be mitigated with the construction aquatic crossing protocol.

The conversion of areas upstream from known populations to agriculture and/or silviculture is a possible impact pathway from operations in the district[241], which will be mitigate with the processes of the requisite water access plans (WAPs).

The construction of dams[242] can be another potential impact pathway due the conversion/inundation of populations and their habitats, however the proposed dam for this project will inundate agriculture land and will be fed via an intake from the Poatina Tailrace (a non-natural waterway), as such, no streams that may provide habitat for the Swan galaxias will be blocked/altered by this construction and no habitat will be lost to inundation.

3.2.6.4. MITIGATION MEASURES

To allow for the potential presence of conservation significant values in waterways and waterbodies in the works area, an aquatic crossing construction environmental protection guideline (EPG) has been developed (see **Attachment 9, Pages 23-29**) as part of TI's EPRs and must be implemented by the Contractor as part of a project specific Construction Environmental Management Plan (CEMP). This protocol includes the following risk minimisation strategies to address potential impact pathways to this species:

- Wherever practicable, construct crossings without disturbing the waterway, either by utilising above-ground crossing, or horizontal directional drilling techniques;
- Scheduling stream works in dryer months (November– March) to avoid higher flow rates. This also avoid works being conducted during the spawning season for this species;
- Minimising disturbance to stream flow, channel sediment, form, coarse woody debris, and aquatic vegetation by reducing the construction footprint as much as is practical;
- Diverting natural flow as is necessary to reduce the mobilisation of fine sediments. Stream beds must be reinstated to match the existing layers post-works;
- Utilise existing crossings where possible;
- Restrict machinery and vehicular use within stream areas to avoid unnecessary disturbance;
- Install sediment traps downstream of any ground disturbance upon commencement of construction; and
- Rehabilitate disturbed areas with native flora sourced from the local area.

With these measures in place, construction activities can with confidence minimise the disturbance to waterways that may contain potential habitat for the Swan galaxias through either avoiding direct impacts to in-stream values, or by having measures in place to ensure that the movement of fish is not impeded. With the application of this EPG, the proposed construction works will not conflict with the

[240] Threatened Species Unit (1998)
[241] Threatened Species Unit (1998)
[242] Threatened Species Unit (1998)

management objectives of the recovery plan for this species[243] and potential impact pathways from the construction will be mitigated.

Further to the application of the aquatic crossing mitigation measures, during the operational phase of the NMIS, individual irrigators must consider the impact to this species when applying water for irrigation such that flow regimes are not altered beyond acceptable levels. The impacts to this species will be assessed through the Farm WAP process, with potential for targeted surveys to be required if waterways that may support the species are likely to be subject to altered flow regimes. If the Swan galaxias is recorded during this process, a 50 m buffer of streams containing this species must be applied to satisfy the requirements of the Tasmanian Irrigation Strategic Assessment Priority Species Code[244]. This code was developed to assist in the assessment and management of biodiversity values within Farm WAPs. Should there be any impacts to any MNES within this 50 m buffer, individual irrigators may be required to refer their action independently. The buffer zone begins from the edge of known populations, or new populations if discovered[245].

A summary of proposed mitigation is provided in Table 40, and an assessment of the project against the significant impact criteria for the Swan galaxias is provided in Table 41. All of the relevant requirements within the EPG and WAP process are consistent with development mitigation measures referenced within applicable species guidelines[246] and thus can be treated with a very high degree of confidence, particularly in a scenario where the species is considered to have a relatively low likelihood of occurring within the impact areas (based on low habitat suitability and compatibly presence of introduced predators).

[243] Threatened Species Section (2006b)
[244] Department of Primary Industries, Parks, Water, and Environment (2012)
[245] Department of Primary Industries, Parks, Water, and Environment (2012)
[246] Threatened Species Unit (1998); Threatened Species Section (2023d); Threatened Species Section (2006b)

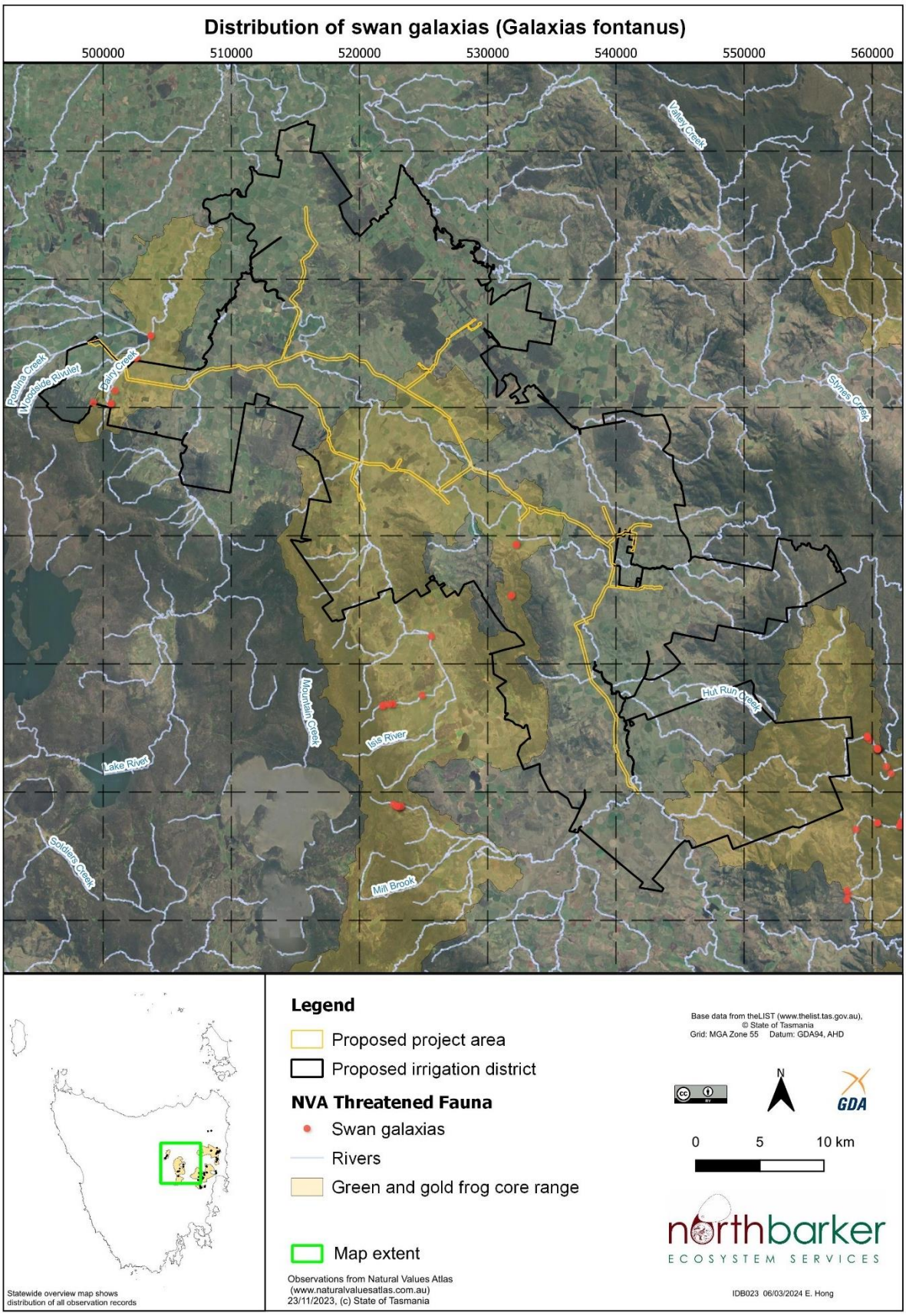


Figure 19: Distribution and core range of the Swan galaxias

3.2.6.5. SUMMARY OF MITIGATION AND AVOIDANCE MEASURES

Table 40: Summary of mitigation and avoidance measures for the Swan galaxias

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
Aquatic crossing EPG	The civil contractor must apply the impact minimisation strategies detailed in **Section 3.2.6.4** as well as complying with the provisions of the Tasmanian Irrigation Environmental Protection Requirements. The measures proposed in this protocol include: • Construct crossings without disturbing the waterway, either by utilising above-ground crossing, or horizontal directional drilling techniques; • Scheduling stream works in dryer months (November– March) to avoid higher flow rates. This also avoid works being conducted during the spawning season for this species; • Minimising disturbance to stream flow, channel sediment, form, coarse woody debris, and aquatic vegetation by reducing the construction footprint to the smallest extent possible. • Diverting natural flow as is necessary to reduce the mobilisation of fine sediments. Stream beds must be reinstated to match the existing layers post-works; • Utilise existing crossings where possible; • Restrict machinery and vehicular use within stream areas to avoid unnecessary disturbance; • Install sediment traps downstream of any ground disturbance upon commencement of construction; and • Rehabilitate disturbed areas with native flora	Tasmanian Irrigation Civil Contractor	All small waterway crossings (excludes major streams and rivers that contain brown trout) Entire duration of construction phase	**Very high** The aquatic crossing EPG is a mitigation method developed by Tasmanian Irrigation and has been applied to the construction of numerous irrigation schemes across several years. This protocol includes a Construction Water Quality Management Program, which operates in accordance with the Australian Pipelines and Gas Association Ltd (AGPA) Code of Environmental Practice – Onshore Pipelines, as well as an Erosion, Sedimentation and Surface Runoff EPG, and the NMIS Turbidity Management Framework. All of the relevant requirements within the EPG and WAP process are consistent with development mitigation measures referenced within applicable species guidelines and thus can be treated with a very high degree of confidence, particularly in a scenario where the species is considered to have a relatively low likelihood of occurring within the impact areas (based on low habitat suitability and compatibly presence of introduced predators).

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
	sourced from the local area.			
Farm WAP	A Tasmanian Irrigation program designed to identify, avoid, and mitigate risks to natural values due to the operation of the scheme. Each property that purchases water from the NMIS must have a Farm WAP. This will the risks associated with the potential for facilitated impacts to MNES. See **Section 1.1.1** for detail on process.	Tasmanian Irrigation Individual Irrigator	All applicable properties that wish to use NMIS water. Operational Phase	**Very high** The Farm Water Access Plan has been developed by Tasmanian Irrigation as a further measure to mitigate against impacts to natural values and processes. The Farm WAP process has been applied to over 15 irrigation schemes in Tasmania. Farm WAPs are a condition of Federal and State Government approval for all Tasmanian Irrigation built schemes. All of the relevant requirements within the EPG and WAP process are consistent with development mitigation measures referenced within applicable species guidelines[247] and thus can be treated with a very high degree of confidence, particularly in a scenario where the species is considered to have a relatively low likelihood of occurring within the impact areas (based on low habitat suitability and compatibly presence of introduced predators).

[247] Threatened Species Unit (1998); Threatened Species Section (2023d); Threatened Species Section (2006b)

3.2.6.6. SIGNIFICANT IMPACT ASSESSMENT

Table 41: Significant impact criteria with regards to the Swan galaxias

Significant Impact Criteria	Likelihood of Significant Impact	Comments
1. Lead to a long-term decrease in the size of a population.	None	The project impacts areas are not considered likely to support part of the local population, as a result of the lack of suitable habitat present at required crossings. As a further method of precaution however, the proposed mitigation measures allow for the presence of the species by applying targeted mitigation of potential impact pathways. With these measures in place, the action will not lead to a long-term decrease in the size of a population.
2. Reduce the area of occupancy of the species.	None	Given that the proposed crossings predominantly occur within agricultural land, which is sub-optimal habitat for this species, with the proposed mitigation measures in place, the action will not reduce the area of occupancy for this species.
3. Fragment an existing population into two or more populations.	None	Natural populations of this species are scarce, and extremely isolated, occupying less than 2.5 km of stream in most cases[248]. The project area does not intersect with an existing population and will not create an barriers within potential habitat, as such, the action will not fragment an existing population into two or more populations.
4. Adversely affect habitat critical to the survival of a species.	None	With the proposed mitigation measures in place, the action will not adversely affect habitat critical to the survival of this species.
5. Disrupt the breeding cycle of a population.	None	The aquatic crossings protocol recommends scheduling works around waterways during periods of drier weather when some streams may be dry, and also to avoid the spawning season for this species. Provided that this measure is adhered to, the proposed action will not disrupt the breeding cycle of a population.
6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	None	With the proposed mitigation measures in place, the impact to potential habitat for this species will be negligible, with all impacted areas to be returned to its original condition through revegetation. As such, the proposed action will not modify, destroy, remove, isolate, or decrease the availability of habitat to the extent that this species is likely to decline.
7. Result in invasive species that are	None	The proposed action will not result in invasive species that are harmful to the species (e.g. brown trout, redfin perch)

[248] Threatened Species Section (2006b)

Significant Impact Criteria	Likelihood of Significant Impact	Comments
harmful to the species becoming established in the species' habitat.		becoming established in the species' habitat nor will it conceivably exacerbate existing occurrences as it will not alter flow nor alter boundaries to their dispersal.
8. Introduce disease that may cause the species to decline.	None	The proposed action will not conceivably introduce disease that may cause the species to decline, noting no diseases are known to be a risk to the species.
9. Interfere with the recovery of the species.	None	With the proposed mitigation measures in place, the action will not interfere with the management objectives of the recovery plan for this species, which involve managing invasive species, reducing habitat loss and increased community engagement[249].
Summary		
The proposed action will not have a significant impact on the Swan galaxias.		

[249] Department of Climate Change, Energy, the Environment and Water (2023c)

3.2.7. GREEN AND GOLD FROG (*LITORIA RANIFORMIS*)

3.2.7.1. CONTEXT

In Tasmania, the species occurs in lowland areas in the south-east (where it is very rare) and north (where it is relatively common). It has declined significantly (over 20 %) in range and abundance over the last 30 years, having mostly disappeared from the Midlands, Derwent Valley, much of the Hobart region and parts of the north-west coast (although historical records are also less common in that region)[250].

Breeding occurs in permanent freshwater or slightly brackish habitats, generally with emergent vegetation. The species has been recorded in coastal swamps, marshes, dune swales, lagoons, lakes and other estuary wetlands as well as around riverine floodplain wetlands, billabongs and ponds in slow flowing or ephemeral streams[251]. Constructed water bodies such as stormwater detention basins, farm dams, areas bunded by earthworks and by road or rail structures, drains, ditches and other excavated areas that can capture water (including quarries and brick pits) have also been used as breeding habitat[252]. Smaller or less obvious structures have also been observed in use, such as water tanks, bunded safety areas surrounding industrial chemical storage areas, wells, irrigation pits, water troughs, laundry tubs and old bathtubs[253].

Optimal breeding habitat is the shallow part of lagoons (up to approximately 1.5 m deep) where there is generally a complex vegetation structure. Breeding sites in Tasmania often contain vegetation communities dominated by emergent plants such as water ribbon (*Cycnogeton* spp.) and spikesedge (*Eleocharis* spp.) and submerged plants such as watermilfoil (*Myriophyllum* spp.), running marshflower (*Ornduffia reniformis*), erect marshflower (*Liparophyllum exaltatum*) and pondweed (*Potamogeton* spp.). However, other plant communities can form equally suitable habitat[254].

The preferred foraging habitat generally contains flowering plants and grasses – foraging habitat can be a considerable distance from a waterbody, with frogs being found up to 500 m away from the nearest waterbody[255].

Green and gold frogs can be found taking refuge in a variety of habitats, which typically include areas where frogs can shelter from predators and climatic extremes. These refuge areas can include dumped materials (e.g. sheet iron, fibro, concrete, and bricks)[256]. Green and gold frogs are frequently found basking on grassy banks near water, however in the winter months they hibernate in warm, moist areas such as the mud at the bottom of ponds, under logs, rock and debris, or beneath thick vegetation[257]. They are rarely seen in open water and spend most of their time in vegetation at the water's edges.

Green and gold frogs can also be found in areas that connect other more suitable habitat areas; these connectivity habitats may include drainage lines, stormwater culverts, swales, periodically damp areas, easements, laneways, and open grassy areas[258].

Minor parts of the project area are within area of core range for this species (as defined on the Tasmanian Natural Values Atlas [informed by the FPA] as being all areas within 2 km of a known record from any time or place, not taking into account the accuracy of the record nor any internal

[250] Threatened Species Section (2023c)
[251] Department of State Growth (2015); Clemann & Gillespie (2012)
[252] Department of State Growth (2015); Clemann & Gillespie (2012)
[253] Department of State Growth (2015)
[254] Threatened Species Section (2023c)
[255] Department of State Growth (2015); Clemann & Gillespie (2012)
[256] Department of State Growth (2015); Clemann & Gillespie (2012)
[257] Department of State Growth (2015); Clemann & Gillespie (2012)
[258] Garvey (2021)

habitat characteristics within the radius[259]), notably around Campbell Town and Ross (Figure 20). There have been only three observations of this species within 5 km of the alignment, the most recent occurring in 2008 on the Macquarie River near Cressy – the recent records within 5 km are essentially outliers from the northern Tasmania population (Figure 20), with the records indicating isolated individuals rather than breeding populations. All other occurrences within 5 km were recorded prior to 1975[260], consistent with the reported decline in the region[261]. The potential range is considered unlikely by NRE to extend far outside the currently known range as the species is highly conspicuous and readily detectable where present [262], which is consistent with numerous and regular incidental informal reports within online nature forums, but always within the known population range as it stands (in our experience monitoring reports in such groups – G. Daniels *pers. obs.*).

Baseline NVA surveys undertaken for the assessment of this project included dozens of hours for potential observations of the species, with the natural values assessment (**Attachment 3**) noting other species of frogs were recorded and that no meaningful amount of high-quality habitat for the green and gold frog was recorded as present.

Population parameters

According to the definition in the EPBCA *Significant Impact Guidelines 1.1*[263], 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 populations either for breeding or dispersal;
- Populations that are necessary for maintaining genetic diversity; and/or
- Populations that are near the limit of the species' range.

Further to this, an important population for the green and gold frog is a population that is considered viable and thus is a population that is[264]:

- Not physically isolated from other populations or waterbodies and thus is a key source for breeding, dispersal and maintaining genetic diversity,
- Near the limit of its range, or
- Well-studied with a history of monitoring that provides greater understanding of that species.

Our assessment of the project area is that if green and gold frogs were present, it would not meet the definition of an important population due to the following:

- Given that the green and gold frog has scarcely been recorded from nearby to the project area and the location of the project area in the context of the known distribution of the species (as shown in Figure 20), it cannot plausibly be considered a key source population for either breeding or dispersal (particularly in the absence of meaningful amounts of internal habitat meeting the definitions of habitat suitable to support breeding and dispersal to a significant degree – see discussion below);
- If present, any population/s are unlikely to be necessary to maintain genetic diversity for the species as they would not be isolated from other populations and would have no mechanism in place to result in genetic distinctiveness;
- The project area is not physically isolated from other populations. Known populations occur downstream within the Macquarie River catchment and to the north where the northern Tasmanian population extends[265];

[259] Forest Practices Authority (2022)
[260] Tasmanian Natural Values Atlas data – as of 23 November 2023
[261] Threatened Species Section (2023c)
[262] Threatened Species Section (2023c)
[263] Department of Sustainability, Environment, Water, Population and Communities (2013)
[264] Department of the Environment, Water, Heritage, and the Arts (2009a)

- The project area is not within the limits of the species range. The green and gold frog is known from south-eastern Australia, with the southern limits being a known population at Richmond[266] (~80 km south of Ross) – within Tasmania there are confirmed records of the species being extant in all general directions of the compass (Figure 20); and
- The project area is not well studied with a history of monitoring (as it has not been targeted as such on the basis of the long-term absence of the species within much of the area and the limited habitat opportunities within the agricultural landscape).

3.2.7.2. SURVEY FINDINGS

Baseline reconnaissance surveys (as noted in **Attachment 3** established that potential habitat for this species was sparse in the general areas of investigation (at district level) and not likely to be necessary to intersect within the impact corridor (i.e. avoidance feasible at a landscape scale); thus, in the absence of optimal breeding habitat, targeted surveys were deemed not to be warranted (noting that suboptimal habitats are less reliable/meaningful for targeted survey work as they are more likely to be used on a transient/temporary basis and thus do not warrant high level avoidance as temporary use of a habitat patch can be mitigated with construction practices at the point of works[267]).

During the more detailed baseline natural values assessment of the project area and impact footprint, a minor amount of potential habitat was recorded, with avoidance and realignments targeting removal of even seasonal wetland habitats from the corridor to the degree possible and to the degree warranted by the quality of habitat (**Attachment 3**); based on that process only a minor amount of habitat remains in the works area. No green and gold frogs were observed/heard during the natural values general surveys, despite optimal conditions and timing for calling, such that other species of frogs were noted to be present (e.g. *Limnodynastes* spp.*, Crinia signifera*, *Litoria ewingii*)[268].

Assessment of habitat

Refuge habitat is present throughout much of the project area, particularly around log piles in paddocks, and thick vegetation along stream banks. Connectivity habitat is present throughout much of the project area, particularly in damp paddocks, drainage lines, and swales. These localised habitat traits are important within the context of broader patches of potential habitat but not recognised as being sufficient to support individuals in isolation[269].

A definition of optimal or important habitat for green and gold frogs can be derived from the broad habitat descriptions given in various guidelines, management plans, and species management profiles. As such, we have developed a habitat stratification method based on these sources to demonstrate the distribution and quality of habitat within the project area (Table 42). It should be noted that regardless of whether habitat is classified as optimal or sub-optimal, it is all treated as potential habitat when assessing the potential for significant impacts.

Potential habitat is present around the margins of the Macquarie River and smaller streams where sedges and rushes are present, as well as around wetlands even though they are seasonal and ephemeral in most cases. All wetland areas have been avoided to the maximum extent possible, with only 0.24 ha of seasonally wet lacustrine herbland (TASVEG - AHL) proposed to be impacted – this herbland occurs in a series of lentic wetlands to the west of the Campbell Town Golf Course and appears to be dry almost all of the time and constitutes very marginal habitat for the green and gold

[265] Tasmanian Natural Values Atlas data – as of 5 November 2022
[266] Tasmanian Natural Values Atlas data – as of 5 November 2022
[267] Garvey (2021)
[268] Observations from within the natural values surveys by North Barker Ecosystem Services – Attachment 3
[269] Threatened Species Section (2023c)

frog (Plate 7). The works can be completed in a manner than does not impact the long-term ability of the site to collect water nor support aquatic vegetation when the conditions are suitable (see impact and mitigation sections).

Fast-flowing rivers such as the Macquarie River (Plate 8) are largely unsuitable habitat as per the general definitions provided, but conservatively are classified as sub-optimal in our treatment due to the niche habitats that may occur at points along the river and function as potential habitat when conditions are suitable.

3.2.7.3. IMPACTS

No known populations will be impacted by the proposed works and are considered to be unlikely habitat/locations for the species to occur at, however the potential presence of the species has been allowed for on the basis of not having definitively been ruled out (to the degree that this is even possible for fauna species, given they can move around) and on the basis that project area has historical records.

The primary threat to the green and gold frog is due to habitat loss and fragmentation, as well as habitat degradation through agricultural practices. Although some potential breeding habitat is present within the project area (

Table 44), the likelihood of frogs occurring within the project area is considered to be very low based on the paucity of records from the northern Midlands for much of the past 30 years[270] and their noted decline in the region[271].

Results of habitat mapping (

Table 44) determined that the project area contains no habitat considered as optimal for breeding. Sub-optimal habitat accounts for a total of 220.96 ha of the design corridor, with 39.08 ha (17.69 %) of this occurring in the construction corridor. A total of 0.15 ha of sub-optimal habitat will be impacted by permanent infrastructure. This is a habitat loss of 0.39 % of the potential habitat within the construction corridor, and 0.07 % of the habitat within the design corridor.

