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Executive summary

Overview

The Sunshine Coast Council (SCC), in partnership with the Queensland State Government (represented by the Department of Transport and Main Roads (TMR)), proposes to construct and operate a new integrated transport corridor in Caloundra, Queensland (Qld) referred to as the Caloundra Transport Corridor Upgrade (CTCU) Project (the 'Project' or proposed action).

The proposed action is a critical road infrastructure project jointly funded by both the Queensland State and local government (SCC), with SCC holding overall Project delivery responsibility as the Project proponent, with support from TMR as SCC's Project delivery partner.

Proposed action description

The proposed action will deliver a combination of new and upgraded existing transport infrastructure, to provide a 1.6 kilometre (km) two way/two lane, dual carriageway urban sub-arterial transport link between Omrah Avenue and Nicklin Way (a State-controlled road), with connection through to Industrial Avenue, north of the existing Caloundra Road roundabout. The new integrated transport corridor will provide a critical, strategic connection between the Caloundra central business, tourism and development district, and major road and public transport infrastructure, both existing and planned.

The proposed action includes the following:

- A 900 metre (m) upgrade of existing sections of Omrah Avenue, Oval Avenue and Third Avenue from two to four lanes with a new two-way cycle track and walking path for the entire length
- A new 700 m two way/two lane transport link including new two-way cycle track and walking path for the entire length which utilises the high voltage power line easement and unmade road reserve.

The Project's integrated transport corridor upgrade forms part of a long-term plan to provide better access, and improved travel choice to and from Caloundra for public transport users, cyclists, pedestrians, and motorists now and into the future by reducing environmental impacts from traffic congestion, preserving function and efficiency of existing roads, enhancing connectivity accessibility and safety, supporting improvements in public and active transport travel choices whilst minimising potential environmental, social and economic impacts.

Assessment background

This preliminary documentation report has been prepared in response to a request for additional information made by the Commonwealth Department of Climate Change, Energy, Environment and Water (DCCEEW) for the Caloundra Transport Corridor Upgrade Project, which, on 30 October 2024, was determined to be a 'controlled action' requiring assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) by preliminary documentation (EPBC Reference 2024/09956).

This referral determination was based on DCCEEW's assessment of the Project as having the potential to result in significant impacts on the following Matters of National Environmental Significance (MNES):

- The ecological character of the declared Ramsar wetlands (sections 16 and 17B)
- Listed threatened species and communities (sections 18 and 18A).

The information provided within this preliminary documentation report responds to the DCCEEW formal request for information (RFI) issued on 14 November 2024 under Section 95A(2) of the EPBC Act. In doing so, this preliminary documentation report seeks to inform DCCEEW's assessment of the potential Project impacts, and the evaluation of the proposed Project strategies for avoiding and mitigating any adverse impacts.

This document has been prepared as a stand-alone document and has been structured into sections that reflect the order in which items were raised in the DCCEEW RFI.

In accordance with the RFI, Appendix A includes a cross-referenced table detailing each of the items requested (which comprises two parts; Attachments A and B), together with section locations and links of where to find the responses within this document.

Further, where relevant information was provided in the original referral, this information has been incorporated into this document, with cross-references back to the original referral documentation provided.

This report includes detailed desktop assessments and findings of targeted ecological assessments of threatened species and ecological communities within and adjacent to areas informing assessment of likely significant impacts after avoidance, minimisation and mitigation of potential direct and indirect impacts from the proposed action.

A range of measures have been taken to avoid and minimise impacts on the environment, including specific measures targeted at protecting the identified MNES. These measures adhere to relevant legislation, guidelines, and best-practice techniques to ensure that environmental impacts are minimised to acceptable levels.

Significant impact assessment

In accordance with the *Significant Impact Guidelines: Matters of National Environmental Significance* (MNES Significant Impact Guidelines 1.1) (Department of the Environment (DotE), 2013a) significant impact assessments (SIAs) were undertaken to assess the nature, likelihood, consequence and extent of potential significant impacts to listed threatened species and communities, and the ecological character of the declared Ramsar wetland identified with a potential risk from the proposed action. After avoidance, the assessment concluded significant residual impacts are likely for the following:

- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland Threatened Ecological Community (Coastal Swamp Sclerophyll Forest TEC) – up to 2.09 hectares (ha)
- Koala habitat – up to 4.65 ha
- Grey-headed flying-fox habitat – up to 5.20 ha.