The proposed pipeline crosses a number of small minor waterways and drainage lines that provide potential connectivity habitat for this species should it be present. Destruction of habitat and direct destruction of individuals tadpoles/adult frogs are most likely avenues for impacts to occur but are both extremely unlikely given individuals in all stages are highly mobile and impacts within potential habitat patches will be limited to linear strips likely to rapidly be recolonised by equivalent quality habitat from the adjacent remaining vegetation. It is noted that areas of the northern Midlands in which the species has been reported in the last 30 years have been subject to numerous actions and equivalent land management.

The introduction of chytrid fungus to the project area also presents an impact pathway to this species. Although no occurrences have been recorded within 10 km of the project area[272], its presence cannot be definitively ruled out. A conservative mitigation approach of managing for its *potential* occurrence in aquatic areas has been adopted, with this revolving around hygiene measures to prevent introduction at given locations and/or limit the potential for spreading chytrid from one location to the next should it be present. The implementation of hygiene measures will be included in a project specific Weed and Hygiene Management Plan and will apply to the entire project area. While general

[270] Tasmanian Natural Values Atlas data – as of 23 November 2023
[271] Threatened Species Section (2023c)
[272] Tasmanian Natural Values Atlas data – as of 23 November 2023

hygiene measures will be adopted throughout the scheme area, targeted washdown procedures with respect to chytrid fungus need only apply in instances where works intersect with an area suitable for its occurrence and expression (i.e., waterways and dams).

Plate 7: Potential (sub-optimal - seasonal/ephemeral) wetland habitat (within an agricultural matrix) east of the Campbell Town golf course

Plate 8: Example of aquatic area on Macquarie River subject to periodically unsuitable conditions for breeding of green and golf frog, due to the intensity and flow of water - water flow is rapid in many sections of the river within the vicinity of the project area

Table 42: Green and gold frog breeding and dispersal habitat suitability classes

Habitat suitability class for green and gold frog breeding	Rationale
Optimal (Breeding)	The NRE Threatened Species Profile[273] suggests that the potential range for the green and gold frog is unlikely to extend far beyond the known range. Optimal breeding habitat is the shallow part of lagoons (up to approximately 1.5 m deep) where there is generally a complex vegetation structure. Breeding sites in Tasmania often contain vegetation communities dominated by emergent plants such as water ribbon (*Cycnogeton* spp.) and spikesedge (*Eleocharis* spp.) and submerged plants such as watermilfoil (*Myriophyllum* spp.), running marshflower (*Ornduffia reniformis*), erect marshflower (*Liparophyllum exaltatum*) and pondweed (*Potamogeton* spp.). However, other plant communities can form equally suitable habitat[274]. Any areas of optimal habitat are areas that are: • Within 500 m of a known record (excluding records prior to 1990), noting that the potential for the species to occur far beyond the known extent is low[275], and frogs can be found up to 500 m away from the nearest waterbody[276]. • Permanent, slow-flowing, water bodies within 500 m of a known record are buffered by 60 m[277]. • All Class 1-4 waterways within 500 m of a known record are buffered according to the distances defined in Table C7.3 of the Tasmanian Planning Scheme, which is directly related to the buffer areas of the Waterways and Coastal Protection Area code overlay (• Table 43). **Note:** The impact threshold recommendations of an important population suggests a 200 m buffer of water bodies for the permanent removal or degradation of terrestrial habitat in temperate regions (Table 45). This recommendation is not applicable to this proposal due to the temporary nature of the pipeline construction works (no removal or degradation of habitat), as well as the absence of an important population from the project area. Additionally, if a population were to be recorded in the project area, it is not considered plausible that it would meet the definition of an important population based on the area and the known distribution of records.

[273] Threatened Species Section (2023c)
[274] Threatened Species Section (2023c)
[275] Threatened Species Section (2023c)
[276] Department of State Growth (2015); Clemann & Gillespie (2012)
[277] Bryant & Jackson (1999)

Sub-optimal (Breeding)	This habitat class contains the same buffers on watercourses as the optimal class, with smaller buffers on permanent waterbodies. • A 30 m buffer on all permanent, slow-flowing, water bodies[278]. • All Class 1-4 waterways will be buffered according to the distances defined in Table C7.3 of the Tasmanian Planning Scheme, which is directly related to the buffer areas of the Waterways and Coastal Protection Area code overlay (• Table 43). • A 1 m buffer on all other minor streams and drains (Class 5).
Unsuitable	This habitat class contains no permanent or ephemeral waterbodies suitable for breeding and is in beyond the buffered extent of all sub-optimal habitat. • All other environments outside of sub-optimal habitat areas.

Table 43: Spatial extent of buffers applied to watercourse categories[279]

Category	Description	Buffer Width
Class 1	Watercourses named on the 1:100,000 topographical series maps, lakes, artificial water storages (other than farm dams), and the high-water mark of tidal waters.	40 m
Class 2	Watercourses from the point where their catchment exceeds 100 ha.	30 m
Class 3	Watercourses carrying running water for most of the year between the points where their catchment is from 50 ha to 100 ha.	20 m
Class 4	All other watercourses carrying running water for part or all of the year for most years.	10 m

Table 44: Extent of habitat classes within the project area (all areas are in hectares)

Habitat Class	Design Corridor (% of Corridor)	Construction Corridor (% of Corridor)	Permanent Impacts
Optimal	-	-	-
Sub-optimal	259.88 (9.85 %)	38.74 (8.70 %)	0.14 (0.36 % of habitat within construction corridor)
Unsuitable	2,378.91 (90.15 %)	406.65 (91.30 %)	19.89

[278] Forest Practices Authority Threatened Species Advisor – available at https://fpa.tas.gov.au/Planning/biodiversity; Bryant & Jackson (1999)
[279] Table C7.3 of the Tasmanian Planning Scheme

Table 45: Significant impact thresholds for the green and gold frog

Ecological Element Affected	Impact Threshold	Comment
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 m of a water body in temperate regions, or 350 m 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.	Habitat is a connected area that supports one or more key ecological functions for this species. These functions may include, but are not limited to foraging, breeding, dispersal, shelter. Any action that results in the degradation of habitat such that the recruitment, survival or dispersal rates of an important population are lowered may have a significant impact on the species. Habitat quality **increases** with: • increasing wetland area, • water permanence, and • aquatic vegetation cover. Habitat quality **decreases** with: • the degree of development in the terrestrial zone (that is, Roads, buildings etc), and • the presence of predatory fish.
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.	Habitat connectivity could be provided by a linear water body (for example creek line) or by suitable terrestrial habitat between waterbodies. Individuals may use a range of terrestrial and aquatic habitats as movement corridors between water bodies, including flood ways or grassy fields. Any isolation of water bodies, through destruction of habitat, or creation of a barrier such that movement or migration between waterbodies is less likely to have a significant impact on the species.

3.2.7.4. MITIGATION MEASURES

As targeted surveys weren't conducted as part of preliminary site investigations, the presence of frogs throughout the project area is allowed for as a possibility; as such, a protocol has been developed by Tasmanian Irrigation (**Attachment 14**) and will be implemented throughout the construction phase of the project. The protocol has been prepared in accordance with the Species Management Profile for Green and Gold Frogs[280], and the Green and Gold Frog (*Litoria raniformis*) Management Guidelines report[281]. The application of this protocol aims to mitigate the significant impact thresholds[282] for this species (

[280] Threatened Species Section (2023c)
[281] Department of State Growth (2015)

Table 45).

Mitigation of construction impacts for green and gold frog largely relates to the protection of habitat and drainage lines and preventing contamination. Mitigation methods detailed within the protocol include:

- Pre-construction planning and risk minimisation
  - The contractor must incorporate all biodiversity objectives, including any fauna sensitive design requirements, into their Construction Environmental Management Plan, for TI approval. The contractor shall ensure adequate training of staff on the CEMP requirements.
  - Any areas identified as high-quality potential habitat (i.e. permanent wetlands, ponds, dams) that are in the vicinity of the proposed construction area must be buffered by a minimum of 30 m and designated as works exclusion zones. These areas must be clearly marked on the CEMP and on the ground.
- Timing of works
  - Where possible, works should be completed between April and August in any potential high-quality habitat locations. Known locations are defined as any area that contains records on the Tasmanian Natural Values Atlas (or other threatened fauna databases).
  - If heavy rain is falling, forecast to fall, or has recently fallen during the previous 24 hours, measures should be taken to restrict construction works within waterways until water levels have returned to 'normal' background levels.
- Construction hygiene
  - Contractors must implement measures a project specific weed and hygiene management plan and from best practice guidelines[283] during all construction activities. This is required to manage the risk associated with the transmission of chytrid fungus.
  - Best practice guidelines - Allan, K. and Gartenstein, S. (2010) Keeping it Clean - A Tasmanian field hygiene manual to prevent the spread of freshwater pests and pathogens. NRM South. ISBN: 978-1-921082-09-2.
- Pre-construction searches
  - Within the week prior to commencement of construction activities through a waterbody, concerted efforts should be made by qualified ecologists (with relevant permits) to detect, and capture threatened frogs (and other ground-dwelling fauna within the construction area), using active searching techniques. Search techniques should follow the recommendations in the significant impact guidelines for the vulnerable growling grass frog[284].
  - If construction is to occur through a waterbody during the breeding season for the green and gold frog, and the environmental conditions at the time are conducive to increased frog activity (i.e., warm, and wet nights), then nocturnal searches for the species should also be made prior to construction, to maximise the chances of detecting and clearing frogs from the construction zone.
  - If a non-linear waterbody (i.e., wetland, pond, dam) is intercepted by the construction zone and needs to be drained before construction, then tadpoles and aquatic metamorphs of the green and golden frog will need to be removed from the waterbody and relocated to the nearest available suitable aquatic habitat, according to pre-

[282] Department of the Environment, Water, Heritage, and the Arts (2009a)
[283] Allan & Gartenstein (2010)
[284] Department of the Environment, Water, Heritage, and the Arts (2009a)

determined handling protocols and chytrid fungus protocols. Prior to any relocation, testing of both source and receiving populations for chytrid fungus is required.
    - If a linear waterbody (i.e., stream, channel, drainage line) is intercepted by the construction zone, and upstream water is to be dammed and then pumped around the construction area to the downstream side of the construction zone, then no collection of tadpoles will be required.
    - Measures to avoid the spread of chytrid fungus must be implemented during the animal-handling process only. Chytrid often occurs in a mosaic pattern within the landscape, with infected and uninfected ponds occurring within close proximity of one another. Given this, a risk assessment needs to be completed to ascertain the potential to distribute chytrid fungus. For example, if the waterway is downstream, within the same catchment, the risk of spreading chytrid fungus would be small. However, if the habitat is located in a separate catchment, the risk would be much higher. Where there is a medium to high risk of spreading chytrid fungus, testing needs to be completed before translocation can occur.
- Construction activities
    - Ensure excavation activities (including stockpiles) do not impede surface water flows;
    - Conduct construction activities across drainage lines when dry, where practicable;
    - Utilise sediment control measures;
    - Ensure all vehicles are well maintained and that all servicing occurs at designated facilities, and ensure that vehicles movements are restricted to a designated pathway;
    - Adopt appropriate chemical and oil storage, handling and disposal.
- Post construction
    - Reinstate surface contours as part of the rehabilitation process.

Further to the application of the green and gold frog protocol, during the operational phase of the NMIS, individual irrigators must consider the impact to this species when applying water for irrigation and/or clearing land for agriculture. The impacts to this species will be assessed through the Farm WAP process, with potential for targeted surveys to be required if potential habitat is likely to be impacted. A buffer of 200 m buffer[285] around waterbodies containing known important populations must be applied to satisfy the requirements of the Tasmanian Irrigation Strategic Assessment Priority Species Code[286]. This code was developed to assist in the assessment and management of biodiversity values within Farm WAPs. Should there be any impacts to the green and gold frog within this 200 m buffer, individual irrigators may be required to refer their action independently.

A summary of proposed mitigation is provided in Table 46, and an assessment of the project against the significant impact criteria for the green and gold frog is provided in Table 47.

[285] As recommended in EPBCA Policy Statement 3.14
[286] Department of Primary Industries, Parks, Water, and Environment (2012)

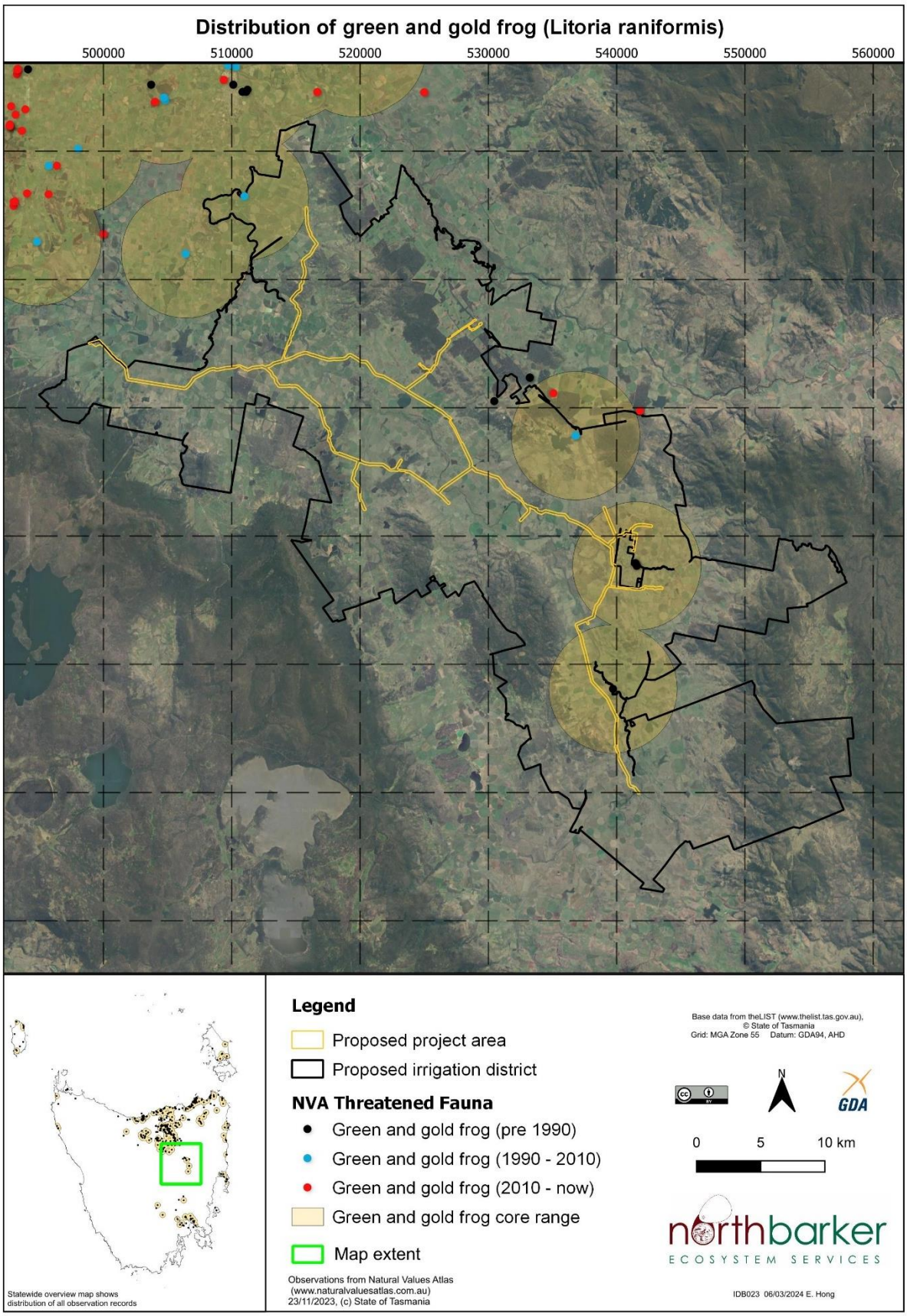


Figure 20: Distribution and core range of the green and gold frog (as defined within the Tasmanian Natural Values Atlas)

3.2.7.5. SUMMARY OF MITIGATION AND AVOIDANCE MEASURES

Table 46: Summary of mitigation and avoidance measures for the green and gold frog

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
Green and gold frog protocol	The civil contractor must apply the green and gold frog protocol as detailed in **Attachment 14** of this document as well as complying with the provisions of the Tasmanian Irrigation Environmental Protection Requirements. <u>Pre-construction planning and risk minimisation</u> o The contractor must incorporate all biodiversity objectives, including any fauna sensitive design requirements, into their Construction Environmental Management Plan. The contractor shall ensure adequate training of staff on the CEMP requirements. o Any areas identified as high-quality habitat that are in the vicinity of the proposed construction area must be buffered by a minimum of 30 m and designated as works exclusion zones. These areas must be clearly marked on the CEMP and on the ground. <u>Timing of works</u> o Where possible, works should be completed between April and August in any potential high-quality habitat locations. Known locations are defined as any area that contains records on the Tasmanian Natural Values Atlas. o If heavy rain is falling, forecast to fall or has recently fallen during the previous 24 hours, measures should be taken to restrict construction works within waterways until water	Tasmanian Irrigation Civil Contractor	All areas of potential habitat Construction Phase	**Very high** This protocol has been developed in accordance with the approved advice published in the Department of State Growth (2015) Green and Gold Frog (*Litoria raniformis*) Management Guidelines and thus can reliably meet the mitigation aims of the project.

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
	levels have returned to 'normal' background levels. <u>Construction hygiene</u> o Contractors must implement measures from best practice guidelines [287] during all construction activities. This is required to manage the risk associated with the transmission of chytrid fungus. <u>Pre-construction searches</u> o Within the week prior to commencement of construction activities through a waterbody, concerted efforts should be made by qualified ecologists (with relevant permits) to detect, and capture threatened frogs (and other ground-dwelling fauna within the construction area), using active searching techniques. Search techniques should follow the recommendations in the significant impact guidelines for the vulnerable growling grass frog[288]. o If construction is to occur through a waterbody during the breeding season for the green and gold frog, and the environmental conditions at the time are conducive to increased frog activity (i.e., warm and wet nights), then nocturnal searches for the species should also be made prior to construction, to maximise the chances of detecting and clearing frogs from the construction zone.			

[287] Allan & Gartenstein (2010)
[288] Department of the Environment, Water, Heritage, and the Arts (2009a)

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
	○ If a non-linear waterbody (i.e., wetland, pond, dam) is intercepted by the construction zone and needs to be drained before construction, then tadpoles and aquatic metamorphs of the green and golden frog will need to be removed from the waterbody and relocated to the nearest available suitable aquatic habitat, according to pre-determined handling protocols and chytrid fungus protocols. Prior to any relocation, testing of both source and receiving populations for chytrid fungus is required. ○ If a linear waterbody (i.e., stream, channel, drainage line) is intercepted by the construction zone, and upstream water is to be dammed and then pumped around the construction area to the downstream side of the construction zone, then no collection of tadpoles will be required. ○ Measures to avoid the spread of the chytrid fungus must be implemented during the animal-handling process only. Chytrid often occurs in a mosaic pattern within the landscape, with infected and uninfected ponds occurring within close proximity of one another. Given this, a risk assessment needs to be completed to ascertain the potential to distribute chytrid fungus. For example, if the waterway is downstream, within the same catchment, the risk of spreading chytrid fungus would be small. However, if the habitat is located in a separate catchment, the risk would be much higher. Where there is a medium to high risk of spreading chytrid fungus, testing needs to be completed before translocation can occur.			

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
	Construction activities o Ensure excavation activities (including stockpiles) do not impede surface water flows; o Conduct construction activities across drainage lines when dry, where practicable; o Utilise sediment control measures; o Ensure all vehicles are well maintained and that all servicing occurs at designated facilities, and ensure that vehicles movements are restricted to a designated pathway; o Adopt appropriate chemical and oil storage, handling, and disposal. Post construction o Reinstate surface contours as part of the rehabilitation process.			
Farm WAP	A Tasmanian Irrigation program designed to identify, avoid, and mitigate risks to natural values due to the operation of the scheme. Each property that purchases water from the NMIS must have a Farm WAP. This will the risks associated with the potential for facilitated impacts to MNES. See **Section 1.1.1** and **Attachment 2** for detail on process.	Tasmanian Irrigation Individual Irrigator	All applicable properties that wish to use NMIS water. Operational Phase	**Very high** The Farm Water Access Plan has been developed by Tasmanian Irrigation as a further measure to mitigate against impacts to natural values and processes. The Farm WAP process has been applied to over 15 irrigation schemes in Tasmania. Farm WAPs are a condition of Federal and State Government approval for all Tasmanian Irrigation built schemes. The method can be predicted with confidence to work to mitigate impacts on this species as equivalent measures have been applied within a previous Controlled Action on the SWIS project, within the species still extant in that district after 10 years of operations (NBES data).

3.2.7.6. SIGNIFICANT IMPACT ASSESSMENT

Table 47: Significant impact criteria with regards to the green and gold frog

Significant Impact Criteria	Likelihood of Significant Impact	Comments
1. Lead to a long-term decrease in the size of an important population.	None	An important population for the green and gold frog is a population that is considered viable and thus is a population that is: • not physically isolated from other green and gold frog populations or waterbodies and thus is a key source for breeding, dispersal and maintaining genetic diversity, • near the limit of its range, or • well-studied with a history of monitoring that provides greater understanding of that species. Our assessment of the project area is that if green and gold frogs were present, it would not meet the definition of an important population due to the following: • Given that the green and gold frog has scarcely been recorded from nearby to the project area and the location of the project area in the context of the known distribution of the species (as shown in Figure 18), it cannot plausibly be considered a key source population for either breeding or dispersal (particularly in the absence of meaningful amounts of internal habitat meeting the definitions of habitat suitable to support breeding and dispersal to a significant degree – see discussion below); • If present, any population/s are unlikely to be necessary to maintain genetic diversity for the species as they would not be isolated from other populations and would have no mechanism in place to result in genetic distinctiveness; • The project area is not physically isolated from other populations. Known populations occur downstream within the Macquarie River catchment and to the north where the northern Tasmanian population extends; • The project area is not within the limits of the species range. The green and gold frog is known from south-eastern Australia, with the southern limits being a known population at Richmond (~80 km south of Ross) – within Tasmania there are confirmed records of the species being extant in all general directions of the compass (Figure 18); and • The project area is not well studied with a history of monitoring (as it has not been targeted as such on the basis of the long-term absence of the species within much of the area and the limited habitat opportunities within the agricultural landscape). With this assessment in mind, even if the green and gold frog is present within the project area, the proposed action will not lead to a long-term decrease in the size of an important population.
2. Reduce the area of occupancy of	None	An important population for the green and gold frog is a population that is considered viable and thus is a population

Significant Impact Criteria	Likelihood of Significant Impact	Comments
an important population.		that is: • not physically isolated from other green and gold frog populations or waterbodies and thus is a key source for breeding, dispersal and maintaining genetic diversity, • near the limit of its range, or • well-studied with a history of monitoring that provides greater understanding of that species. Our assessment of the project area is that if green and gold frogs were present, it would not meet the definition of an important population as per the reasons listed above. With this in mind, the proposed action will not reduce the area of occupancy of an important population.
3. Fragment an existing important population into two or more populations.	None	The temporary nature of the majority of the project impact area will allow for rehabilitation of any potential habitat that is impacted due to works. Any frogs that are located during pre-clearance searches will be relocated to nearby suitable habitat as per the provisions of the green and gold frog protocol. Further to this, our assessment of the project area is that if green and gold frogs were present, it would not meet the definition of an important population as per the reasons listed in Criterion 1. With this in mind, the proposed action will not fragment an existing important population into two or more populations.
4. Adversely affect habitat critical to the survival of a species.	None	The temporary nature of the majority of the project impact area will allow for rehabilitation of any potential habitat that is impacted due to works. Thus, the action will not adversely affect habitat critical to the survival of this species.
5. Disrupt the breeding cycle of an important population.	None	The peak breeding season for this species is between November and January[289]. The green and gold frog protocol recommends completing works in between April and August in any "known" habitat locations to avoid impacting breeding frogs, however it is noted that there are no known sites within the project area. The green and gold frog protocol includes measures to minimise impacts to potential breeding habitat. With the application of the protocol, the proposed action will not disrupt the breeding cycle of an important population.
6. Modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.	None	With protocols in place to restore any temporary vegetation clearance, the proposal will not modify, destroy, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.