Offsets

Biodiversity offsets are provided in accordance with the *EPBC Act Environmental Offsets Policy* (Department of Sustainability, Environment, Water, Population and Communities, 2012) (EOP) for significant residual impacts to Coastal Swamp Sclerophyll Forest TEC, Koala habitat and Grey-headed flying-fox habitat. To address the proposed action offset requirements, and in response to the DCCEE RFI, an Offset Proposal and Offset Management Plan (OMP) have been developed.

The OMP demonstrates compliance with Part 9 of the EOP and identifies management requirements ensuring a no net loss to these MNES, including:

- Legal security to ensure that offset areas are legally protected through legal instruments that prevent future development or land-use changes that could negatively impact biodiversity values.
- Fire, weed and pest management regimes to respond to the ecological needs of the habitat and species to maintain or improve habitat quality, and minimise threats.
- Targeted replanting approach to accelerate natural regeneration, connectivity and enhance foraging availability.

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Key definitions

Term	Definition
Approval Holder	The person to whom the EPBC Act project approval is granted and is responsible for compliance with conditions (if any) applied to a project.
disturbance footprint	The disturbance footprint is defined as the extent of impacts associated with the Proposed action. The disturbance footprint is 15.81 hectares comprising the Project permanent footprint (permanent design and operational footprint) and the temporary footprint (temporary impact during construction only).
EPBC Act	The <i>Environment Protection and Biodiversity Conservation Act 1999</i> is Australia's national environmental law. It provides a legal framework to protect the environment, especially those aspects that are matters of national environmental significance.
habitat quality survey / habitat quality	A method of evaluating habitat quality within a particular community based on key indicators including site condition, site context and species habitat index (if necessary). The method produces a score out of 10, where the maximum score of 10 represents a fully intact system. Scores of 4, 5 and 6 may indicate good quality regrowth or medium value habitat.
matters of national environmental significance (MNES)	Environmental values protected under the Commonwealth EPBC Act and defined under the <i>Matters of National Environmental Significance Significant impact guidelines 1.1</i> as: <ul style="list-style-type: none"> ■ world heritage properties ■ national heritage places ■ wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed) ■ nationally threatened species and ecological communities ■ migratory species ■ Commonwealth marine areas ■ the Great Barrier Reef Marine Park ■ nuclear actions (including uranium mining) ■ a water resource, in relation to coal seam gas development and large coal mining development Significant impacts to these values may require offsets under the legislation.
Modified Habitat Quality Assessment	The Modified Habitat Quality Assessment (MHQA) method is a best-practice approach to derive Habitat Quality Scores (HQS) for input to the EPBC Act Offset Assessment Guide (offset calculator). These methods are intended to generate a HQS that represents key habitat values provided by a site (<i>Site Condition</i>) and values of its surrounding landscape (<i>Site Context</i>). When applied to threatened species, HQS also quantifies the value of both the site and the species population (<i>Species Stocking Rate</i>).
pest/s	Means any pest species identified under the <i>Biosecurity Act 2014</i> (Qld) known to provide threats to the threatened species discussed within this report.
preliminary documentation (this document)	A preliminary documentation report (this document) is a direct response to the request for information issued by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) on 14 November 2024 as part of the 'controlled action' determination for the Project.
proposed action	The proposed action comprises activities across the construction and operational phases of the Caloundra Transport Corridor Upgrade (CTCU) Project (refer the Project). The proposed action excludes works discussed in Section 2.3.4.
Regional Ecosystem	A vegetation community in a bioregion that is consistently associated with a combination of geology, landform, and soil. Regional Ecosystems are described in the Regional Ecosystem Description Database, produced by the Queensland Herbarium.
regrowth vegetation	Vegetation which forms the predominant canopy of the community but does not meet either: <ol style="list-style-type: none"> a) 50% of the undisturbed predominant canopy; or b) more than 70% of the vegetation's undisturbed height; and c) is composed of species characteristic of the vegetation's predominant canopy and is greater than 15 years.