[289] Threatened Species Section (2023c)

Significant Impact Criteria	Likelihood of Significant Impact	Comments
7. Result in invasive species that are harmful to the species becoming established in the species' habitat.	None	The proposed action will not result in invasive species that are harmful to the species becoming established in the species' habitat.
8. Introduce disease that may cause the species to decline.	None	The project presents a potential risk of introducing chytrid fungus to the project area. The implementation of hygiene measures will be included in a project specific Weed and Hygiene Management Plan and will apply to the entire project area. While general hygiene measures will be adopted throughout the scheme area, targeted washdown procedures with respect to chytrid fungus need only apply in instances where works intersect with an area suitable for its occurrence and expression (i.e., waterways and dams). Provided that hygiene protocols are applied, the action will not introduce disease that may cause this species to decline.
9. Interfere substantially with the recovery of the species.	None	The proposed action will not interfere with the objectives of the approved recovery plan[290] for this species.
Summary		
The proposed action will not have a significant impact on the green and gold frog.		

[290] Clemann & Gillespie (2012)

3.3. THREATENED FLORA SPECIES

This subsection details MNES flora relevant to the request for additional information, covering context, survey findings, and proposed avoidance/mitigation measures that have been put in place to minimise potential impacts. Maps of MNES distribution in relation to the project area, and Tasmania are provided in the relevant Sections for each MNES.

3.3.1. GRASSLAND GREENHOOD (*PTEROSTYLIS ZIEGELERI*)

3.3.1.1. CONTEXT

Pterostylis ziegeleri is known from a range of habitats across Tasmania, however it is only known from 25-30 sub-populations, the largest of which is near Brighton (3-4,000 plants in 2008[291]). Based on the known sub-populations of this species, it is estimated that the total number of *P. ziegeleri* in Tasmania is 6-7,000 plants[292]. In the Tasmanian Midlands, occurrences of *P. ziegeleri* are generally associated with lowland *Themeda triandra* grasslands (TASVEG – GTL) and grassy woodlands on well-drained clay loams derived from basalt[293]. It is also known from coastal sites on the slopes of low, stabilised sand dunes. The nearest known records are from Merton Vale (west of Campbell Town), and the Campbell Town Golf Course (Figure 21)

3.3.1.2. SURVEY FINDINGS

A single colony of this species was recorded within a *Themeda triandra* / *Poa labillardierei* mosaic along Valleyfield Road, opposite the Kirkland's Presbyterian Cemetery. The species was widespread throughout the patch; however, the density was highest closer to the road. The extent of the distribution of this species within the patch totals ~0.9 ha, with a potential range of up to 6 ha. The population may contain upwards of 1,000 plants. This population is within a fenced paddock, with a minimum buffer of 25 m to the existing construction corridor, separated by a sealed road (which will further act as physical buffer in that construction work would be extremely unlikely to mistakenly occur on the other side of the road and behind a fence). Approximately 10 plants were recorded on the south side of the road.

Given the low numbers of this species across the State[294], this subpopulation at Kirkland's is a significant site and efforts should be made to conserve this population.

3.3.1.3. IMPACTS

The discovery of a significant population of this species on the northern side of Valleyfield Road at Kirkland's Presbyterian Cemetery led to a design realignment to the southern side of the road to avoid impacting this important population. The presence of a sealed road acts as a buffer on this population and is sufficient to manage the potential for inadvertent impacts during the construction phase. The northern side of the road will be treated as an exclusion zone to ensure that there is no impact to this species.

Further surveys discovered ~10 plants south of Valleyfield Road, however the pipeline alignment and construction corridor have been moved and/or narrowed to avoid impacting these plants.

Facilitated impacts applicable to this species that may arise from the operation of the NMIS may include:

- clearance and conversion of undocumented habitat
- erosion
- altered hydrology (including changes to flow regime, runoff, lowering/raising of water table)

[291] Threatened Species Section (2009)
[292] Threatened Species Section (2009)
[293] Jones *et al.* (1999)
[294] Department of Climate Change, Energy, the Environment and Water (2023d)

- increased/decreased salinity
- disease introduction
- weed infestations
- land use changes (i.e. native vegetation converted to pasture/crop)

3.3.1.4. MITIGATION MEASURES

A summary of proposed mitigation is provided in Table 48, and an assessment of the project against the significant impact criteria for *Pterostylis ziegeleri* is provided in Table 49.

Construction Phase

The northern side of Valleyfield Road at Kirklands must be treated as an exclusion zone in order to protect the important population (utilizing the sealed road as a buffer from the construction area). The construction corridor currently sites a minimum of 25 m south of the existing population. The occurrences on the south side of the road must be buffered by 10 m, and clearly demarcated on a CEMP as well as on the ground. It is recommended that on-ground marking is conducted during flowering season to assist with detection and to reduce the risk of unintended impacts.

The construction of the pipeline also presents a risk of introducing weeds to the area, which may lead to reduced habitat availability. The implementation of a project specific Weed and Hygiene Management Plan across the entire project area is sufficient to mitigate this potential risk.

Operational Phase

Individual irrigators must apply a Farm WAP (see **Section 1.1.1** and **Attachment 2** for further information on this process) prior to any irrigation activity on a property. Water sourced from the NMIS cannot be applied to land without a Farm WAP.

Further to the application of the Farm WAP, any future irrigation use must occur outside of a 50 m buffer of known populations of this species to satisfy the requirements of the Tasmanian Irrigation Strategic Assessment Priority Species Code[295]. This code was developed to assist in the assessment and management of biodiversity values within Farm WAPs. Should there be any impacts to any MNES within this 50 m buffer, individual irrigators may be required to refer their action independently. The buffer zone begins from the edge of known populations, or new important populations if discovered[296]. This mitigation measure is consistent with the measures in place for the lowland native grasslands of Tasmania ecological community and is supported by annual monitoring withing the Tasmanian Irrigation Landscape Monitoring Program.

The potential for facilitated impacts (i.e. erosion, altered hydrology, increased/decreased salinity, altered water flow regime, disease introduction, weed infestations, land use changes, land clearance/degradation) due to the operational phase of the NMIS will be mitigated by the implementation of the Tasmanian Irrigation Farm WAP, which applies the principals of the Priority Species Code to properties that propose to access water from the scheme. If it is determined by the Farm WAP that impacts due to the operation of the NMIS on individual properties are likely, individual irrigators may need to refer their action independently.

[295] Department of Primary Industries, Parks, Water, and Environment (2012)
[296] Department of Primary Industries, Parks, Water, and Environment (2012)

3.3.1.5. SUMMARY OF MITIGATION AND AVOIDANCE MEASURES

Table 48: Summary of mitigation and avoidance measures for *Pterostylis ziegeleri*

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
Avoidance	Known location have been avoided through pipeline realignment and excising of areas of the design corridor.	Tasmanian Irrigation	Prior to referral	**Very high** No impacts due to avoidance of all known records. Inadvertent impacts to be mitigated through other measures. Avoidance is a direct measure of mitigation and thus comes with high confidence in effectiveness.
Exclusion zone	Demarcate the northern side of Valleyfield Road as an exclusion zone to protect the recorded important population at this site. Occurrences on the southern side must be buffered by 10 m. This must be cleared marked on the CEMP and on the ground.	Tasmanian Irrigation Civil contractor	Valleyfield Road (Kirklands Presbyterian cemetery site) Construction phase - Optimal time for identifying exclusion zones is between September and December, however, is not critical to establishing exclusion zones	**Very high** The implementation of exclusion zones is a frequently used method to minimise impacts to threatened values. Avoidance is a direct measure of mitigation and thus comes with high confidence in effectiveness.
Farm WAP	A Tasmanian Irrigation program designed to identify, avoid, and mitigate risks to natural values due to the operation of the scheme. Each property that purchases water from the NMIS must have a Farm WAP. This will the risks associated with the potential for facilitated impacts to MNES. See **Section 1.1.1 and Attachment 2** for detail on process.	Individual Irrigator Tasmanian Irrigation	All applicable properties that wish to purchase NMIS water. Operational Phase	**Very high** The Farm Water Access Plan has been developed by Tasmanian Irrigation as a further measure to mitigate against impacts to natural values and processes. The Farm WAP process has been applied to over 15 irrigation schemes in Tasmania with numerous threatened flora populations protected under the process. Farm WAPs are a condition of Federal and

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
				State Government approval for all Tasmanian Irrigation built schemes.
Weed and hygiene management plan	A project specific weed and hygiene management plan that complies with the Tasmanian *Biosecurity Act 2019*. The WHMP must cover all relevant aspects of the control and management of declared and environmental weeds, including: a) An overarching set of objectives and the context in which they are to be achieved. b) An assessment of the potential impact of the introduction of weeds, including immediate and adjacent areas which are free of weeds. c) Strategies for managing weeds including their eradication within the project area and on any public roads used for project related transport. d) Strategies for ongoing monitoring and control of weeds within the project area. e) Identification of appropriate herbicides for control and how they are to be used. A hygiene plan also aimed at pathogen control is part of the WHMP to ensure there is no introduction of pathogens or 'declared' weeds or significant environmental weed species into the area, translocation of weeds within the project area or the import of existing declared weeds from outside the area. The hygiene plan should cover, but not be limited to:	Tasmanian Irrigation Civil Contractor	Entire project area Construction Phase	**Very high** The application of project specific weed and hygiene management plans is a frequently used mechanism to meet the legislative requirements of the Tasmanian *Biosecurity Act 2019* and can with confidence be considered likely to address the prevention of weeds and pathogens as an impact pathway in this case.

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
	a) Vehicle, machinery, and equipment hygiene. b) Washdown protocols when travelling between clean and contaminated areas. c) Location and management of washdown areas and facilities, including management of effluent. d) Maintaining logbooks detailing adherence to hygiene protocols for all civil contractors. Material hygiene (soils, gravel, plant material etc.) – ensuring that no materials contaminated with weed propagules (seed, propagative vegetative material) are imported into the project area.			

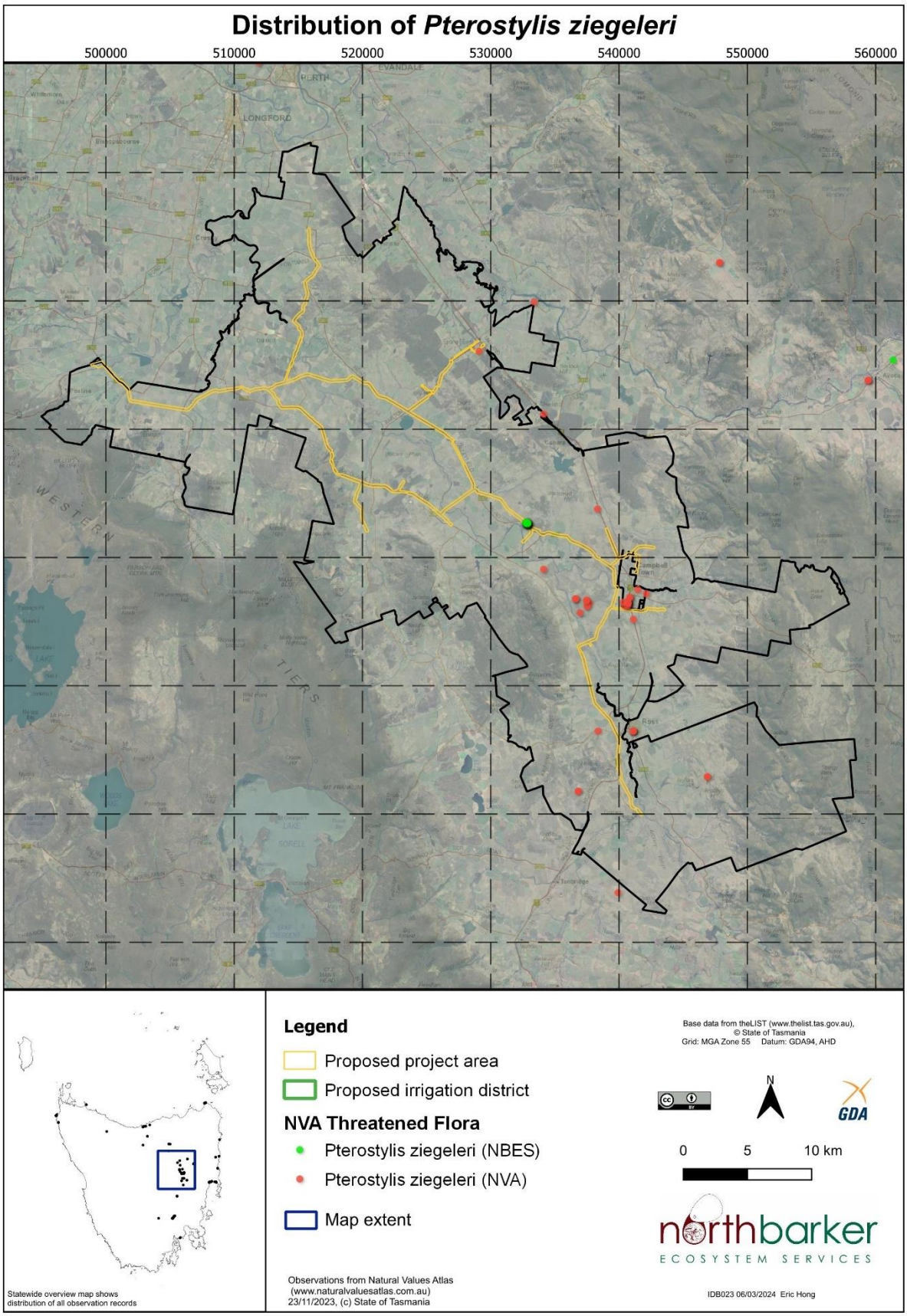


Figure 21: Distribution of *Pterostylis ziegeleri*

3.3.1.6. SIGNIFICANT IMPACT ASSESSMENT

Table 49: Significant impact criteria with regards to *Pterostylis ziegeleri*

Significant Impact Criteria	Likelihood of Significant Impact	Comments
1. Lead to a long-term decrease in the size of an important population.	None	The SPRAT profile for this species[297] states that all sub-populations are considered necessary for the long-term survival of this species, as such, this sub-population is treated as an important population. As all known occurrences of this species have been avoided through design, and all operational phases are subject to the Farm WAP process, which will further protect this sub-population, the proposed action will not lead to a long-term decrease in the size of an important population.
2. Reduce the area of occupancy of an important population.	None	The SPRAT profile for this species[298] states that all sub-populations are considered necessary for the long-term survival of this species, as such, this sub-population is treated as an important population. Provided that the Farm WAP process is applied effectively, and a minimum buffer of 50 m is applied for any use during the operational phase of the NMIS, the action will not reduce the area of occupancy of an important population.
3. Fragment an existing important population into two or more populations.	None	As the proposed action will not impact upon any population of this species, and any known populations in the vicinity of the works area will be clearly marked as exclusion zones, the proposed action will not fragment an existing population into two or more populations.
4. Adversely affect habitat critical to the survival of a species.	None	Given that the revised alignment now passes through agricultural land rather than native grassland, suitable habitat is now absent from the construction corridor, thus the proposed action will not adversely affect habitat critical to the survival of this species.
5. Disrupt the breeding cycle of an important population.	None	As the proposed action will not impact upon any population of this species, and any known populations in the vicinity of the works area will be clearly marked as exclusion zones, the proposed action will not disrupt the breeding cycle of an important population of this species.
6. Modify, destroy, remove, isolate, or decrease the availability or	None	Direct impacts to this species have been mitigated through avoidance such that there is suitable habitat within the current alignment in the vicinity of the known population. Indirect impacts due to the operation of the NMIS will be mitigated

[297] Department of Climate Change, Energy, the Environment and Water (2023d)
[298] Department of Climate Change, Energy, the Environment and Water (2023d)

Significant Impact Criteria	Likelihood of Significant Impact	Comments
quality of habitat to the extent that the species is likely to decline.		through the Farm WAP process, as well as the restrictions put in place in the Tasmanian Irrigation Strategic Assessment Priority Species Code[299]. With these measures in place, the action will not modify, destroy, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.
7. Result in invasive species that are harmful to the species becoming established in the species' habitat.	None	The introduction of weed species poses a risk to this species, as it is a species that typically prefers light and space[300]. With this potential risk in mind, TI have committed to implementing a project specific weed and hygiene management plan to prevent the introduction of weeds to the landscape and to contain existing infestations. Ongoing monitoring and audits will be a component of this management plan. With this measure in place, there is no likelihood that the proposed action will result in invasive species that are harmful to this species becoming established in the species' habitat.
8. Introduce disease that may cause the species to decline.	None	The proposed action will not conceivably introduce disease that may cause the species to decline, noting no diseases are known to be a risk to the species. The implementation of a project specific weed and hygiene management plan is nonetheless a commitment made by TI.
9. Interfere substantially with the recovery of the species.	None	The recovery plan for this species is part of a recovery plan for all Tasmanian orchids[301]. While the proposed action will not interfere with the recovery plan, it has an opportunity to assist in the objectives of the plan. As the population at Kirklands was a newly recorded population for this species, the project has increased the number of known sub-populations (Objective 1). And has the potential to increase the number of individuals within this sub-population with future surveys (Objective 2).
Summary		
The proposed action will not have a significant impact on *Pterostylis ziegeleri* – grassland greenhood.		

[299] Department of Primary Industries, Parks, Water, and Environment (2012)
[300] Department of Climate Change, Energy, the Environment and Water (2023d)
[301] Threatened Species Section (2017)

3.3.2. MATTED FLAX-LILY (*DIANELLA AMOENA*)

3.3.2.1. CONTEXT

Dianella amoena occurs mainly in the northern and southern Midlands, where it grows in native grasslands and grassy woodlands[302]. It is most frequent on basalt substrates in *Themeda triandra* grasslands. This species is listed and endangered under the EPBCA.

3.3.2.2. SURVEY FINDINGS

Several occurrences were recorded within the design corridor, with the highest density recorded around the junction of the Midland Highway and Mona Vale Road (Figure 22). A smaller populations was recorded in GCL north of Valleyfield Road. This species was also recorded the Campbell Town Golf Course, in GTL east of Campbell Town, and Merton Vale region (outside of the current design corridor).

Only the small patch north of Valleyfield Road remains within the indicative construction corridor.

3.3.2.3. IMPACTS

Approximately 4 m^2 of this species north of Valleyfield Road, which may contain up to 10 plants, will be impacted.

3.3.2.4. MITIGATION MEASURES

There is limited scope to avoid impacting the Valleyfield Road population due to obstructions by waterways to the northwest. All other occurrences have been avoided through realignment and corridor narrowing. In context of the broader northern Midlands area, impacts of this scale are not considered to be significant.

A summary of proposed mitigation is provided in Table 50, and an assessment of the project against the significant impact criteria for *Dianella amoena* is provided in Table 51.

[302] Department of Climate Change, Energy, the Environment and Water (2023e)

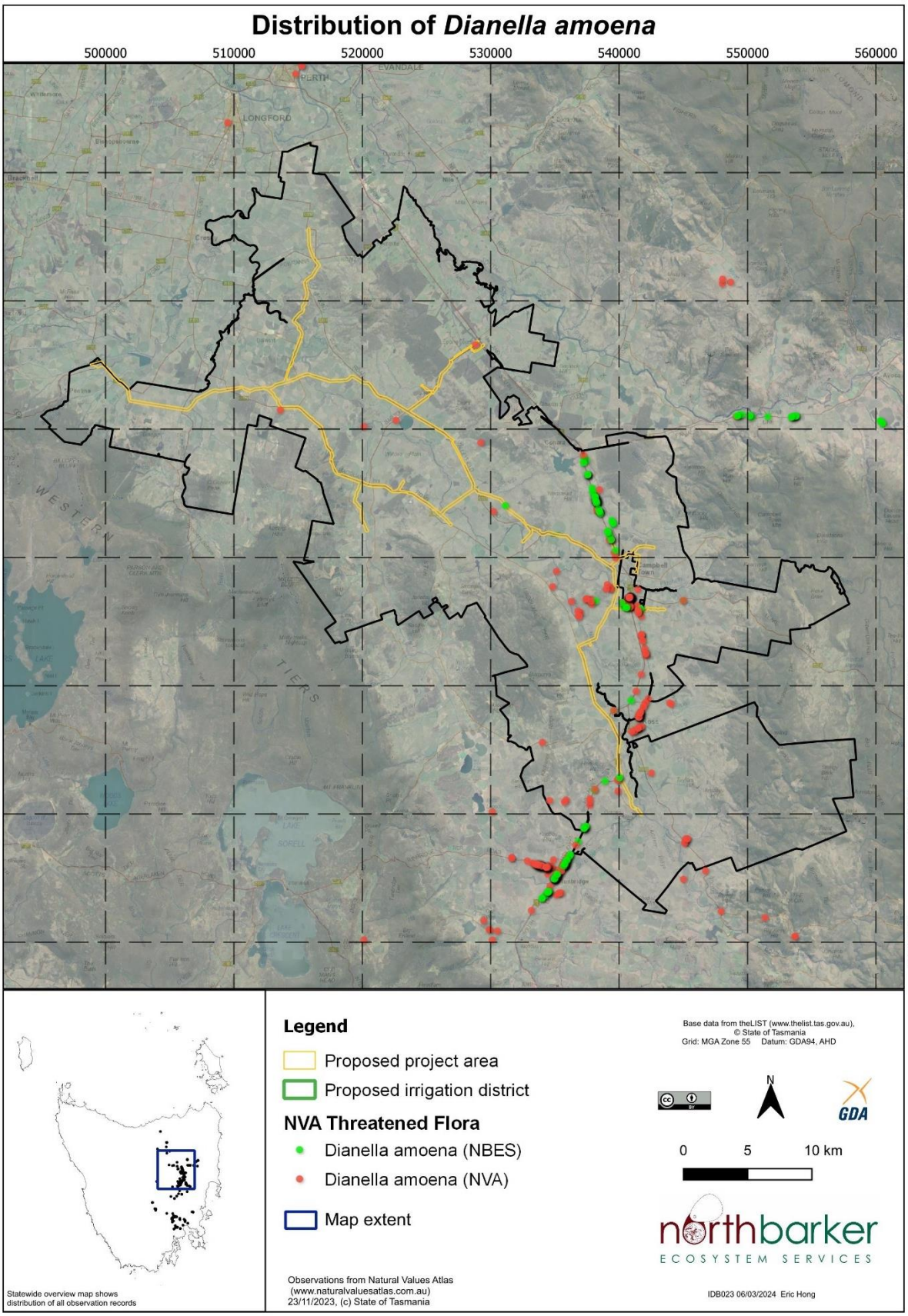


Figure 22: Distribution of *Dianella amoena*

3.3.2.5. SUMMARY OF MITIGATION AND AVOIDANCE MEASURES

Table 50: Summary of mitigation and avoidance measures for *Dianella amoena*

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
Avoidance	Known location have been avoided through pipeline realignment and excising of areas of the design corridor.	Tasmanian Irrigation	Prior to referral	**Very high** No impacts beyond the 4 m^2 identified within the construction corridor. Avoidance of all known other known occurrences directly guarantees no impacts to those individuals. Inadvertent impacts to be prevented/mitigated through other measures.
Exclusion zones	Demarcate a 10 m buffer zone around known location within construction corridor. Must be clearly marked on CEMP and on the ground	Tasmanian Irrigation Civil Contractor	Around known occurrences During active construction phase.	**Very high** The implementation of exclusion zones is a frequently used method to minimise impacts to threatened values and can be relied on to be effective.
Weed and hygiene management plan	A project specific weed and hygiene management plan that complies with the Tasmanian *Biosecurity Act 2019*. The WHMP must cover all relevant aspects of the control and management of declared and environmental weeds, including: f) An overarching set of objectives and the context in which they are to be achieved. g) An assessment of the potential impact of the introduction of weeds, including immediate and adjacent areas which are free of weeds. h) Strategies for managing weeds including their eradication within the project area and on any	Tasmanian Irrigation Civil Contractor	Entire project area Construction Phase	**Very high** The application of project specific weed and hygiene management plans is a frequently used mechanism to meet the legislative requirements of the Tasmanian *Biosecurity Act 2019* and can be relied on to prevent the introduction of weeds or pathogens into populations of *Dianella amoena.*

	public roads used for project related transport. i) Strategies for ongoing monitoring and control of weeds within the project area. j) Identification of appropriate herbicides for control and how they are to be used. A hygiene plan also aimed at pathogen control is part of the WHMP to ensure there is no introduction of pathogens or 'declared' weeds or significant environmental weed species into the area, translocation of weeds within the project area or the import of existing declared weeds from outside the area. The hygiene plan should cover, but not be limited to: e) Vehicle, machinery, and equipment hygiene. f) Washdown protocols when travelling between clean and contaminated areas. g) Location and management of washdown areas and facilities, including management of effluent. h) Maintaining logbooks detailing adherence to hygiene protocols for all civil contractors. Material hygiene (soils, gravel, plant material etc.) – ensuring that no materials contaminated with weed propagules (seed, propagative vegetative material) are imported into the project area.			
Farm WAP	A Tasmanian Irrigation program designed to identify, avoid, and mitigate risks to natural values due to the operation of the scheme. Each property that purchases water from the NMIS must have a Farm WAP. This will the risks associated with the potential for facilitated impacts to MNES. See **Section 1.1.1 and Attachment 2** for detail on	Individual Irrigator Tasmanian Irrigation	All applicable properties that wish to use NMIS water. Operational Phase	**Very high** The Farm Water Access Plan has been developed by Tasmanian Irrigation as a further measure to mitigate against impacts to natural values and processes and has successful managed/prevented impacts to numerous threatened flora.

	process.			The Farm WAP process has been applied to over 15 irrigation schemes in Tasmania. Farm WAPs are a condition of Federal and State Government approval for all Tasmanian Irrigation built schemes.

3.3.2.6. SIGNIFICANT IMPACT ASSESSMENT

Table 51: Significant impact criteria with regards to *Dianella amoena*

Significant Impact Criteria	Likelihood of Significant Impact	Comments
1. Lead to a long-term decrease in the size of a population.	None	The occurrence of this species that will be impacted covers an area of ~4 m^2 within an agricultural environment. Due to the mat forming nature of this species, it is difficult to ascertain the exact number of plants in this patch (it is likely to be between 1 and 10 plants). Whilst still within the known geographic range for this species, the location of the impact plants, to the northwest of the Kirklands cemetery, it is an outlier when shown against known populations of this species on the Midland Highway and Campbell Town Golf Course, and Merton Vale sites. Within the project area, several occurrences of *Dianella amoena* were recorded (See **Attachment 3, Section 3.2**), as well as 427 records listed on the NVA within 500 m of the project area[303]. With the extent of this species known from the broader area, the removal of ~4 m^2 of this species will not lead to a long-term decrease in the size of a population.
2. Reduce the area of occupancy of the species.	None	Within the project area, several occurrences of *Dianella amoena* were recorded (See **Attachment 3, Section 3.2**), as well as 427 records listed on the NVA within 500 m of the project area[304]. With extent of this species known from the broader area, the removal of ~4 m^2 of this species will not significantly reduce the area of occupancy of this species.
3. Fragment an existing population into two or more populations.	None	Due to the clump forming nature of the *Dianella amoena*, abundance is difficult to determine, thus defining a population is difficult[305]. Given that the proposed impact is to an isolated occurrence and is scarcely large enough to call this an existing population, the proposed action will not fragment an existing population into two or more populations.

[303] Department of Natural Resources and Environment Tasmania (2023)
[304] Department of Natural Resources and Environment Tasmania (2023)
[305] Carter (2010)

Significant Impact Criteria	Likelihood of Significant Impact	Comments
4. Adversely affect habitat critical to the survival of a species.	None	The habitat in which the proposed impacts to this species to occurs in (marginal grassland in an agricultural environment) is not typical of this species. *Dianella amoena* prefers grassland (dominated by *Themeda triandra*) and grassy woodland habitats on basalt substrates, which are seldom impacted due to the proposed action, thus the proposed action will not adversely affect habitat critical to the survival of this species.
5. Disrupt the breeding cycle of a population.	None	This species is pollinated by native bees and is also capable of vegetative reproduction through rhizomes. The proposed action will not impact on the pollination and reproduction of this species due to the proposed construction, thus the action will not disrupt the breeding cycle of a population of this species.
6. Modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.	None	The habitat in which the proposed impacts to this species to occurs in (marginal grassland in an agricultural environment) is not typical of this species. The remainder of the impact areas do not constitute important habitat for this species; thus, the proposed action will not modify, destroy, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.
7. Result in invasive species that are harmful to the species becoming established in the species' habitat.	None	The introduction of weed species poses a risk to this species, Excess biomass can smother plants and reduce the available area for rhizome shootings and prevent seedling recruitment[306]. With this potential risk in mind, TI have committed to implementing a project specific weed and hygiene management plan to prevent the introduction of weeds to the landscape and to contain existing infestations. Ongoing monitoring and audits will be a component of this management plan. With this measure in place, there is no likelihood that the proposed action will result in invasive species that are harmful to this species becoming established in the species' habitat.
8. Introduce disease that may cause the species to decline.	None	The proposed action will not conceivably introduce disease that may cause the species to decline, noting no diseases are known to be a risk to the species. The implementation of a project specific weed and hygiene management plan is nonetheless a commitment made by TI.
9. Interfere with the recovery of the species.	None	There is a national recovery plan for this species[307], developed in 2010. Although this recovery plan does not recognise the Tasmanian population in this recovery plan (due to taxonomic uncertainty at the time of publication), the plan is still applicable.

[306] Department of Climate Change, Energy, the Environment and Water (2023e)
[307] Carter (2010)

Significant Impact Criteria	Likelihood of Significant Impact	Comments
		The proposed action will not interfere with the recovery actions outlined in this place.
Summary		
The proposed action will not have a significant impact on *Dianella amoena* – matted flax-lily.		

3.3.3. PROPELLOR PLANT (*STENANTHEMUM PIMELEOIDES*)

3.3.3.1. CONTEXT

Stenanthemum pimeleoides is restricted to Tasmania's central East Coast and the Northern Midlands, where it occurs in dry sclerophyll forest or woodland with an open heathy or shrubby understorey. The topography tends to be flat to gently sloping. The species occurs in the drier parts of the State with rainfall between 500-800 mm per year, and usually at elevations below 100 m. *Stenanthemum pimeleoides* is listed as vulnerable under the EPBCA.

3.3.3.2. SURVEY FINDINGS

This species was recorded in a small number of locations with a conservation covenant on Barton Road. This species forms a dense mat, and individual plants can cover a large area. Occurrences of this species cover approximately 20 m^2 across 3 locations (Figure 23).

3.3.3.3. IMPACTS

There is a patch of this species, covering an area of ~5 m^2, containing ~10 plants, occurring on the edge of the Tom Gibson Reserve on Barton Road. This patch is within the design corridor; however, impacts due to the proposed works will be on the opposite side of the fence and thus impacts to this population can be avoided. No works will be conducted within the Tom Gibson Reserve. All other recorded occurrences are no longer within the design corridor and will not be impacted.

Indirect impacts are not anticipated due to the operation of the scheme. Habitat suitable for this species is unlikely to be altered to a point where this species can no longer persist. Any potential for indirect impacts will be mitigated through the Farm WAP process.

This species is well reserved within the Tom Gibson Reserve and within the survey area it occurs in greater numbers within a conservation covenant along Barton Road, which will not be impacted due to the proposed action.

3.3.3.4. MITIGATION MEASURES

The mitigate the risk of impacts to this species, known locations within the design corridor must be clearly marked and treated as exclusion zones on all construction environmental management plans and on the ground – a 5 m buffer to apply.

A summary of proposed mitigation is provided in Table 52, and an assessment of the project against the significant impact criteria for *Stenanthemum pimeleoides* is provided in Table 53.

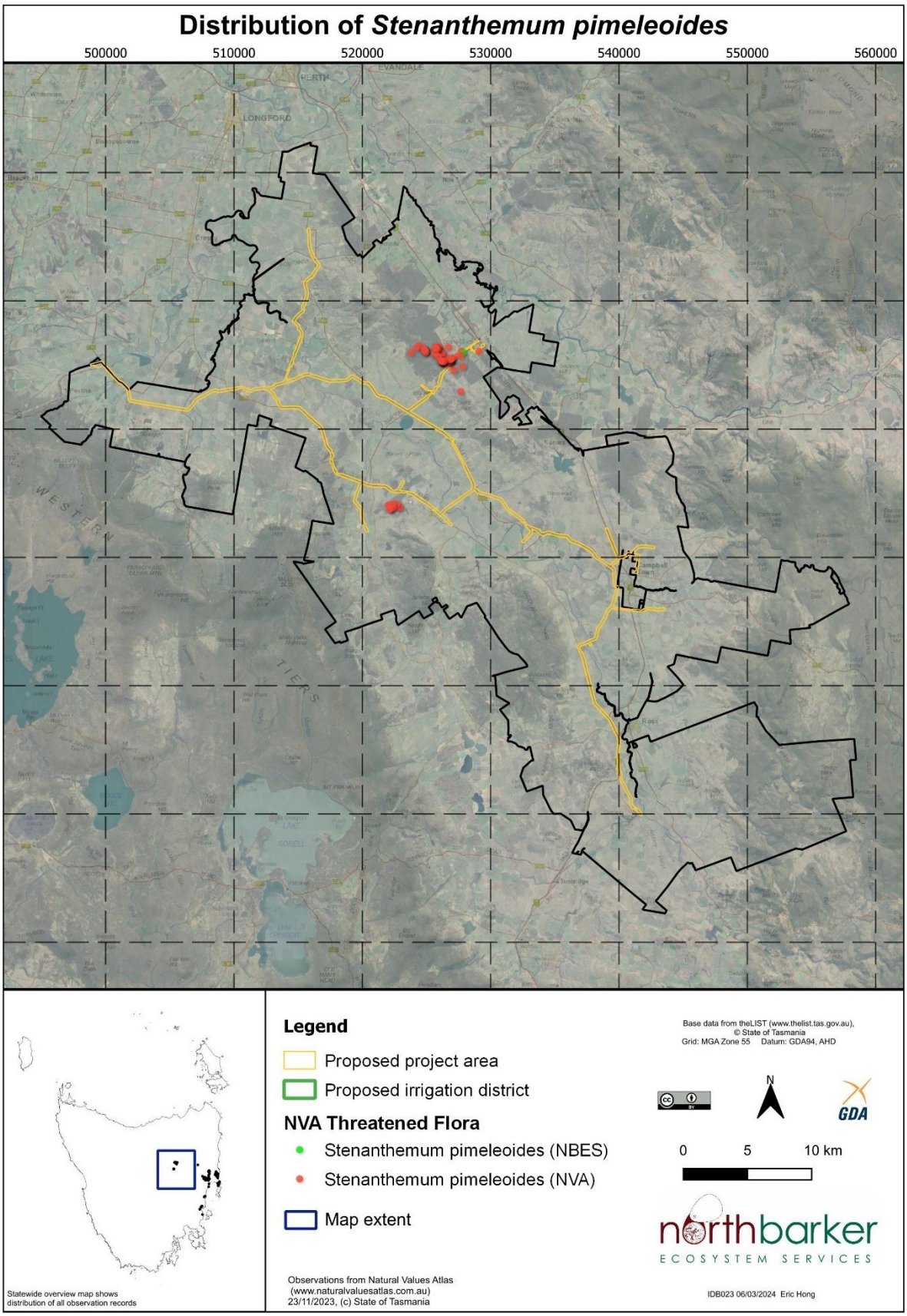


Figure 23: Distribution of *Stenanthemum pimeleoides*

3.3.3.5. SUMMARY OF MITIGATION AND AVOIDANCE MEASURES

Table 52: Summary of mitigation and avoidance measures for *Stenanthemum pimeleoides*

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
Avoidance	Known location have been avoided through pipeline realignment and excising of areas of the design corridor.	Tasmanian Irrigation	Prior to referral	**Very high** No impacts to occurrences within both the construction corridor and design corridor. Avoidance is a direct measure of mitigation and thus comes with high confidence in effectiveness.
Exclusion zones	Demarcate a 5 m buffer zone around known location within construction corridor. Must be clearly marked on CEMP and on the ground	Tasmanian Irrigation Civil Contractor	Edge of Tom Gibson Reserve During active construction phase.	**Very high** The implementation of exclusion zones is a frequently used method to minimise impacts to threatened values. Avoidance is a direct measure of mitigation and thus comes with high confidence in effectiveness.
Weed and hygiene management plan	A project specific weed and hygiene management plan that complies with the Tasmanian *Biosecurity Act 2019*. The WHMP must cover all relevant aspects of the control and management of declared and environmental weeds, including: k) An overarching set of objectives and the context in which they are to be achieved. l) An assessment of the potential impact of the introduction of weeds, including immediate and adjacent areas which are free of weeds. m) Strategies for managing weeds including their eradication within the project area and on any public roads used for project related transport. n) Strategies for ongoing monitoring and control of weeds	Tasmanian Irrigation Civil Contractor	Entire project area Construction Phase	**Very high** The application of project specific weed and hygiene management plans is a frequently used mechanism to meet the legislative requirements of the Tasmanian *Biosecurity Act 2019* and can with confidence be considered likely to address the prevention of weeds and pathogens as an impact pathway in this case.

	within the project area. o) Identification of appropriate herbicides for control and how they are to be used. A hygiene plan also aimed at pathogen control is part of the WHMP to ensure there is no introduction of pathogens or 'declared' weeds or significant environmental weed species into the area, translocation of weeds within the project area or the import of existing declared weeds from outside the area. The hygiene plan should cover, but not be limited to: i) Vehicle, machinery, and equipment hygiene. j) Washdown protocols when travelling between clean and contaminated areas. k) Location and management of washdown areas and facilities, including management of effluent. l) Maintaining logbooks detailing adherence to hygiene protocols for all civil contractors. Material hygiene (soils, gravel, plant material etc.) – ensuring that no materials contaminated with weed propagules (seed, propagative vegetative material) are imported into the project area.			
Farm WAP	A Tasmanian Irrigation program designed to identify, avoid, and mitigate risks to natural values due to the operation of the scheme. Each property that purchases water from the NMIS must have a Farm WAP. This will the risks associated with the potential for facilitated impacts to MNES. See **Section 1.1.1 and Attachment 2** for detail on process.	Individual Irrigator Tasmanian Irrigation	All applicable properties that wish to purchase NMIS water. Operational Phase	**Very high** The Farm Water Access Plan has been developed by Tasmanian Irrigation as a further measure to mitigate against impacts to natural values and processes. The Farm WAP process has been applied to over 15 irrigation schemes in Tasmania with numerous threatened flora populations protected under the process. Farm WAPs are a condition of Federal and State Government approval for all Tasmanian Irrigation built schemes.

3.3.3.6. SIGNIFICANT IMPACT ASSESSMENT

Table 53: Significant impact criteria with regards to *Stenanthemum pimeleoides*

Significant Impact Criteria	Likelihood of Significant Impact	Comments
1. Lead to a long-term decrease in the size of an important population.	None	No important populations have been formally identified[308]; however, the Epping Forest sub-population is identified as having the greatest number of occurrences of all sub-populations within Tasmania, containing over 16,000 mature plants[309]. On this basis, the Epping Forest sup-population is assessed as an important population. Impacts to this species will be avoided, thus the action will not lead to a long-term decrease in the size of a population.
2. Reduce the area of occupancy of an important population.	None	No important populations have been formally identified[310]; however, the Epping Forest sub-population is identified as having the greatest number of occurrences of all sub-populations within Tasmania[311]. On this basis, the Epping Forest sup-population is assessed as an important population. Provided that the identified occurrence is avoided, the action will not reduce the area of occupancy of this important population.
3. Fragment an existing important population into two or more populations.	None	The identified occurrence of this species will be avoided and clearly marked on the ground to mitigate the risk of any unanticipated impacts. The occurrence is on the edge of a known population, which even if it were impacted, would not lead to the fragmentation of an important population. Thus, the proposed action will not fragment an existing population into two or more populations
4. Adversely affect habitat critical to the survival of a species.	None	This species occurs in dry sclerophyll forest or woodland with an open heathy or shrubby understorey. Any impacts to viable habitat to this species will be remediated post-construction. As such, the proposed action will not adversely affect habitat critical to the survival of this species.
5. Disrupt the breeding cycle of an important population.	None	This species is pollinated by insects and is known to resprout following fire and germinate prolifically from soil-stored seed[312]. The nature of the proposed action will not impact on the viability of pollination and provided known occurrence are avoided, will not impact upon soil seed stores. As such, the proposed action will not disrupt the breeding cycle of an

[308] Department of the Environment, Water, Heritage and the Arts (2008)
[309] Department of Climate Change, Energy, the Environment and Water (2023f)
[310] Department of the Environment, Water, Heritage and the Arts (2008)
[311] Department of Climate Change, Energy, the Environment and Water (2023f)
[312] Department of Climate Change, Energy, the Environment and Water (2023f)

Significant Impact Criteria	Likelihood of Significant Impact	Comments
		important population of this species.
6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	None	All impacts to viable habitat for this species will be remediated post-construction. The proposed action will not modify, destroy, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.
7. Result in invasive species that are harmful to the species becoming established in the species' habitat.	None	Although not specifically identified as a threat to this species, the introduction of weeds may impact on the habitat available for this species. TI have committed to implementing a project specific weed and hygiene management plan to prevent the introduction of weeds to the landscape and to contain existing infestations. Ongoing monitoring and audits will be a component of this management plan. With this measure in place, there is no likelihood that the proposed action will result in invasive species that are harmful to this species becoming established in the species' habitat.
8. Introduce disease that may cause the species to decline.	None	The proposed action will not conceivably introduce disease that may cause the species to decline, noting no diseases are known to be a risk to the species. The implementation of a project specific weed and hygiene management plan is nonetheless a commitment made by TI.
9. Interfere substantially with the recovery of the species.	None	There is no recovery plan for this species; however, as impacts will be avoided, there will be no interference with any existing recovery strategies.
Summary		
The proposed action will not have a significant impact on *Stenanthemum pimeleoides* – propellor plant.		

3.4. THREATENED ECOLOGICAL COMMUNITIES

This subsection details MNES ecological communities relevant to the request for additional information, covering context, survey findings, and proposed avoidance/mitigation measures that have been put in place to minimise potential impacts. Maps of MNES distribution in relation to the project area, and Tasmania are provided in the relevant Sections for each MNES.

All ecological communities MNES that were predicted to occur in the region[313] have been considered, with only the Lowland Native Grasslands of Tasmania (LNGT) community determined to have likely presence in the project area. Other ecological communities considered include:

- Alpine sphagnum bogs and associated fens.
    - This ecological community was determined to have no chance of occurring due to the project area occurring well outside of the altitudinal range for this community (typically above 800 m above sea level[314]).
- Tasmanian forests and woodlands dominated by black gums or Brookers gums.
    - A patch originally mapped as Midlands woodland complex (TASVEG-DMW) was reported from within the project area. This patch was targeted for assessment and subsequently re-mapped as *Eucalyptus amygdalina* forest and woodland on Cainozoic deposits (TASVEG - DAZ) based on substrate and structure. Further detail on this patch is provided in **Attachment 3, Section 3.1**.
- Tasmanian white gum wet forest.
    - No wet forests were recorded within the project area during field surveys, and very few occurrences exist within the Northern Midlands bioregion[315].

3.4.1. LOWLAND NATIVE GRASSLANDS OF TASMANIA

3.4.1.1. CONTEXT

The PMST predicts the likely occurrence of this community within 5 km of the project area. This is correct with our experience assessing grasslands in the northern Midlands area and our broader survey area.

The Lowland native grasslands of Tasmania ecological community is listed as critically endangered under the EPBC Act. Native grasslands are generally defined as areas of native vegetation dominated by native grasses (notably *Poa labillardierei* and *Themeda triandra*), with few or no emergent woody species, with a diverse herbaceous flora component. The LNGT community typically occurs in areas up to 600 m above sea level, generally on soils derived from basalt, dolerite, deep sands, or alluvial deposits[316].

The LNGT is one of the most fragmented and threatened ecosystems in Tasmania, largely due to the prevalence of land clearance for agriculture since European settlement. By 2009, more than 83 % of the pre-colonial extent had been lost. The majority of grassland sites are found on private land[317]. Clearing and conversion of remnants, urban expansion and peri-urban development threaten the LNGT ecological community through direct removal of remnant vegetation and subsequent fragmentation of the ecological community across its range[318]. Pasture improvement and fertilisation, invasion by weeds and feral animals, inappropriate grazing and fire regimes, salinity and off-road vehicle disturbance threaten the structure and function of remaining remnants by impacting on

[313] Commonwealth of Australia (2023)
[314] Kirkpatrick (1997)
[315] Department of Agriculture, Water, and the Environment (2021)
[316] Department of the Environment, Water, Heritage, and the Arts (20010)
[317] Department of the Environment, Water, Heritage, and the Arts (2010)
[318] Kirkpatrick *et al.* (1988); Gilfedder *et al.* (2003); Gilfedder *et al.* (2008)

species diversity and composition[319]. Little of the ecological community is protected under conservation-related land tenure with the majority of the grasslands occurring on private property[320]. The extent of grassland patches that are present in the broader area, according to TASVEG mapping, is displayed in Figure 24.

Given the limited extent of the LNGT ecological community, any potential clearance and conversion of this community is considered significant and warrants further consideration. This was at the forefront of planning and design phase of the NMIS, with pipeline realignments made at a very early stage after initial reconnaissance surveys (Table 7) identified high value sites that warranted avoidance.

During the field survey process, all areas of native grassland were assessed to determine the potential for qualification as the LNGT ecological community. This was conducted over several iterations of the design process, with areas with very high or certain likelihood of qualification avoided early in the design phase based on the results of preliminary reconnaissance surveys, as mentioned above. Of the native grassland areas that remain within the pipeline alignment, the majority of patches were determined to not meet the listing criteria due to either:

1. Lacking the tussock cover to meet the condition threshold criteria; or
2. Containing high cover of weeds, notably gorse, and various thistle species.

Patches that had been determined not to meet the EPBCA condition thresholds based upon the results of field verification were not considered for further targeted assessments. Where there was uncertainty whether a patch could meet the condition thresholds, targeted assessments were conducted in accordance with the EPBCA Policy Statement 3.18[321].

The pipeline alignment revision left two grasslands (Kirklands and Stockwell) that were deemed to have potential to qualify for listing (Figure 25), and thus were subject to targeted assessments.

Surveys were conducted on 15-16 November 2021 to allow for optimal timing for spring-flowering herbs and grasses. Survey plots consisted of 50 x 50 m quadrats, with all vascular plants within each plot recorded. The listing criteria for grasslands either dominated by *Poa labillardierei* (Figure 26) or *Themeda triandra* (Figure 27) were assessed within each plot. Once a series of plots was assessed, a walkthrough of the broader grassland area beyond the design corridor was surveyed using a meandering search technique to determine if other patches within the same grassland contained a) further native species, and b) areas containing fewer weed species and cover. The results of these assessments are in Table 54.

3.4.1.2. SURVEY FINDINGS

Results of targeted grassland assessments (Table 54) determined that the two remaining high-quality grasslands within the pipeline design corridor failed to qualify for listing as Lowland Native Grasslands of Tasmania. Seven out of the ten plots failed to qualify against two criteria – the number of native herbs per 0.5 ha, and the percentage cover of perennial weeds. All plots failed against the weed cover criterion. Further meandering through grassland patches failed to locate any areas of improved condition within the two grassland patches.

Further to this, all patches of potential high-quality grasslands were targeted for other important natural values, such as threatened flora and fauna.

Targeted surveys at the Kirklands grassland detected a large population of the EPBCA vulnerable listed *Pterostylis ziegeleri*, as well as the TSPA rare listed tussock skink (*Pseudemoia pagenstecheri*). As a result of this, despite not qualifying for listing as LNGT, this grassland was prioritised for avoidance as it contains important natural values.

[319] Lunt (1991); Kirkpatrick & Gilfedder (1995); Zacharek et al. (1997); Gilfedder *et al.* (2003)
[320] Department of the Environment, Water, Heritage, and the Arts (2009b)
[321] Department of the Environment, Water, Heritage, and the Arts (2010)

Other grasslands were also avoided for containing other threatened values (e.g. near the Campbell Town golf course, and a grassland within a TLC stewardship at Merton Vale), noting that these areas were avoided prior to LNGT surveys, and thus may have also qualified for listing.

The Stockwell grassland is still within the design and construction corridor areas.

3.4.1.3. IMPACTS

Although no EPBCA grasslands were recorded within the current design corridor, they are present within the irrigation district, and it can be expected there are further patches in the district that are currently unmapped or untested against condition criteria. Therefore, operation of the scheme has the potential for facilitated significant impacts on EPBCA grasslands in cases where they may be cleared for agriculture (without mapping or assessment) on the impetus of more readily available irrigation.

Facilitated impacts that may arise from the operation of the NMIS may include:

- clearance and conversion of undocumented grasslands
- erosion
- altered hydrology (including changes to flow regime, runoff, lowering/raising of water table)
- increased/decreased salinity
- disease introduction
- weed infestations
- land use changes (i.e. native vegetation converted to pasture/crop)
- land clearance/degradation

3.4.1.4. MITIGATION MEASURES

The provision of Tasmanian Irrigation water does not allow for landowners to conduct unregulated land clearance. All land irrigated with Tasmanian Irrigation water within the NMIS is subject to rigorous assessment through the Farm WAP process. The risk of native grassland clearance due to Tasmanian Irrigation water will be managed through the Farm WAP process, with measures in place to ensure that grasslands that qualify as LNGT, are adequately protected by applying exclusion areas and applying buffers from particular agricultural activities, as per the protected matters standard management actions detailed in **Attachment 2 - Appendix A**. It is critical that the potential for facilitated impacts to occur is mitigated through the Tasmanian Irrigation Farm WAP process (see **Section 1.1.1** and **Attachment 2 - Appendix A** for more detail on this process.

Any future irrigation use must occur outside of a 50 m buffer of known populations of this species to satisfy the requirements of the Tasmanian Irrigation Strategic Assessment Priority Species Code[322]. This code was developed to assist in the assessment and management of biodiversity values within Farm WAPs. Should there be any impacts to any MNES within this 50 m buffer, individual irrigators may be required to refer their action independently. The buffer zone begins from the edge of known grasslands, or new grasslands if discovered[323]. This mitigation measure is supported by annual monitoring withing the Tasmanian Irrigation Landscape Monitoring Program. If it is determined by the Farm WAP that impacts due to the operation of the NMIS on individual properties are likely, individual irrigators may need to refer their action independently.

Further to this, Tasmanian Irrigation have committed to increasing the Farm WAP management prescriptions to include patches of TASVEG grassland units that have the potential to qualify for listing in the future. This commitment is as follows:

[322] Department of Primary Industries, Parks, Water, and Environment (2012)
[323] Department of Primary Industries, Parks, Water, and Environment (2012)

- Native grassland communities will be assessed for potential LNGT during the Farm WAP field surveys. Grasslands that meet the condition thresholds will be clearly mapped and excluded from irrigation with NMIS water. Grasslands that do not meet condition thresholds will be mapped according to their relevant TASVEG vegetation community and a description on their status as potential LNGT provided in the report. Updated mapping will be provided to TASVEG (a branch within the Tasmanian Department of Natural Resources and Environment).
- No clearance of LNGT, or irrigation with NMIS water within 50m of identified LNGT will be permitted. The annual Farm WAP audit program will ensure irrigation activities with NMIS water, or as a result of additional NMIS water resource on the property, do not encroach on confirmed LNGT. This includes prohibiting ploughing or cropping within the area, irrigation with TI water within 50 m, and chemical or fertiliser application within 10m.
- Where areas >1 ha of GPL or GTL native grassland vegetation are identified (as part of the Farm WAP process) as being in good condition with **potential** to be managed to reach LNGT condition thresholds in the future, these areas will be clearly mapped, and irrigators will be made aware of their value. Where irrigators intend to clear or convert areas of "potentially qualifying" grasslands identified in their Farm WAP, they must seek advice from a suitably qualified ecologist to determine if self-assessment under EPBCA is required.

It should also be noted that areas of high-quality grasslands will require targeted surveys for other threatened values such as threatened flora and fauna through the Farm WAP process, as such, may provide protection through this avenue regardless of whether a grassland qualifies as LNGT.

A summary of proposed mitigation is provided in Table 55, and an assessment of the project against the significant impact criteria for the lowland native grasslands of Tasmania ecological community is provided in Table 56.

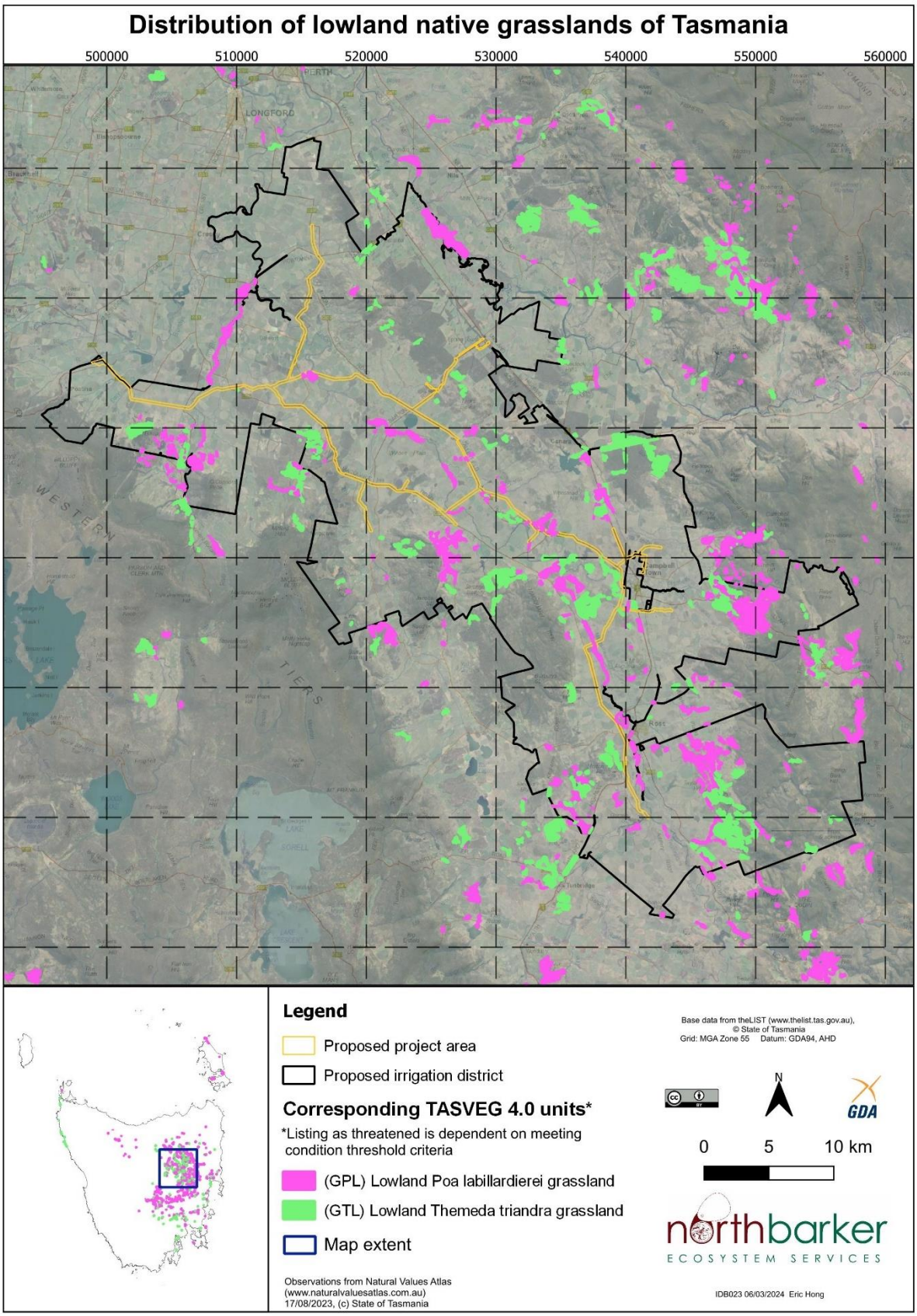


Figure 24: Distribution of TASVEG grassland communities that may qualify for listing if condition thresholds are satisfied – noting all patches of potentially qualifying vegetation within the works area have been considered and found not to qualify

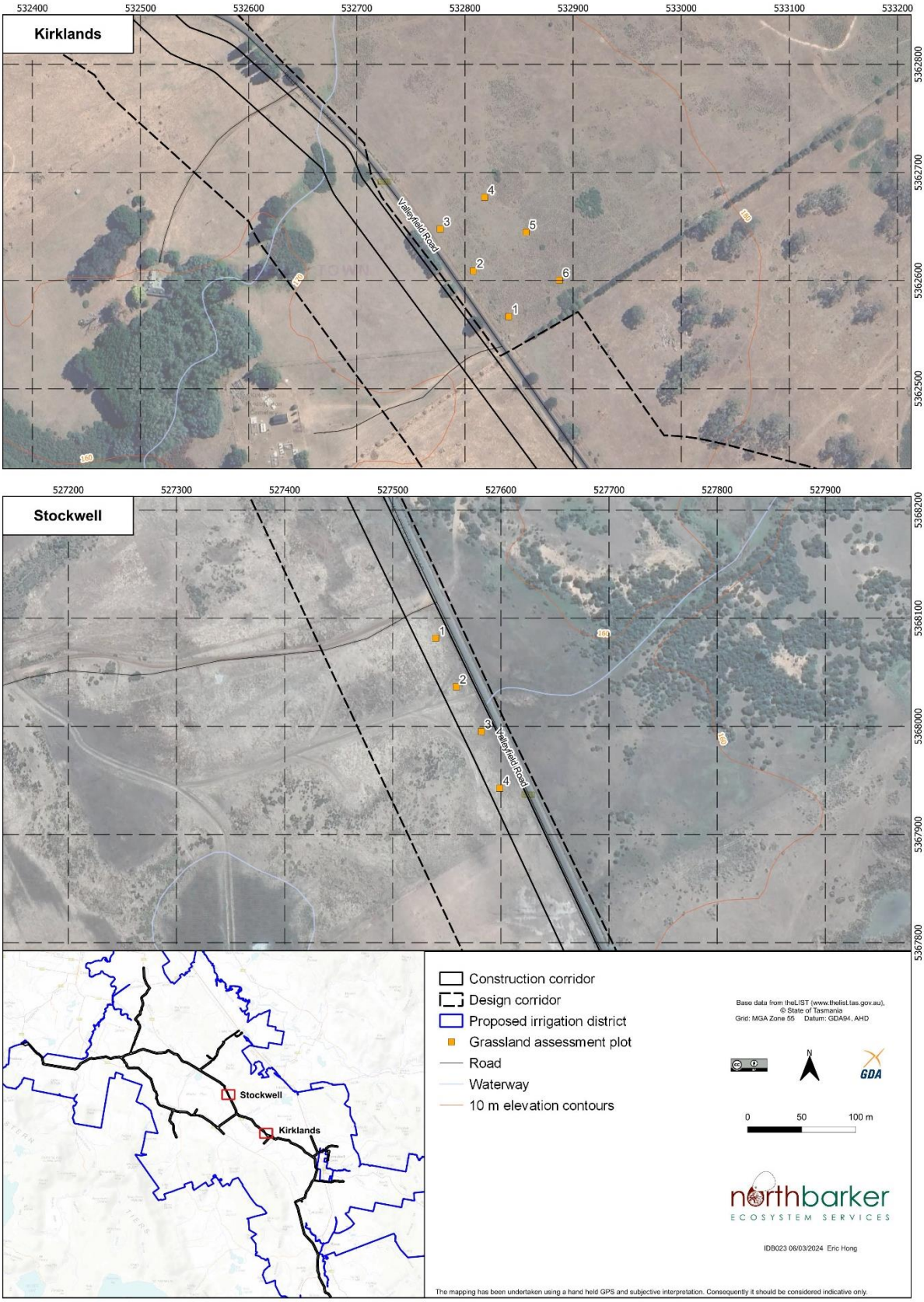


Figure 25: Location of grassland assessment plots

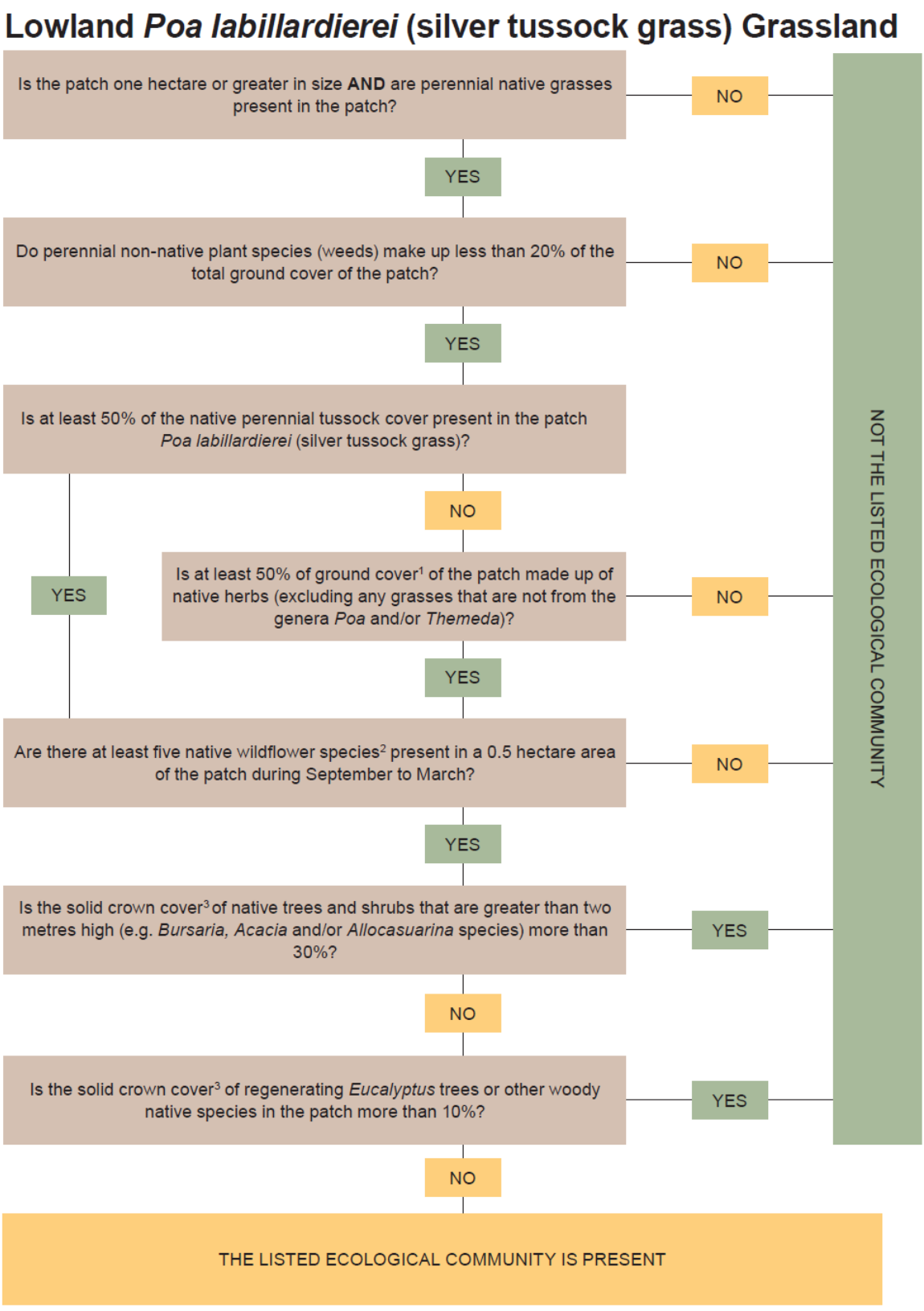


Figure 26: Condition flowchart for grasslands dominated by *Poa labillardierei*[324]

[324] Department of the Environment, Water, Heritage, and the Arts (2010)

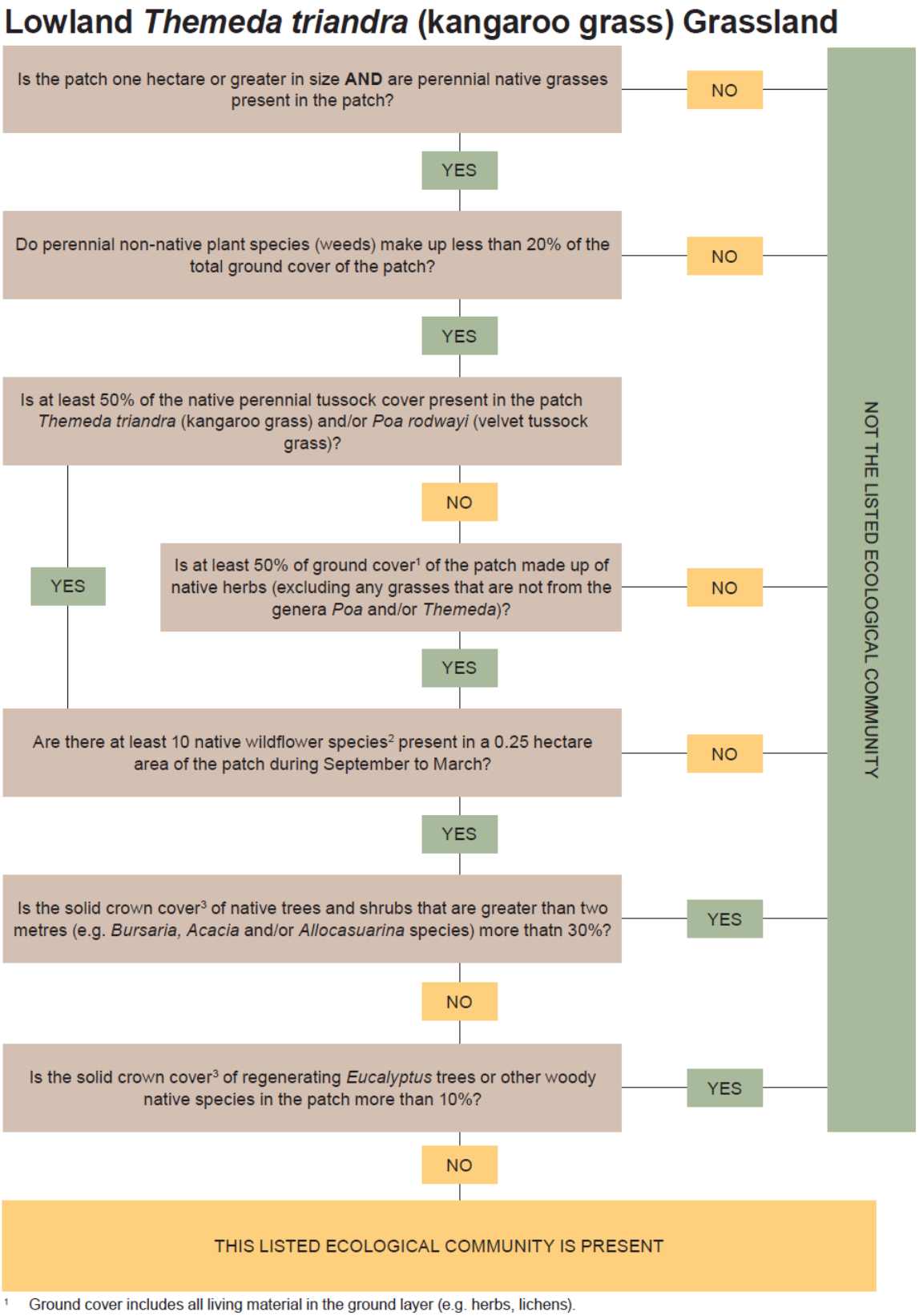


Figure 27: Condition flowchart for grasslands dominated by *Themeda triandra*[325]

[325] Department of the Environment, Water, Heritage, and the Arts (2010)

Table 54: Results of grassland assessments against the listing criteria for Lowland Native Grasslands of Tasmania. Criteria that fails to meet condition thresholds shaded in orange

Plot	Patch Size >1 hectare AND	≥50 % of perennial native tussock cover is *Poa* and/or *Themeda* OR Herbs + *Poa/ Themeda* ≥50 % total ground cover, AND	If *P. lab* dominant, ≥5 native herb species in 0.5 ha (Sept – March) OR If *T. tri* dominant ≥10 native herb species in 0.5 ha (Sept – March) AND	≤5 Mature *Eucalyptus* trees per hectare AND	≤30 % solid crown cover of trees and shrubs > 2 m AND	≤10 % solid crown cover of regenerating woody natives AND	≤20 % of ground cover is perennial weeds	Qualifies (Yes/No)
Kirklands 1	Yes	80 %	*Poa labillardierei* – 2 herbs	Yes	0 %	0 %	30 %	**No**
Kirklands 2	Yes	90 %	*Poa labillardierei* – 4 herbs	Yes	0 %	0 %	30 %	**No**
Kirklands 3	Yes	70 %	*Themeda triandra* – 5 herbs	Yes	0 %	0 %	50 %	**No**
Kirklands 4	Yes	100 %	*Poa labillardierei* – 5 herbs	Yes	0 %	0 %	40 %	**No**
Kirklands 5	Yes	80 %	*Poa labillardierei* – 5 herbs	Yes	0 %	0 %	40 %	**No**
Kirklands 6	Yes	100 %	*Poa labillardierei* – 5 herbs	Yes	0 %	0 %	30 %	**No**
Stockwell 1	Yes	90 %	*Poa labillardierei* – 3 herbs	Yes	0 %	0 %	25 %	**No**
Stockwell 2	Yes	90 %	*Poa labillardierei* – 0 herbs	Yes	0 %	0 %	50 %	**No**
Stockwell 3	Yes	90 %	*Poa labillardierei* – 1 herb	Yes	0 %	0 %	40 %	**No**
Stockwell 4	Yes	95 %	*Poa labillardierei* – 3 herbs	Yes	0 %	0 %	30 %	**No**

3.4.1.5. SUMMARY OF MITIGATION AND AVOIDANCE MEASURES

Table 55: Summary of mitigation and avoidance measures for the lowland native grasslands of Tasmania ecological community

Mitigation / Avoidance Measure	Description	Responsible Party	Location and Timing	Assessment of Effectiveness
Avoidance	Sites identified as having a high potential to qualify as the LNGT community have been avoided through realignment.	Tasmanian Irrigation	Prior to referral	**Very high** All patches of grassland with potential to qualify have been avoided. No qualifying grasslands are present in the construction impact areas, nor is there any chance of these occurring. Avoidance is the most direct and therefore guaranteed process of mitigation.
Weed and hygiene management plan	A project specific weed and hygiene management plan to put measures in place to minimise the spread of weeds and pathogens across the project area.	Tasmanian Irrigation Civil Contractor	Entire project area Construction Phase	**Very high** The application of project specific weed and hygiene management plans is a frequently used mechanism to meet the legislative requirements of the Tasmanian *Biosecurity Act 2019* and can with confidence by relied on to prevent the spread of pathogens and weeds into any EPBCA grassland in the district.
Farm WAP	See **Section 1.1.1** and **Attachment 2** for detail on process.	Tasmanian Irrigation Individual Irrigator	All applicable properties that wish to purchase NMIS water. Operational Phase	**Very high** The Farm Water Access Plan has been developed by Tasmanian Irrigation as a further measure to mitigate against impacts to natural values and processes. The Farm WAP process has been applied to over 15 irrigation schemes in Tasmania. Farm WAPs are a condition of Federal and State Government approval for all Tasmanian Irrigation built schemes. No inadvertent clearance or impacts to EPBCA grassland have occurred under this process.

3.4.1.6. SIGNIFICANT IMPACT ASSESSMENT

Table 56: Significant impact criteria with regards to the lowland native grasslands of Tasmania ecological community

Significant Impact Criteria	Likelihood of Significant Impact	Comments
1. Reduce the extent of an ecological community.	None	Through avoidance of known quality grassland sites, there will be no direct impact to this community due to the construction phase of the action. The application of a Farm WAP will adequately protect any identified grassland patches within areas that have expressed interest in purchasing water through the NMIS. This process has the potential to increase the known extent of this ecological community. Thus, the proposed action will not reduce the extent of an ecological community.
2. Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines.	None	As no occurrences of the ecological community occur within the project footprint, there will be no direct impact to this community, thus the action has no chance of fragmenting the lowland native grasslands of Tasmania ecological community during the construction phase. During the operational phase, any property wishing to apply NMIS water, or convert land to use for irrigation will be subject to developing a Farm WAP. This process will prevent any future clearance of grassland patches with potential to qualify for listing (as well as undocumented grasslands), thus no chance of fragmenting the lowland native grasslands of Tasmania ecological community.
3. Adversely affect habitat critical to the survival of an ecological community.	None	There are no direct impacts to this ecological community anticipated due to the proposed action during the construction phase. The application of a Farm WAP to all properties that wish to purchase and use water from the NMIS will implement measures to ensure that no future actions will adversely affect habitat critical to the survival of this ecological community.
4. Modify or destroy abiotic factors necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	None	There are no direct impacts to this ecological community anticipated due to the proposed action during the construction phase. The application of a Farm WAP to all properties that wish to purchase and use water from the NMIS will implement measures to ensure that no future actions will modify or destroy abiotic factors necessary for the survival of this ecological community.
5. Cause a substantial change in the species composition of an	None	There are no direct impacts to this ecological community anticipated due to the proposed action during the construction phase.

Significant Impact Criteria	Likelihood of Significant Impact	Comments
occurrence of an ecological community, including causing a decline or loss of functionally important species.		The application of a Farm WAP to all properties that wish to purchase and use water from the NMIS will implement measures to ensure that no future actions will cause a substantial change in the species composition of any occurrences of this ecological community that may be identified through this process.
6. 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. • 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.	None	There are no direct impacts to this ecological community anticipated due to the proposed action during the construction phase. All construction activities will be subject to a project specific weed and hygiene management plan, as is recommended in the Natural Values Assessment report (see **Attachment 3, Page 54**). This measure will minimise the risk of the action spreading invasive species and pathogens throughout the broader area. The application of a Farm WAP to all properties that wish to purchase and use water from the NMIS will implement measures to ensure that no future actions will cause a substantial reduction in the quality or integrity of an occurrence of this ecological community should one be identified through this process.
7. Interfere with the recovery of an ecological community.	None	There is no adopted recovery plan for this ecological community[326].
Summary		
The proposed action will not have a significant impact on the lowland native grasslands of Tasmania ecological community.		

[326] Department of the Climate Change, Energy, the Environment and Water (2023g)

3.5. SUMMARY OF PROPOSED MITIGATION MEASURES

Table 57: Summary of proposed mitigation measures

Mitigation Measure	Description	Applicable MNES	Location and Timing	Responsible Party	Further Information
Avoidance	Avoidance to the extent possible of protected matters, achieved through realignment, reduction of the design corridor, and exclusion areas.	All MNES	Prior to referral and up to the point of works.	Tasmanian Irrigation	-
Exclusion zones	Demarcate a minimum 5 m buffer zone around known threatened flora locations within construction corridor. This must be clearly marked on CEMP and on the ground.	*Pterostylis ziegeleri*, *Stenanthemum pimeleoides*	A minimum 5 m buffer on all known threatened flora MNES locations within the construction corridor. Construction phase.	Tasmanian Irrigation Civil Contractor	**Section 3.3.1**, **Section 3.3.3**
Weed and hygiene management plan (WHMP)	A project specific weed and hygiene management plan that complies with the Tasmanian *Biosecurity Act 2019*. The WHMP must cover all relevant aspects of the control and management of declared and environmental weeds, including: a) An overarching set of objectives and the context in which they are to be achieved. b) An assessment of the potential impact of the introduction of weeds, including immediate and adjacent areas which are free of weeds. c) Strategies for managing weeds including their eradication within the construction area and on any public roads used for project related transport.	Threatened flora MNES and lowland native grasslands of Tasmania	Whole action area over the entire construction phase	Individual Irrigator Civil Contractor Tasmanian Irrigation	**Section 2.2** and **Section 2.3** discusses risks presented by the NMIS. A weed and hygiene management plan is yet to be developed.

Mitigation Measure	Description	Applicable MNES	Location and Timing	Responsible Party	Further Information
	d) Strategies for ongoing monitoring and control of weeds within the project area. e) Identification of appropriate herbicides for control and how they are to be used. A hygiene plan also aimed at pathogen control is part of the WHMP to ensure there is no introduction of pathogens or 'declared' weeds or significant environmental weed species into the area, translocation of weeds within the project area or the import of existing declared weeds from outside the area. The hygiene plan should cover, but not be limited to: a) Vehicle, machinery, and equipment hygiene. b) Washdown protocols when travelling between clean and contaminated areas. c) Location and management of washdown areas and facilities, including management of effluent. d) Maintaining logbooks detailing adherence to hygiene protocols for all civil contractors. Material hygiene (soils, gravel, plant material etc.) – ensuring that no materials contaminated with weed propagules (seed, propagative vegetative material) are imported into the project area.				
Farm WAP	A Farm Water Access Plan is required for all properties that NMIS water is applied to. Farm WAPs will be prepared by a prequalified	Swan galaxias, green & gold frog, threatened flora	All applicable properties that wish to purchase NMIS	Tasmanian Irrigation	**Section 1.1.1** and **Attachment 2**

Mitigation Measure	Description	Applicable MNES	Location and Timing	Responsible Party	Further Information
	consultant and will be prepared in accordance with the State approved soil, water, and biodiversity modules of the Farm WAP program. The irrigator is responsible for: • having a Farm WAP in place, • ensuring TI water is only applied to land where a current Farm WAP is in place, • informing TI of any changes to practices, so TI can assist with the updating and approval of a revised Farm WAP prior to those changed practices being implemented, • applying the water in accordance with the Farm WAP requirements including ensuring that the volume of water applied matches the land capability and crop water usage volumes, • complying with the management actions and monitoring schedules prescribed in the Farm WAP • keeping records of irrigation, chemical and fertiliser use in compliance with Tasmanian regulations. Farm WAPs must be audited in accordance with the conditions under the Tasmanian *Water Management Act 1999*.	MNES, and lowland native grasslands of Tasmania	water. Operational Phase		
Pre-clearance check and unanticipated den	Prior to the commencement of the action, the civil contractor must implement the pre-	Tasmanian devil, spotted tail quoll,	Two weeks prior to any vegetation clearance,	Civil Contractor	**Section 3.2.1**, **Section**

Mitigation Measure	Description	Applicable MNES	Location and Timing	Responsible Party	Further Information
discovery protocol	clearance check and unanticipated den discovery protocol as detailed in **Attachment 12**. This protocol will require approvals under the Tasmanian *Nature Conservation Act 2002* should dens be required to be decommissioned. The application of this protocol must: a) Be conducted within two weeks of the commencement of any vegetation clearance and must be applied to a 50 m buffer of the works area. b) If dens are located, they must be subject to a den monitoring assessment as detailed in Section B of the protocol. c) Comply with the reporting and regulation components of Section C of the protocol.	eastern quoll	including a 50 m buffer of the pipeline alignment	Tasmanian Irrigation	**3.2.2**, **Section 3.2.3**
Roadkill mitigation and monitoring	During the construction phase of the action, the civil contractor must comply with roadkill mitigation measures as detailed in **Section 3.2.1.4**. Roadkill mitigation measures include: a) Reduction of speed across all project roads for project vehicles. b) Centralising transport of key infrastructure to core roads. c) Restricting use of roads outside of daylight hours as much as is practicable. d) Project vehicles will be fitted with a basic, high-frequency animal repellent device. e) Specific mitigation for special purpose	Tasmanian devil, spotted tail quoll, eastern quoll	All project roads. Ongoing throughout construction phase of the project	Tasmanian Irrigation Civil Contractor	**Section 3.2.1**, **Section 3.2.2**, **Section 3.2.3**

Mitigation Measure	Description	Applicable MNES	Location and Timing	Responsible Party	Further Information
	vehicles, including travel convoys, escort vehicles, and further speed reduction. f) Roadkill monitoring. Collision data must be reviewed at a minimum of every 6 months. Data must be submitted to the Department of Natural Resources and Environment Tasmania and the Department of Climate Change, Energy, the Environment and Water.				
Construction outside of eagle breeding season	The civil contractor will not conduct any works within 500 m direct distance and/or 1,000 m line-of-sight of an active eagle nest during the breeding season (defined as the beginning of July to the end of January, unless advice surrounding shortened or lengthened breeding season is provided by the Forest Practices Authority).	Tasmanian wedge-tailed eagle	Applicable to nests within 500 m direct distance and/or 1 km line-of-sight from construction areas. February – June (inclusive) designated as the period outside of the breeding season, other than following seasons in which breeding extends into February (which gets identified annually around November by the FPA and NRE.	Tasmanian Irrigation Civil Contractor	**Section 3.2.4**
Aerial nest search	Commitment to undertake periodic aerial nest search/es outside of the eagle breeding season to detect any new nests within proximity of the project area – noting that any new nests will be subject to the same avoidance principles and seasonal constraints.	Tasmanian wedge-tailed eagle	Applicable to area within 500 m direct distance and 1 km line of sight of works area. Every 2 years for the duration of the construction phase. February – June (inclusive) designated as the period outside of the breeding	Tasmanian Irrigation	**Section 3.2.4**

Mitigation Measure	Description	Applicable MNES	Location and Timing	Responsible Party	Further Information
			season, other than following seasons in which breeding extends into February.		
Using annual eagle nest activity assessment to inform seasonal constraints around active nest sites	Survey conducted during the eagle breeding season to establish the activity status of known eagle nests within 500 m direct distance and/or 1 km line-of-sight of parts of the project area in which works may be required/desired during the eagle breeding season. Nests must be assumed to be active from the commencement of the season until a nest activity assessment proves otherwise. Works can be undertaken around inactive nests with no risk of disturbance. If a nest is active, no construction will occur (within 500 m or 1 km line of sight) for the remainder of the breeding season unless in the event of an emergency, in which emergency principles must apply.	Tasmanian wedge-tailed eagle	Applicable to nests within 500 m direct distance and/or 1 km line-of-sight from construction areas. Annually (for duration of construction) during breeding season, July – January (inclusive) (extended into February in late years). As required (for scheduled maintenance).	Tasmanian Irrigation Assessments conducted by the Forest Practices Authority or qualified practitioners	**Section 3.2.4**
Future planning	Forward planning of scheduled maintenance to occur outside of the eagle breeding season.	Tasmanian wedge-tailed eagle	Applicable to nests within 500 m direct distance and/or 1 km line-of-sight from construction areas. February – June (inclusive) designated as the period outside of the breeding season, other than following seasons in which breeding	Tasmanian Irrigation	**Section 3.2.4**

Mitigation Measure	Description	Applicable MNES	Location and Timing	Responsible Party	Further Information
			extends into February.		
Exceptional circumstances	In exceptional circumstances where works are required in the vicinity of any nest which is active that season, the following measures will be put in place within 500 m direct distance and/or 1 km line of sight of the respective nest (consistent with Forest Practices Authority guidelines for conducting browser management and planting during the eagle management constraint period[327]): • No activity to be conducted within 200 m of the nest. • A maximum of 2 light vehicles are permitted for up to 30 minutes, and a maximum of 2 visits per week between 200 m and 1,000 m radius from the nest. • If safety requirements allow, discreet colours rather than hi-visibility clothing should be worn. • Efforts should be made to ensure parked vehicles are not within line-of-sight of the nest. • Workers should remain in close proximity to each other as much as possible. This is less threatening to eagle than people being spread out over large distances. • Any worker breaks must be conducted outside of the eagle nest management zone.	Tasmanian wedge-tailed eagle	Applicable to nests within 500 m direct distance and/or 1 km line-of-sight from operational areas.	Tasmanian Irrigation Civil Contractor	**Section 3.2.4**

[327] Forest Practices Authority (2023)

Mitigation Measure	Description	Applicable MNES	Location and Timing	Responsible Party	Further Information
	• In the event that eagles are observed on or around a nest during emergency works (or the nest is known to be active when the emergency procedure commences), the regulator must be notified immediately and a nest-specific management plan prepared by the proponent, with further mitigation measures to be implemented to the degree practicable on a case-by-case basis. These measures may include: o If possible, the works to cease immediately – until the nesting season is finished and/or the nest is deemed inactive. o If the nature of the emergency is such that works cannot cease, suitably qualified ecologist/s must be present to observe and monitor the eagle(s) for signs of distress and disruption of breeding activity and advise the contractors accordingly. Further advice from the regulator will be sought in the event of eagle distress.				
Habitat tree protocol	The civil contractor must avoid the removal of potential habitat trees to the extent that is practicable. Trees that are identified as unavoidable impacts will be subject to a habitat tree management protocol (**Attachment 13**). If a tree is confirmed/likely to be a masked owl breeding tree, it will be excluded from clearance. A 150 m exclusion	Tasmanian masked owl	Applicable locations marked on Protocol Application Area map (**Attachment 13**) Prior to tree removal (between March 1st and July 31st is preferred to reduce likelihood of nesting masked	Civil Contractor Tasmanian Irrigation	**Section 3.2.5 and Attachment 13**

Mitigation Measure	Description	Applicable MNES	Location and Timing	Responsible Party	Further Information
	zone where no works will occur must be applied until fledging has completed (up to 18 weeks), breeding has failed, or additional evidence is available to refute the suspected breeding evidence. A monitoring program will be required to inform this process and will need to be determined by the ecologist as to what is most suitable for the particular nesting tree. Alignment deviation works can commence within this buffer area upon determination of absence from the ecologist.		owls)		
Aquatic crossing EPG	The civil contractor must apply the impact minimisation strategies detailed in **Section 3.2.6.4** as well as complying with the provisions of the Tasmanian Irrigation Environmental Protection Requirements.	Swan galaxias	All watercourse crossings Entire duration of construction phase	Individual Irrigator Tasmanian Irrigation Civil Contractor	**Section 3.2.6**
Green & gold frog protocol	The civil contractor must apply the green and gold frog protocol as detailed in **Attachment 14** of this document as well as complying with the provisions of the Tasmanian Irrigation Environmental Protection Requirements.	Green & gold frog	All areas of potential habitat Construction Phase	Individual Irrigator Tasmanian Irrigation Civil Contractor	**Section 3.2.7** and **Attachment 14**

4. RESIDUAL IMPACTS AND PROPOSED OFFSETS

Tasmanian Irrigation determined that the residual impact will be limited to the permanent impact within the construction corridor to 0.66 ha of optimal and 0.67 ha of sub-optimal denning habitat for the Tasmanian devil and the eastern and spotted-tail quoll.

Tasmanian Irrigation determined that the temporary disturbance of 16.81 ha of optimal habitat and 56.48 ha of suboptimal habitat did not contribute to the significant impact due to it being regenerated with 12 months (see **Section 3.1.1.1**).

A summary of residual impacts is listed in Table 58, based upon the relevant outcomes discussed in **Section 3**.

All other MNES has either been avoided through design, avoidance, seasonal construction constraints, and specific impact mitigation.

Based on the residual impacts listed in Table 58, the residual impacts of the action was not considered to breach significant impact criteria based on our interpretation of the *MNES Significant Impact Guidelines 1.1*[328] , which would therefore not require an offset.

DCCEEW however have advised that they consider habitat impacts of 17.47 ha from the project will result in a significant residual impact on three species due to the following:

- Eastern quoll (EPCBA endangered) - *The department considers the proposed action is likely to reduce the area of occupancy of the species and modify or remove the availability and quality of habitat to the extent the species is likely to decline.*
- Tasmanian devil (EPCBA endangered) - *The department considers the proposed action is likely to reduce the area of occupancy of the species and modify or remove the availability and quality of habitat to the extent the species is likely to decline.*
- Spotted-tail quoll (EPCBA vulnerable) - *The department considers the proposed action is likely to reduce the area of occupancy of an important population and modify or remove the availability and quality of habitat to the extent the species is likely to decline.*

This recommendation has been accepted by TI and a suitable offset site is currently being investigated by TI, and an offset proposal has been submitted to DCCEEW for approval. An offset management plan will be drafted upon the receipt of the approval of the offset proposal.

[328] Commonwealth of Australia (2013)

Table 58: Summary of residual impacts

Matter of National Environmental Impact	Mitigation / Avoidance Measures	Residual Impact
Fauna		
Tasmanian devil	Roadkill mitigation measures proposed An unanticipated den discovery protocol has been developed to eliminate the potential to destroy a denning site. Temporary impact areas will be rehabilitated immediately post works, which will allow for foraging to remain viable in all areas of temporary disturbance.	0.66 ha of optimal habitat 0.67 ha of sub-optimal habitat All other construction impacts are temporary. No significant impacts anticipated due to the operation of the scheme.
eastern quoll	Roadkill mitigation measures proposed An unanticipated den discovery protocol has been developed to eliminate the potential to destroy a denning site. Temporary impact areas will be rehabilitated immediately post works, which will allow for foraging to remain viable in all areas of temporary disturbance.	0.66 ha of optimal habitat 0.67 ha of sub-optimal habitat All other construction impacts are temporary. No significant impacts anticipated due to the operation of the scheme.
spotted-tail quoll	Roadkill mitigation measures proposed An unanticipated den discovery protocol has been developed to eliminate the potential to destroy a denning site. Temporary impact areas will be rehabilitated immediately post works, which will allow for foraging to remain viable in all areas of temporary disturbance.	0.66 ha of optimal habitat 0.67 ha of sub-optimal habitat All other construction impacts are temporary. No significant impacts anticipated due to the operation of the scheme.
Tasmanian wedge-tailed eagle	Construction within 500 m direct distance and 1 km line-of-sight of an active eagle nest will not occur during the breeding season (July-January inclusive). Ongoing activity assessments for works within 500 m direct distance and 1 km line-of-sight (as required).	With mitigation measures in place, no significant impacts are anticipated.
Tasmanian masked owl	Over 80 % of the large potential hollow bearing trees recorded within the project area have been avoided through design. Remaining potential habitat trees within the construction corridor that cannot be avoided will be subject to a habitat tree protocol involving targeted hollow use inspections, which may involve tree climbing. It is anticipated that some trees will require removal. The habitat tree protocol is currently under review by the conservation assessments	With mitigation measures in place, no significant impacts are anticipated.

Matter of National Environmental Impact	Mitigation / Avoidance Measures	Residual Impact
	branch of the Department of Natural Resources and Environment Tasmania.	
Swan galaxias	Aquatic crossing construction protocol has been developed, assuming the presence of this species.	With mitigation measures in place, no significant impacts are anticipated.
green and gold frog	Highest quality habitat has been avoided through design. All other areas of potential breeding or connectivity habitat are subject to a species specific protocol to mitigate potential risks.	With mitigation measures in place, no significant impacts are anticipated.
Flora		
grassland greenhood	All known occurrences have been avoided through design. Known occurrences will be fenced off as exclusion zones to prevent unintended impacts. Facilitated impacts due to the operation of the scheme will be mitigated through the TI Farm WAP.	No direct impacts due to construction. With mitigation measures in place, no significant impacts are anticipated due to the operation of the scheme.
matted flax-lily	Some occurrences have been avoided through design; however, one small patch remains in the design corridor. A permit to take under the TSPA has been submitted. Facilitated impacts due to the operation of the scheme will be mitigated through the TI Farm WAP.	Loss of 4 m^2, containing approximately 30 plants. With mitigation measures in place, no significant impacts are anticipated due to the operation of the scheme.
propellor plant	Known occurrences will be fenced off as exclusion zones to prevent unintended impacts. Facilitated impacts due to the operation of the scheme will be mitigated through the TI Farm WAP.	No direct impacts anticipated. With mitigation measures in place, no significant impacts are anticipated due to the operation of the scheme.
Vegetation Communities		
lowland native grasslands of Tasmania	Patches that were deemed likely to qualify were avoided through design. Patches with potential to qualify within the project area were assessed against the listing criteria, however no patches qualified for listing. Facilitated impacts due to the operation of the scheme will be mitigated through the TI Farm WAP.	No direct impacts due to construction. With mitigation measures in place, no significant impacts are anticipated due to the operation of the scheme.

We note that with respect to the Tasmanian devil, the population within which the project area occurs is stated by the department to contain a population size between 12,000 and 37,500 mature individuals[329], which equates to 0.24-0.74 devils per square kilometre.

Conservation advice from the department notes that Tasmanian devils are less susceptible to habitat modification than many other species, however if population densities are low, there is a risk that disturbance and destruction of maternal dens could pose a significant risk to the species. TI will mitigate this risk through the application of a pre-clearance check and unanticipated den discovery protocol (**Attachment 12**).

In addition to this, with 0.66 ha of the 17.47 ha being permanent loss of habitat (with the remaining 16.81 ha being temporary loss to be rehabilitated post-works), 95.50 % of the impact footprint within the construction corridor (424.78 ha), from the long-term perspective of devil habitat use will merely be habitat disturbance, with the extent of the pipeline post-works once more becoming viable habitat for foraging, dispersal (and potentially denning but still less likely than foraging/dispersal based on pre-existing landscape attributes such as the extent of cleared land) – even during construction there will be scope for devils to move through areas in a relatively unfettered fashion and for the works area to still provide habitat value in that sense.

Given the conservation advice, the scale of permanent impacts, and the proposed mitigation measures, these impacts cannot be considered residual significant impacts to the Tasmanian devil.

With respect to the eastern quoll, we note the conservation advice from the department on the species does not list habitat loss as being a conservation threat to the species. It is noted that the species is not listed as threatened in Tasmania as it was not found to meet the requisite listing criteria when considered (concurrent with the timing of the EPBCA listing). Although there is evidence to suggest that this species is in decline[330], this is yet to be reflected by a review of the conservation status at the State level.

With respect to the spotted-tail quoll, none of the components making up the 17.47 ha of habitat loss intersect with the range of important populations (Figure 14). By default, therefore, we found these impacts could not be considered residual significant impacts to the species.

Whilst our assessment differs to the department's assessment for the reason's outlined above, having been advised that the most rapid pathway for the project to proceed is to provide an offset, the proponent is willing to provide an offset for the loss of 17.47 ha of optimal denning habitat loss for the specified species.

[331] https://www.tasmanianirrigation.com.au/
[331] https://www.tasmanianirrigation.com.au/

5. SOCIAL AND ECONOMIC

Tasmanian Irrigation has completed extensive public consultation regarding the NMIS. Public consultation has been ongoing since 2018. The project commenced in 2018 and a Business Case was submitted to the Tasmanian Irrigation board in June 2021.

5.1.1. COMMUNITY CONSULTATION

The project was discussed, and interest gauged with various community groups and interested parties within the Northern Midlands regional communities between 2018-2020. A six-person working group was elected to represent interested community members and to work with TI to develop an irrigation scheme for the district. NMIS irrigators continue to be represented by this group. Meetings with individual landowners, the irrigator working group as a whole and other interested parties are held as required. During the development of the scheme design, the working group committee met formally several times. In addition, numerous site meetings with individuals have occurred to ensure that any issues of concern were considered in the scheme design.

Since 2018, TI has produced community newsletters providing information relating to the scheme design progress. These newsletters are either mailed or emailed to about 120 landowners and 45 interested parties. Newsletters are available on Tasmanian Irrigation's website[331]. In addition, the local community newspaper has run a number of articles on the scheme. The NMIS scheme has been the subject of a number of Local ABC radio and television interviews and has also been discussed in a general context for the past 4 years.

An eight-week water sales period commenced in December 2020, which resulted in 45 acceptable applications significantly exceeding the initial indicated volume for the scheme. Following the water sales period, the scheme volume of 25,500 ML was determined.

5.1.2. LOCAL GOVERNMENT CONSULTATION

Tasmanian Irrigation has had ongoing communications with representatives of the Northern Midlands Council throughout the projects duration. The scheme project manager along with the Tasmanian Irrigation CEO briefed the council members in July 2021.

The Council has indicated its support for scheme and continue to assist wherever possible. The Council has been consulted regarding pump station and pipeline locations, road crossings and other key infrastructure with this items to be finalised as part of the Development Application.

5.1.3. STATE GOVERNMENT CONSULTATION

Tasmanian Irrigation has engaged closely with the Tasmanian Department of Natural Resources and Environment Tasmanian to ensure appropriate surveys are undertaken relating to the environment, heritage, and water. The Business Case for the scheme has been assessed by NRE and the Treasury Department of the Tasmanian government.

Tasmanian Irrigation has consulted and been supported by both State and Federal Members of Parliament as the scheme proposal has been progressed.

5.1.4. TRADITIONAL LANDOWNER CONSULTATION

Following an examination of alignment options, and the development of an initial preferred option, Aboriginal heritage surveys and consultation with the Aboriginal community were progressed. Indigenous stakeholder bodies that are being consulted include the regulator; Aboriginal Heritage Tasmania (AHT), and various Aboriginal community representative groups including the Aboriginal Heritage Council.

[331] https://www.tasmanianirrigation.com.au/

Consultation with the Aboriginal community includes the involvement of an Aboriginal Heritage Officer in both the identification of artefacts and the completion of any on-ground survey work.

5.2. COSTS AND BENEFITS

The Northern Midlands Irrigation Scheme will be an important driver of continued economic growth in the Northern Midlands region of Tasmania, with direct benefits flowing to the larger population centres of Launceston and surrounding regions of Campbell Town, Ross, Poatina, Conara, Cressy, and Longford. Increased expenditure by irrigators will benefit contractors, agricultural suppliers, business service providers and retail businesses in the local district.

The reliability of water extracted from Hydro Tasmania's Poatina Tailrace, which is part of the Great Lake hydro scheme, as the primary water source for the scheme ensures that 95 % minimum Tasmanian Irrigation requirement is met. As with all Tasmanian Irrigation's schemes the high reliability of water availability ensures that farmers can confidently expand their businesses.

The enterprises that will utilise water from the NMIS will help enhance Tasmania's increasing international reputation for high quality meat production, vegetable production, cropping and stone fruit production, enhancing the State's growing reputation to international and mainland visitors the opportunity to enjoy 'paddock to plate' experiences.

This is a revised business case and follows on from the initial business case submitted to the Tasmanian Government in June 2021 and approved in September 2021. The initial business case was also submitted to the Commonwealth Government by the Tasmanian Government in 2021.

After submitting the business case, Tasmanian Irrigation commissioned the detailed design for the scheme which would form part of the tender documentation for construction of the scheme. The detailed design was subjected to two independent cost estimation reviews. These coupled with industry-wide cost escalation has resulted in the capital cost estimate increasing from $146.89 million quoted in the original business case to the P50 estimate of $173.09 million and P90 estimate of $217.96 million assuming the project proceeds to tender in 2022.

The economic modelling for the $173.09 million scheme demonstrates a strong case for public funding with a net present value (NPV) of $150.42 million, a benefit cost ratio of 1.79, internal rate of return (IRR) of 12.9% and the creation of up to 90 positions during the 36-month approval and construction period, and up to 222 direct and indirect full-time employment positions once fully operational. The private on-farm investment undertaken by farmers taking up entitlements is estimated at around $81.98 million (including the cost of water entitlements), which equates to around 47% of the total capital expenditure required for the scheme.

The NMIS provides the basis for an ongoing stimulus to the region, building on its diverse agricultural attributes – both physical and human. It provides the foundation for development of high value horticulture in the region as well as broadacre cropping and intensive livestock enterprises.

Tasmania's Midlands and Northern Midlands regions have proven to be suitable for irrigated broadacre cropping, vegetable production as well as emerging high value enterprises, including cherry orchards and berry fruit production.

The main impediment to expansion of the irrigation sector in the region is the limited supply of water and the lack of security associated with that supply. The area of irrigable land within the project area is estimated at 89,642 ha or 73 % of the total area. Accordingly, there are extensive areas of irrigable land available which can be used to support further irrigation developments.

Key results from the financial and economic modelling undertaken for the preliminary business case are as follows:

- The economic returns from the proposed NMIS are expected to be positive and the scheme as a whole will generate an estimated $150.42 million in direct economic benefits (economic NPV).
- The net government funding required for the NMIS is estimated at around $136.36 million and equates to 79 % of the total capital cost, including land and Tasmanian Irrigation's project-related costs. Funding for $86.54 million is sought from the National Water Infrastructure Development Fund (NWIDF) – Capital Component, representing 50 % of the capital cost.
- Irrigators will fund $36.72 million (21.2%) through the purchase of water entitlements.
- The Tasmanian Government will fund $49.82 million (28.8 %) representing the balance of the total capital cost including land and Tasmanian Irrigation's project delivery costs.

Sensitivity testing using the economic model of the proposed NMIS shows that the economic NPV (or net economic benefit) of the scheme is positive for all 11 scenarios examined. Moreover, sensitivity testing of a combination of unfavourable assumptions – 10 % increase in capital and operating costs, a 10 % reduction in net farm margins and Slow Demand Uptake – resulted in a net economic benefit estimated at $95.18 million with a benefit-cost ratio (BCR) of 1.46.

This shows that the project is likely to remain economically viable even if there are large, unfavourable movements in key parameters (such as capital development costs, operating costs, crop margins, and demand up-take rate) impacting the economic performance of the scheme.

Accordingly, there is a very strong a priori basis for development of new water infrastructure to supply an important farming region of Tasmania.

In addition, at a national level, there is growing uncertainty about the impact on the production of a number of tree crops and long-term trends in wine grape production in some of the mainland areas due to increases in temperature. This temperature increase creates a lack of chill hours during the winter months, which is vital to plant growth and fruit development.

In contrast, recent research by the Tasmanian Institute of Agriculture has indicated the impact of climate change on Tasmania is likely to result in warmer atmospheric temperatures, reduced frost risk and rainfall will remain relatively stable, and is predicted to have a positive impact on increasing the accumulation of growing day degrees and decrease the incidence and severity of frost. Overall, horticulture, cropping and pastoral based industries in Tasmania should see increased productivity provided the right agronomy package is adopted. This includes varietal selection (likely to be longer maturity types with a lower vernalisation requirement), increased nutrient applications to facilitate the higher potential yields. Irrigation will continue to play a critical role such that the ability to access high surety good quality water supply is essential.

Climate change is likely to result in a geographic shift in irrigation in Australia due to declining system yields from the Murray Darling Basin, where 75% of Australia's irrigated agriculture (by area) is located. The response by governments and private enterprise will be to seek to diversify irrigation in other regions, with Tasmania, north-west Australia and north Queensland considered the more suitable areas for expansion of irrigation.

In reviewing the overall performance of the NMIS, it is noted that the project:

- Has a core direct net benefit expected from the use of water for irrigation purposes during business-as-usual (or 'non-drought' periods). This allows for expansion by existing growers as well as the avoidance of a contraction in irrigated agricultural output in dry periods due to a lack of water supply. The economic returns from the scheme are high and will generate direct economic benefits (economic NPV) estimated at $150.42 million with a BCR of 1.79 and an IRR of 12.9 %.

- Provides wide-ranging benefits in terms of regional development, water security, and strong stakeholder commitment.
- Is designed to facilitate water trading within zones.
- Is expected to provide a minimum employment stimulus of up to 225 jobs (direct and indirect full-time equivalents) in the local region with additional jobs (90 jobs) created during construction of the scheme not including the additional jobs created through the investment in on-farm infrastructure.
- Has no fundamental weaknesses in terms of environmental impacts, cultural heritage impacts, impact on Aboriginal relics, or other project risks – technical, environmental, or financial.

Sensitivity testing using the economic model developed shows that there is a net economic benefit of the NMIS under all 11 scenarios modelled, including an "Extreme" case involving a 10 % increase in capital and operating costs, a 10 % decrease in net margins across all years, and a "Slow" uptake in demand. Even under this case a positive NPV of $95.18 million and a BCR of 1.46 were estimated.

On balance, it is considered that the results of the analyses are conclusive in supporting the case for development of the NMIS. A key factor is that the economic performance of the preferred design option is robust and there are no major obstacles in terms of environmental impacts or technical impediments to the project.

A sum of $86.54 million is sought from the NWIDF-Capital Component with a further $49.82 million in funding from the Tasmanian Government. Irrigators will contribute $36.72 million through the purchase of water entitlements as well as an additional $45.26 million in on-farm works.

5.2.1. COSTS ASSOCIATED WITH ALTERNATE TIMEFRAMES

An alternate timeline could have far-reaching social and economic impacts for the northern Midlands region, and thus is not feasible or desirable in this case.

If timelines are postponed, it can be expected that there will be an increasing demand for water from already heavily allocated natural waterways, and that agriculture within the region will continue to be constrained. The distribution area has moderate annual rainfall with a limited potential for additional water to be sourced from within the district's catchments; landowners who do not have immediate access to water already will have limited opportunity to access alternate water in a future without Northern Midlands Irrigation Scheme.

Without delivery of the NMIS, there may be limited growth of agricultural opportunities in the NMIS region; continued exposure of farmers in the region to climate risks – both climate change and rainfall variability which impact on the viability of irrigated enterprises; limited scope for expansion of higher value enterprises reliant on irrigation, due to the lack of viable additional water sources; financial vulnerability of some operators, due to the impacts of periods of low rainfall; limited potential for expansion of Tasmanian agribusiness and tourism-related enterprises in the region; and the potential need for publicly funded drought relief.

6. OTHER APPROVALS AND CONDITIONS

6.1. LIST OF APPROVALS

The legislative and planning framework that governs the protection and management of Tasmania's environment and heritage has been considered in the planning and design of the NMIS. The relevant instruments and their relationship to the protection of matters listed on the EPBC Act are discussed below. The EPBC Act assessment is the only Commonwealth approval that is required for the project.

The project will not require assessment as a project of State significance or via the major projects planning pathway. However, the project will need to meet the requirements of various State Acts, including the *Tasmanian Water Management Act 1999, Threatened Species Protection Act 1995* and the *Nature Conservation Act 2002*. The purpose of the latter two acts is to provide for the protection and management of threatened native flora and fauna and to enable and promote the conservation of native flora and fauna. Under these acts, the crown can issue a 'permit to take' a threatened species or the product of a threatened species (e.g. a possible burrow) for the planned activity, with mitigation and offset requirements determined by the nature of the proposed impact.

6.1.1. TASMANIAN *WATER MANAGEMENT ACT 1999*

Water Licence (Part 6, Section 54)

This instrument is in place to ensure that water is allocated in accordance with National Water Initiative (NWI) principles. It sets environmental flows, daily take limits and cease to take limits for watercourses.

Relevance to project

It ensures that the aquatic habitat requirements for threatened aquatic flora and fauna are protected.

Dam Permit (Part 8, Section 146)

This instrument is in place to ensure that dams built over 1 ML are environmentally sensitive and adhere to national dam building standards. Sets requirements for offsets to impacts to threatened species and communities, as well as sediment and erosion controls during construction.

Relevance to project

The dam permit identifies if assessment under the EPBC Act is required. It assesses impacts on jointly listed species. Sets offset requirements for jointly listed fauna and flora species. Manages indirect impacts on aquatic environment by approving a sediment and erosion control plan for construction.

Water Entity Status (Part 9, Section 166)

The purpose of this instrument is to establish TI as a water entity responsible for the management of an irrigation district.

Relevance to project

It ensures that TI manages the irrigation district in accordance with irrigation district conditions and by-laws.

Irrigation District (Part 9, Section 176)

This sets the area in which irrigation rights can be established, where water can be applied and traded. It establishes the requirement for all water to be supplied under the Farm WAP Framework. It establishes an annual reporting framework.

Relevance to project

This instrument ensures that impacts to flora and fauna species and ecological communities are identified and managed in the irrigation footprint for each scheme, as well as outlining requirements

of annual audits of Farm WAPs, and ensures that an annual report is provided on how legislative requirements of the scheme are being met.

6.1.2. TASMANIAN *IRRIGATION CLAUSES ACT 1973*

Power to Grant Irrigation Rights (Section 23)

This instrument ensures that water from TI schemes can only be used via approved irrigation rights.

Relevance to project

This ensures that irrigation schemes are not over allocated and that all water is accounted for and managed in accordance with approvals.

6.1.3. TASMANIAN *LAND USE AND PLANNING APPROVALS ACT 1993* (LUPAA)

Development Application

LUPAA ensures that construction activities are in accordance with set guidelines and are in the public interest. It manages impacts on soil, water, visual amenity, and heritage.

Relevance to project

LUPAA considers local environment, visual amenity, potential impact to riparian areas and heritage.

6.1.4. TASMANIAN *THREATENED SPECIES PROTECTION ACT 1995* (TSPA)

Permit to Take (Flora and Fauna)

Any impacts on State-listed threatened flora and fauna are assessed. Permits to take (for flora and fauna) are issued if impacts are assessed as acceptable or capable of being offset.

Relevance to project

This ensures that habitat for threatened species is considered and sets processes for ensuring that significant impacts do not occur to threatened flora and fauna.

6.1.5. TASMANIAN *NATURE CONSERVATION ACT 2002* (NCA)

Permit to Take (Products of Wildlife)

The permit to take (products of wildlife) allows for the decommissioning of unused nests and dens and the translocation of species to avoid mortality for species protected under the *Nature Conservation (Wildlife) Regulations 2021.*

Impacts to Threatened Native Vegetation

Impacts to vegetation communities listed under the Tasmanian *Nature Conservation Act 2002* are addressed through the submission of a development application assessed under the Tasmanian *Land Use Planning and Approvals Act 1993*.

Relevance to project

This ensures that habitat for native species is considered and sets processes for ensuring that unacceptable impacts do not occur to fauna.

6.1.6. TASMANIAN *ABORIGINAL LANDS ACT 1995*

Land Vested in Council (Part 3, Section 27), Local Management of Certain Areas (Part 3, Section 31)

The Aboriginal Lands Act 1995 establishes Tasmania's Aboriginal Land Council. Section 27 of the Act permits the Council to bestow in trust areas of land in perpetuity for Aboriginal people as protected Aboriginal Land. Part 3 of the Act details how Aboriginal land is managed, and Section 31 identifies

that the Council can invite local Aboriginal people with an important association with that land to manage it if they possess the ability to do so.

Relevance to project

Considers Aboriginal heritage and allows for indigenous association and management of land.

6.1.7. TASMANIAN *ABORIGINAL RELICS ACT 1975*

Permit to Take, Destroy, Conceal, or Remove

To ensure that all Aboriginal heritage sites of significance are considered and protected.

Relevance to project

Considers Aboriginal sites listed on national registers.

6.1.8. TASMANIAN *BIOSECURITY ACT 2019*

Weed Management Plan

This Act states that landowners and managers must take all reasonable measures to control the impact and spread of declared weeds, particularly to prevent the spread into the habitat of threatened species, threatened communities and reserves.

Relevance to project

This act ensures that declared weeds are appropriately managed, and infestations are contained or removed according to local council weed management strategies. The weed management plan ensures that areas containing MNES are not significantly altered, transformed, or destroyed by the proposed works.

6.1.9. TASMANIAN *CROWN LAND ACT 1976*

Works Permit

The works permit ensures that any works undertaken in land owned by the Tasmanian Government is undertaken in an environmentally sensitive matter.

Relevance to project

Any MNES that occur within crown lands will be assessed and risks mitigated.

6.1.10. TASMANIAN PLANNING SCHEME

Planning Permit

The purpose of planning permits is to ensure that all activities are consistent with the relevant local government planning schemes, which regulate the requirements of Tasmanian *Land Use Planning and Approvals Act 1993* for various projects not triggering other Acts (or requiring multiple assessments). This also includes impacts to threatened native vegetation communities listed under the Tasmanian *Nature Conservation Act 2002*.

Relevance to project

The Natural Assets Code of the Tasmanian Planning Scheme considers EPBCA listed matters as priority biodiversity values for protection. The NCA listed *Eucalyptus amygdalina* forest and woodland on Cainozoic deposits (DAZ) and wetlands vegetation community is within the construction corridor and must be assessed through the Natural Assets Code of the planning scheme;

The majority of the project area is zoned as Agricultural, small areas are zoned as Utilities, Community Purpose, Low-Density Residential, and Environmental Management.

The project area is subject to the Bushire Prone Area Areas, Flood Prone Areas, Scenic Road Corridor, Priority Vegetation (Natural Asset Code), Waterway and Coastal Protection Area (Natural Asset Code), Local Heritage Place, Electricity Transmission Infrastructure Protection, Attenuation Area, and Landslip Hazard planning code overlays.

6.2. MONITORING, ENFORCEMENT, AND REVIEW PROCEDURES

The following documents, plans, and procedures are required to minimise impact on the natural environment and comply with the relevant legislative requirements, regulations, codes of practice and policies.

- Construction Environment Management Plan
- Environmental Protection Guidelines for:
    - Disturbance to terrestrial and aquatic flora and fauna
    - Erosion, sedimentation, and surface run-off
    - Aboriginal artefacts – Unanticipated discovery plan
    - Weed and hygiene control
    - Watercourse crossings
- Threatened fauna and fauna habitat protocols:
    - Unanticipated den discovery
    - Green-lined ground beetle impact mitigation
    - Habitat tree management
    - Forest clearance guidelines
    - Green and gold frog impact mitigation
- Weed Management Plan including:
    - A requirement to systematically survey sections of the construction corridor prior to works and undertake weed mitigation measures as appropriate.
    - Requirement to adhere to best practice guidelines:
        - *Weed and Disease Planning and Hygiene Guidelines - Preventing the spread of weeds and diseases in Tasmania* (DPIPWE 2015) and;
        - T*asmanian Washdown Guidelines for Weed and Disease Control – Machinery, Vehicles and Equipment* (DPIPWE 2004)

7. ENVIRONMENTAL RECORD OF PERSON PROPOSING TO TAKE THE ACTION

Tasmanian Irrigation has a satisfactory record of responsible environmental management. Tasmanian Irrigation has gained approval to construct seventeen irrigation schemes under the EPBCA and are operating in accordance with the approvals. Tasmanian Irrigation has not had any fines or notices issued to it under any Commonwealth or Tasmanian environmental legislation during this time.

There have been no past or present proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against the Person proposing to take the action.

Tasmanian Irrigation schemes are designed and operated in accordance with its environmental policy. The environmental policy is underpinned by internally developed Environmental Protection Requirements (EPRs), construction audit protocols, the Farm Water Access Planning Framework, and a Landscape Monitoring Program.

Previous submissions made by Tasmanian Irrigation (Name of Proposal and EPBC Act No):

- Sassafras-Wesley Vale Irrigation Scheme (EPBC 2010/5327)
- Whitemore Irrigation Scheme (EPBC 2010/5335)
- Headquarters Road Irrigation Scheme (EPBC 2010/5305)

- Winnaleah Irrigation Scheme (EPBC 2011/5798)
- Kindred North Motton Irrigation Scheme (EPBC 2012/6401)
- Upper Ringarooma Irrigation Scheme (EPBC 2013/6787)
- South East Irrigation Scheme (EPBC 2013/6843)
- Dial Blythe Irrigation Scheme (EPBC 2013/7058)
- Southern Highlands Irrigation Scheme (EPBC 2015/7491)
- Swan Valley Irrigation Scheme (EPBC 2015/7560)
- Lower South Esk Irrigation Scheme (Strategic Assessment Midlands Water Scheme)
- Arthurs Pipeline Irrigation Scheme (Strategic Assessment Midlands Water Scheme)
- Duck Irrigation Scheme (EPBC 2016/7778)
- North Esk Irrigation Scheme (EPBC 2017/7936)
- Scottsdale Irrigation Scheme (EPBC 2017/7981)

8. ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The principles of ecologically sustainable development (ESD) are captured within Section 3A of the EPBCA. More broadly, ESD is development that aims to meet the needs of Australians while conserving our ecosystems for the benefit of the future. By following the principles of ESD, we should be able to reduce the risk of serious environmental impacts arising from economic activity. More practically, ESD will mean changes to our patterns of resource use, including improvements in the quality of our air, land, and water, and in the development of new, environmentally friendly products and processes.

The principles of ESD as defined in Section 3A, and how they interact with the proposed action are as follows:

(a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social, and equitable considerations.

The proposed action is one irrigation scheme project in a broader range of existing and proposed irrigation scheme projects (Tranche 3) aimed at providing water security across Tasmania. Each scheme within the Tranche 3 project involves consultation with the community and all levels of government in partnership with landowners. Each scheme includes a socio-economic impact and analysis assessment. The NMIS project is aimed at meeting long-term social and economic goals by providing irrigation surety while reducing impacts on the natural environment.

The NMIS project specifically is forecasted to increase the state farm gate value by $330 million, an increase of 14% on the current state farm gate value. This is an important increase to reach the state target of growing the Tasmania's farm gate value of agriculture to $10 billion per year by 2050. The project also provides a net benefit, after capital costs, of $150.4 million to the state's economy providing a significant long-term economic benefit.

One significant environmental benefit of the scheme will be offering a pipe irrigation water supply into a district that is almost solely reliant on the river systems for the source of this water. The piped water supply will allow the pressure on these water courses to be reduced. By suppling this water under the proven Tasmanian Irrigation model and the requirement to implement and maintain the Farm WAP process ensures the long-term environmental sustainability of the project by ensuring there are no degenerative issues associated with the use of irrigation water from the NMIS. The Farm WAP process is an important mitigation measure to help conserve biodiversity and ecosystem values in the long term, intergenerationally for the future.

The NMIS is situated in the Northern Midlands Council region. Under the proposal, additional water will be supplied to agricultural land in Northern Midlands municipality. The direct benefits are expected to flow mainly to the local population centres of Longford, Cressy, Campbell Town and Conara, and Launceston and the wider Northern region more generally. The wider Northern area is reliant on primary production as a main economic driver for the region.

The project will compliment other schemes in the region, including the Lower South Esk, Whitemore and Cressy-Longford Schemes

The NMIS has the potential therefore to deliver an important positive stimulus to the regional economy with agribusiness firms, contractors and local businesses benefiting from the increased spend in the regional economy. Overall, the estimated quantitative economic impacts include:

- an increase in direct farm jobs of up to 150 FTEs
- indirect employment of up to a further 75 FTEs
- total employment of up to 225 FTEs
- an increase in total salaries and wages (direct and indirect) of up to $15.75 million p.a. following full utilisation of the 25,500 ML provided by the scheme.

The scheme would also provide significant construction benefits to the state economy, not only from the construction period of the project, but also from the on-farm investment undertaken by the local

farmers estimated at approximately $45.26 million, increasing to $81.98 million with the cost of water entitlements. During scheme construction, the project would involve up to 90 additional FTEs over the estimated 36-month approvals and construction period, providing an important stimulus to the regional economy. Based on experience from other similar schemes being constructed by Tasmanian Irrigation, most of the additional employment would be sourced regionally. The scheme will also provide improved drought security and so will have an additional social benefit through the reduction in financial pressure placed on farmers during drought. Moreover, the level of expenditure in the local economy by farmers will become less affected by drought (i.e., due to their improved capacity to maintain production levels). Consequently, the regional economy, and employment levels, will become less prone to downturn during periods of prolonged low rainfall

(b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

The proposed action does not pose a serious risk of serious or irreversible environmental damage. The permanent impact footprint of 20.03 ha of vegetation (of which only 0.91 ha is native vegetation) has been carefully considered, and site selection of permanent infrastructure has been carefully chosen to minimise the impacts to the environment. The remainder of the construction area is temporary in nature and all areas of native vegetation will be remediated post-construction.

(c) the principle of inter-generational equity that the present generation should ensure that the health, diversity, and productivity of the environment is maintained or enhanced for the benefit of future generations.

The proposed action provides for the long-term needs of the community through the provision of water security to the region, which will have social and economic flow-on effects both in the present and in the future (as highlighted under **Section 8 a)**). The mitigation measures proposed will also ensure that the health and diversity, along with the conservation of threatened values are protected into the future.

(d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.

Through all stages of the NMIS development, the conservation of biological diversity and ecological integrity has been at the forefront of decision making. This is evident in the number of surveys conducted (Table 7), and the subsequent alterations in the design to minimise threatened values. The operational phase of the NMIS will continue to promote the conservation of biological diversity and ecological integrity through the implementation of the Farm WAP program across properties that have submitted an EOI to the scheme.

(e) improved valuation, pricing and incentive mechanisms should be promoted.

Placing an appropriate value on ecological features allows the consideration of all impacts of a proposed action (social, environmental, and economic). The assessments submitted indicate the range of habitat quality across the site and the value of the site for the MNES discussed in this document. The significance of the project area to each of these MNES was determined and the potential for impacts assessed using the significant impact guidelines.

9. CONCLUSION

The construction of the Northern Midlands Irrigation Scheme is expected to return significant social and economic benefits to the broader Northern Midlands region and beyond. The project has the support of the local community, local government, and the State government.

Throughout the design phase of the project, areas containing important ecological values have been avoided to the extent possible. Where impacts are unavoidable, mitigation measures and protocols have been developed to minimise the risk/impact to these values.

Based on the residual impacts listed in Table 58, the residual impacts of the action was not considered to breach significant impact criteria based on our interpretation of the *MNES Significant Impact Guidelines 1.1*[332] , which would therefore not require an offset. Residual impacts as a result of the proposed action are anticipated to be very minor and can be mitigated through the TI Farm WAP process.

DCCEEW however have advised that they consider habitat impacts of 17.59 ha from the project will result in a significant residual impact on three species due to the following:

- Eastern quoll (EPCBA endangered) - *The department considers the proposed action is likely to reduce the area of occupancy of the species and modify or remove the availability and quality of habitat to the extent the species is likely to decline.*
- Tasmanian devil (EPCBA endangered) - *The department considers the proposed action is likely to reduce the area of occupancy of the species and modify or remove the availability and quality of habitat to the extent the species is likely to decline.*
- Spotted-tail quoll (EPCBA vulnerable) - *The department considers the proposed action is likely to reduce the area of occupancy of an important population and modify or remove the availability and quality of habitat to the extent the species is likely to decline.*

A suitable offset site is currently being investigated by TI, and an offset proposal has been submitted to DCCEEW for approval. An offset management plan will be drafted upon the receipt of the approval of the offset proposal.

9.1. TASMANIAN DEVILS AND QUOLLS

Surveys and analysis conducted by NBES have established that up to 416.68 ha of the design corridor footprint represents potential denning habitat (109.51 ha of which is classed as optimal, with the remaining 307.17 ha classed as sub-optimal) for the Tasmanian devil and spotted-tail quoll. There is a remaining 2,222.31 ha of habitat that is classed as unsuitable for denning. The proposed construction corridor contains 74.62 ha of potential denning habitat (17.47 ha of optimal habitat, 57.15 ha of sub-optimal habitat). A total of 370.19 ha of unsuitable denning habitat is present within the construction corridor.

The nature of the permanent works is such that permanent habitat loss is extremely minor in the context of the broader area (20.03 ha of total vegetation loss). Only areas proposed to contain balance tanks, and a proposed dam near Poatina are considered to be permanent habitat loss areas (0.66 ha of optimal denning habitat, 0.67 ha of sub-optimal denning habitat). All other impacts are expected to be short-term, with construction consisting of excavation and filling over the course of a two-week period in most cases. The foraging habitat for this species with thus not be significantly compromised during the construction of the pipeline.

Although surveys did not detect any potential dens or recorded any evidence of devils and quolls (in the form of scats, latrines, carcasses), rigorous measures are proposed to ensure that no dens are disturbed should they be discovered during construction, which is detailed in a pre-clearance check

[332] Commonwealth of Australia (2013)

and unanticipated den discovery protocol. The risk of increases in roadkill has been lessened through several roadkill mitigation strategies.

Changes in land use and land clearance, the potential for the introduction of weeds and disease, changes to water quality and flow regimes are not considered to be a risk to the persistence of devils and quolls throughout the broader landscape.

With the mitigation measures for both potential denning habitat and increased roadkill risk in place, the potential impacts to Tasmanian devils and the eastern and spotted-tail quoll are not considered to be significant.

9.2. TASMANIAN WEDGE-TAILED EAGLE

Aerial surveys identified eleven Tasmanian wedge-tailed eagles nests within 1 km of the proposed alignment. Due to the number of nests throughout the landscape, it was not possible to completely avoid areas within 500 m and/or 1 km line-of-sight from known eagle nests. To eliminate the risk of disturbing an active nest, Tasmanian Irrigation have committed to undertaking all works that occur within 500 m or 1 km line-of-sight outside of the breeding season. Eagle nest activity assessments will be carried out as required for the duration of the construction phase of the project.

Impacts due to the presence of permanent infrastructure are not considered to present a disturbance to eagles, with audible impacts expected to be negligible, and ongoing site maintenance to be infrequent and low impact.

Changes in land use and land clearance, the potential for the introduction of weeds and disease, changes to water quality and flow regimes are not considered to be a risk to the persistence of wedge-tailed eagles throughout the broader landscape.

9.3. OTHER MNES

The largely temporary nature of the action, and the avoidance and mitigation measures that have been proposed, the impact to other MNES discussed in this document are not considered to be significant based on the *MNES Significant Impact Guidelines 1.1*[333].

9.4. SUMMARY OF COMMITMENTS

9.4.1. TASMANIAN DEVIL, EASTERN QUOLL AND SPOTTED-TAIL QUOLL

Prior to the commencement of the action, the civil contractor must implement the pre-clearance check and unanticipated den discovery protocol as detailed in **Attachment 12**. This protocol will require approvals under the Tasmanian *Nature Conservation Act 2002* should dens be required to be decommissioned. The application of this protocol must:

a) Be conducted within two weeks of the commencement of any vegetation clearance and must be applied to a 50 m buffer of the works area.
b) If dens are located, they must be subject to a den monitoring assessment as detailed in Section B of the protocol.
c) Comply with the reporting and regulation components of Section C of the protocol.

During the construction phase of the action, the civil contractor must comply with roadkill mitigation measures as detailed in **Section 3.2.1.4**. Roadkill mitigation measures include:

a) Reduction of speed across all project roads for project vehicles.
b) Centralising transport of key infrastructure to core roads.
c) Restricting use of roads outside of daylight hours as much as is practicable.
d) Project vehicles will be fitted with a basic, high-frequency animal repellent device.

[333] Commonwealth of Australia (2013)

e) Specific mitigation for special purpose vehicles, including travel convoys, escort vehicles, and further speed reduction.
f) Roadkill monitoring. Collision data must be reviewed at a minimum of every 6 months. Data must be submitted to the Department of Natural Resources and Environment Tasmania and the Department of Climate Change, Energy, the Environment and Water.

9.4.2. TASMANIAN WEDGE-TAILED EAGLE

The civil contractor will not conduct any works within 500 m direct distance and/or 1,000 m line-of-sight of an active eagle nest during the breeding season (defined as the beginning of July to the end of January, unless advice surrounding shortened or lengthened breeding season is provided by the Forest Practices Authority).

Tasmanian Irrigation commit to the undertaking of periodic aerial nest search/es outside of the eagle breeding season to detect any new nests within proximity of the project area – noting that any new nests will be subject to the same avoidance principles and seasonal constraints.

Nests within 500 m direct distance and/or 1,000 m line-of-sight of any proposed works will be subject to a nest activity assessment during the breeding season to inform eagle nest management constraints. Further to this, Tasmanian Irrigation will engage a suitably qualified ecologist to conduct eagle nest activity assessments as required for the completion of the construction phase of the action. Nest 2943 will be assessed annually to inform maintenance constraints surrounding the Valleyfield Balance Tank during the eagle breeding season.

For situations during operations, where maintenance (routine or otherwise) may be required within the vicinity of an eagle nest, annual activity assessments following the same process will inform the proponent as to which nests are inactive and can thus be worked around without the risk of disturbance. In a situation where maintenance is required (either emergency or routine) within the breeding season in the vicinity of a nest that is active (or assumed to be active, such as in the absence of a nest activity assessment that season) it will be considered to be exceptional circumstances and a specific set of mitigation measure will apply to minimise the potential for impacts – these measures are broadly consistent with Forest Practices Authority guidelines for conducting browser management and planting during the eagle management constraint period around potentially active nests, and thus have been tried and tested for this kind of scenario[334]; the exceptional circumstances measures are as follows:

- All workers must be aware of the nest location but take care not to actively spend too much time observing the nest while they are within 500 m or 1 km line of sight – i.e., the eagle/s are likely to be less disturbed if they can be seen but are not actively observed.
- **No activity to be conducted within 200 m of the nest.**
- **Within 500 m or 1 km line of sight, a maximum of 2 light vehicles are permitted for up to 30 minutes and a maximum of 2 visits per week.**
- If safety requirements allow, discreet colours rather than hi-visibility clothing should be worn.
- Parked vehicles will not be within line-of-sight of the nest.
- Workers will remain in close proximity to each other as much as possible as this is less threatening to eagles than people being spread out over large distances.
- Any worker breaks must be conducted outside of the eagle nest vicinity (500 m and 1 km line of sight).
- In the event that the either of the bold clauses, or all of those not in bold, are not achievable, and/or one or more eagles are noted on or around a nest during works (or the nest is already known or assumed to be active when the exceptional circumstances have been triggered), NRE as a State regulator must be notified immediately and a nest-specific management plan

[334] Forest Practices Authority (2023)

prepared by the proponent to the satisfaction of the regulator, with further mitigation measures to be implemented to the degree practicable on a case-by-case basis. These measures may include:

- If possible/deemed necessary, the works to cease immediately – until the nesting season is finished and/or the nest is deemed inactive.
- If the nature of the works are such that they cannot cease, suitably qualified ecologist/s must be present to observe and monitor the eagle(s) for signs of distress and disruption of breeding activity and advise the contractors accordingly of periods when work can occur.
- Further advice from the regulator will be sought in the event of eagle distress/disturbance.

9.4.3. TASMANIAN MASKED OWL

The civil contractor must avoid the removal of potential habitat trees to the extent that is practicable. Trees that are identified as unavoidable impacts will be subject to a habitat tree management protocol (**Attachment 13**). If a tree is confirmed/likely to be a masked owl breeding tree, it will be excluded from clearance. A 150 m exclusion zone where no works will occur must be applied until fledging has completed (up to 18 weeks), breeding has failed, or additional evidence is available to refute the suspected breeding evidence. A monitoring program will be required to inform this process and will need to be determined by the ecologist as to what is most suitable for the particular nesting tree. Alignment deviation works can commence within this buffer area upon determination of absence from the ecologist.

9.4.4. SWAN GALAXIAS

The civil contractor must apply the impact minimisation strategies detailed in **Section 3.2.6.4** of this document as well as complying with the provisions of the Tasmanian Irrigation Environmental Protection Requirements.

9.4.5. GREEN AND GOLD FROG

The civil contractor must apply the green and gold frog protocol as detailed in **Attachment 14** of this document as well as complying with the provisions of the Tasmanian Irrigation Environmental Protection Requirements.

9.4.6. REVEGETATION

Prior to the commencement of the action, to compensate for the temporary disturbance to foraging and denning habitat of the Tasmanian devil, eastern quoll, and spotted-tail quoll, the civil contractor must submit a Revegetation Plan (RP) to the Tasmanian Irrigation for approval. The environmental outcome of the RP is to restore 24.41 ha of native vegetation (habitat) available for foraging and denning for threatened carnivores. The RP must be consistent with the department's *Environmental Management Plan Guidelines*[335], and will include:

a) Details of the habitat requirements of the relevant protected matters.
b) A table of commitments made in the plan to achieve environmental outcomes, with reference to where these commitments are made in the plan.
c) Compliance with commitments made in the Federal referral and preliminary documentation, as well as the Natural Values Assessment for the NMIS project.
d) Commitments capable of ensuring that the environmental outcomes are achieved, which include:
    1. Commencing revegetation immediately post disturbance.

[335] Commonwealth of Australia (2014)

2. Methods of revegetation (and corrective actions should the primary method not be successful).
3. Measures, including for hygiene, ground preparation, and weed and herbivore control, and the approximate timing of the measures to be undertaken prior to, during, and following planting/seeding to ensure the success of the revegetation.

e) Reporting and review mechanisms to ensure compliance with the RP.
f) A monitoring program which includes measurable performance indicators, trigger values for corrective actions, timing, and frequency of monitoring, and proposed corrective actions, and the timing and methods of submitting monitoring data to the department.

9.4.7. Weed and Hygiene Management

Prior to the commencement of the action, the civil contractor must submit a Weed and Hygiene Management Plan (WHMP) to Tasmanian Irrigation that addresses the weed and hygiene requirements that are highlighted within the EPBCA referral and preliminary documentation and the natural values assessment for the NMIS. The WHMP is a mitigation commitment for several MNES, including Lowland Native Grasslands of Tasmania, threatened flora species, and the green and gold frog.

The WHMP must comply with the Tasmanian *Biosecurity Act 2019*, and must adhere to the following State approved best practice guidelines:

- Keeping it clean - A Tasmanian field hygiene manual to prevent the spread of freshwater pests and pathogens[336];
- Weed and Disease Planning and Hygiene Guidelines - Preventing the spread of weeds and diseases in Tasmania[337];
- Tasmanian Washdown Guidelines for Weed and Disease Control. Machinery, Vehicles & Equipment[338];
- Wetlands and Waterways Works Manual[339].

The WHMP must cover all relevant aspects of the control and management of declared and environmental weeds, including:

a) An overarching set of objectives and the context in which they are to be achieved.
b) An assessment of the potential impact of the introduction of weeds, including immediate and adjacent areas which are free of weeds.
c) Strategies for managing weeds including their eradication within the project area and on any public roads used for project related transport.
d) Strategies for ongoing monitoring and control of weeds within the project area.
e) Identification of appropriate herbicides for control and how they are to be used.

A hygiene plan also aimed at pathogen control is part of the WHMP to ensure there is no introduction of pathogens or 'declared' weeds or significant environmental weed species into the area, translocation of weeds within the project area or the import of existing declared weeds from outside the area. The hygiene plan should cover, but not be limited to:

a) Vehicle, machinery, and equipment hygiene.
b) Washdown protocols when travelling between clean and contaminated areas.
c) Location and management of washdown areas and facilities, including management of effluent.

[336] Allen and Gartenstein (2010)
[337] Department of Primary Industries, Parks, Water & Environment (2015)
[338] Department of Primary Industries, Parks, Water & Environment (2004)
[339] Department of Primary Industries, Parks, Water & Environment (2003)

d) Maintaining logbooks detailing adherence to hygiene protocols for all civil contractors.
e) Material hygiene (soils, gravel, plant material etc.) – ensuring that no materials contaminated with weed propagules (seed, propagative vegetative material) are imported into the project area.

9.4.8. TASMANIAN IRRIGATION ENVIRONMENTAL PROTECTION REQUIREMENTS

Contractors and service providers must, as a minimum, comply with the requirements of relevant Commonwealth and Tasmanian legislation, regulations, codes of practice and environment policies. In addition, contractors and service providers must abide by all ordinances, permit requirements and by-laws designated to the protect the environment.

To ensure that Tasmanian Irrigation's commitments to environmental outcomes are achieved, environmental management must be monitored, audited, and reported.

The civil contractor must adhere to the guidelines for construction activities in relation to the protection of ecological values outlined in the Tasmanian Environmental Protection Requirements. These requirements include guidelines for:

a) Disturbance to terrestrial and aquatic flora and fauna, including (but not limited to) the protected matters detailed within this document.
b) Erosion, sedimentation, and surface run-off.
c) Aboriginal artifacts.
d) Weed and hygiene control.
e) Watercourse crossings.

These guidelines must be understood by the contractor and the contactor's Construction Environmental Management Plan must be compliant with the provisions detailed in these guidelines.

9.4.9. OPERATIONAL COMMITMENTS

9.4.9.1. FARM WATER ACCESS PLANS

A Farm Water Access Plan is required for all properties that NMIS water is applied to. Farm WAPs will be prepared by a prequalified consultant and will be prepared in accordance with the State approved soil, water, and biodiversity modules of the Farm WAP program.

The irrigator will be responsible for:

- having a Farm WAP in place,
- ensuring TI water is only applied to land where a current Farm WAP is in place,
- informing TI of any changes to practices, so TI can assist with the updating and approval of a revised Farm WAP prior to those changed practices being implemented,
- applying the water in accordance with the Farm WAP requirements including ensuring that the volume of water applied matches the land capability and crop water usage volumes,
- complying with the management actions and monitoring schedules prescribed in the Farm WAP
- keeping records of irrigation, chemical and fertiliser use in compliance with Tasmanian regulations.

Farm WAPs must be audited in accordance with the conditions under the Tasmanian *Water Management Act 1999*.

9.4.9.2. TASMANIAN WEDGE-TAILED EAGLE

A nest activity assessment must be conducted annual for Nest 2943 to inform maintenance constraints surrounding the Valleyfield Balance Tank during the eagle breeding season.

Additional eagle nest activity assessments must be conducted prior to any additional scheduled works that occur within 500 m direct distance or 1,000 m line-of-sight of a nest.

10. INFORMATION SOURCES

10.1. SOURCE AND CURRENCY

The field data used to quantify and describe the MNES and analyse the quality of habitats has all been collected since 2020. The most recent ground and aerial surveys were conducted in June 2022.

Distributional data is derived from the Tasmanian Natural Values Atlas and Commonwealth Protected Matters Search Tool. These data include most known records and viability of habitat for threated species. Range boundaries were sourced from the NVA data.

10.2. SOURCE RELIABILITY

All NBES data and specialist input has a high degree of reliability.

The NVA only accepts data that have been deemed to be reliable. The reliability of NVA data is tested in a variety of ways including but not limited to expert review and field verification. The Protected Matters Search Tool predicts occurrences off habitat mapping only, and the certainty of predicted values in moderate. To increase reliability, each MNES predicted to occur is individually assessed against the proposal area to determine the risk of impact.

10.3. UNCERTAINTIES

The reliability and certainty of the assessment is very high. Survey limitations exist (as described below), but these have been supplemented by using other sources such as the NVA and PMST reports to account for any survey limitations.

No botanical survey can guarantee that all vascular flora will be recorded during a single visit due to the limitations of the sampling technique, seasonal and annual variation in abundance and the possible absence of fertile material for identification. Due to seasonal variations in detectability and accurate discrimination (*i.e.* identification of closely related species), there may be some herb, orchid and/or graminoid species present on the route that have been overlooked due to flowering at times of the year other than when the survey was undertaken; due to lack of visibility, submerged species could also be under-surveyed to some degree. To compensate for this, field data from the present study were supplemented with data from the Tasmanian Natural Values Atlas[340] and the EPBCA Significant Matters Database[341]. All threatened plant species known to occur in the local area (500 m) are considered in terms of habitat suitability on site – a wider radius of 5 km was considered in our background assessment, but due to the nature of the works (relatively confined impact area) and the species in question, it was not considered necessary to present consideration of the additional species in the report. Flora surveys were strategically timed to maximize the opportunity to detect seasonal threatened flora.

Limitations of the fauna survey include locating all dens, hollows, and burrows within the area. There is no guarantee that all dens will be recorded during a single visit due to limitations of the sampling technique, variable use by fauna, and the cryptic nature of most dens and burrows. Dens and hollows may be located during repeat visits; however, the number and location of fauna and their habitat found during our surveys are likely to be indicative of the density of fauna and their utilisation of the site. Threatened fauna habitat, including the presence of tree hollows, was assessed from ground level only, other than for the aerial assessment of eagle nesting habitat.

[340] Department of Natural Resources and Environment Tasmania (2023)
[341] Commonwealth of Australia (2023)

10.4. GUIDELINES, PLANS AND/OR POLICIES CONSIDERED

- *Matters of National Environmental Significance Significant impact guidelines 1.1* (Commonwealth of Australia, 2013)
- *Survey guidelines for Australia's threatened mammals - Guidelines for detecting mammals listed as threatened under the EPBCA* (Department of Sustainability, Environment, Water, Population and Communities, 2011)
- Growling Grass Frog (*Litoria raniformis*). *Environmental Protection and Biodiversity Conservation Act 1999* Policy Statement 3.14. (Department of the Environment, Water, Heritage and the Arts, 2009a)
- Species Profile and Threats database profiles and conservation advice listings
- National and State recovery plans
- Forest Practices Authority fauna technical notes
- *Survey Guidelines and Management Advice for Development Proposals that may impact on the Tasmanian Devil (Sarcophilus harrisii)* (DPIPWE, 2015)

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10.6. LIST OF ATTACHMENTS

Attachment 1 – Referral document (EPBC Ref 2022-09295)

Attachment 1a – Referral document (Supplementary Attachments)

Attachment 2 – Tasmanian Irrigation Farm Water Access Plans Biodiversity Module

Attachment 3 – North Barker Ecosystem Services Natural Values Assessment Report

Attachment 3a – North Barker Ecosystem Services Natural Values Assessment Report (Supplementary Attachments)

Attachment 4 – North Barker Ecosystem Services Vegetation, Weeds, and Threatened Flora Maps

Attachment 5 – North Barker Ecosystem Services Vascular Plant Species

Attachment 6 –Tasmanian Natural Values Atlas Report

Attachment 7 – North Barker Ecosystem Services Threatened Fauna and Fauna Habitat Maps

Attachment 8 – North Barker Ecosystem Services Wedge-tailed Eagle Nest Visibility Maps

Attachment 9 – Tasmanian Irrigation - Environmental Protection Requirements for Construction

Attachment 10 – Protected Matters Search Tool Report

Attachment 11 – Pitt & Sherry Traffic Impact Assessment data

Attachment 12 – North Barker Ecosystem Services Pre-clearance Check and Unanticipated Den Discovery Protocol

Attachment 13 – North Barker Ecosystem Services Habitat Tree (Hollow-bearing) Management Protocol

Attachment 14– North Barker Ecosystem Services Green And Gold Frog Habitat Management & Impact Mitigation Protocol