Term	Definition
remnant vegetation	Vegetation which forms the predominant canopy of the community that: <ol style="list-style-type: none"> covers more than 50% of the undisturbed predominant canopy; and averages more than 70% of the vegetation's undisturbed height; and is composed of species characteristic of the vegetation's undisturbed predominant canopy.
request for information (RFI)	A request for additional information was issued by DCCEEW on 14 November 2024 under Section 95A(2) of the EPBC Act to inform DCCEEW's assessment of potential Project impacts, and the evaluation of the Project's proposed strategies for avoiding and mitigating any adverse impacts.
significant impact assessment	Significant impact assessments (SIAs) are used to determine whether an action (e.g. the proposed action) is likely to have a significant impact on MNES and are performed in accordance with the MNES Significant Impact Guidelines 1.1. If so, the action must be referred to the Commonwealth (DCCEEW) for approval before it can proceed.
suitable habitat	A species preferred environment required to sustain a viable population. Suitable habitat may include breeding, foraging and shelter resources for fauna or preferred environmental conditions for flora.
suitably qualified and experienced ecologist	Suitably qualified and experienced ecologist means a person who has relevant professional qualifications and at least three years' work experience designing and implementing flora and fauna surveys and management plans using relevant protocols, standards, methods and/or literature.
suitably qualified person (Protected Plants)	A suitably qualified person (Protected Plants) is someone who has been certified as meeting the defined criteria of a 'suitably qualified person' under Section 4.2.1 of the <i>Flora Survey Guidelines – Protected Plants</i> under the <i>Nature Conservation Act 1992</i> (Qld) (DETSI, 20250a).
the Project	The Caloundra Transport Corridor Upgrade (CTCU) Project. The Project comprises activities across the construction and operational phases (see definition of the 'proposed action'). Minor works also form part of the Project but are excluded from the proposed action (refer Section 2.3.4).
threatened ecological community	An ecological community that is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat and listed under the provisions of the EPBC Act.
threatened species	Extinct (EX), Extinct in the Wild (XW), Critically Endangered (CE), Endangered (E), Vulnerable (V) or Conservation Dependent (CD) under the EPBC Act.
vegetation community	An identified vegetation community (i.e. structure, composition, condition and/or underlying geology) verified from a field survey. Communities may include Regional Ecosystems, remnant vegetation and/or disturbed/novel ecosystems (e.g. parkland, disturbed roadsides etc.).
weed/s	Means any weed species identified within the Weeds of National Significance (WoNS) and weed species listed under the <i>Biosecurity Act 2014</i> (Qld).

Acronyms and abbreviations

Terminology	Definition
ACH Act	<i>Aboriginal Cultural Heritage Act 2003 (Qld)</i>
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ALA	Atlas of Living Australia
AL Act	<i>Acquisition of Land Act 1967 (Qld)</i>
ASRIS	Australian Soil Resource Information System
AASS	actual acid sulfate soils
ASS	acid sulfate soils
BCR	benefit cost ratio
Biosecurity Act	<i>Biosecurity Act 2014 (Qld)</i>
CHMP	Cultural Heritage Management Plan
CIA	Cumulative Impact Assessment
CLR	Contaminated Land Register
cm	centimetres
Coastal Swamp Sclerophyll Forest TEC	Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland Threatened Ecological Community
CPESC	Certified Professional in Erosion and Sediment Control
CREVNT	Critically Endangered, Endangered, Vulnerable and Near Threatened
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTCU	Caloundra Transport Corridor Upgrade
Cth	Commonwealth
DAWE	Department of Agriculture, Water and the Environment (former)
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DETSI	Department of the Environment, Tourism, Science and Innovation
DEWHA	Department of the Environment, Water, Heritage and the Arts (former)
disturbance footprint	extent of change in environmental conditions
DNRMMRRD	Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development
DotE	Department of the Environment (former)
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities (former)
EDR	Environmental Design Report
EMP(C)	Construction Environmental Management Plan
EMP(P)	Environmental Management Plan (Planning)
EMR	Environmental Management Register
EP Act	<i>Environmental Protection Act 1994 (Qld)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cth)</i>
EPP (Water and Wetland Biodiversity)	<i>Environmental Protection (Water and Wetland Biodiversity) Policy 2019</i>
ESCP	Erosion and Sediment Control Plan
ESD	ecologically sustainable development
ESR	Environmental Scoping Report

Terminology	Definition
EVE	Endeavour Veterinary Ecology
g	grams
ha	hectares
HV	high-voltage
IS	Infrastructure Sustainability
ISC	Infrastructure Sustainability Council
ISMP	Infrastructure Sustainability Management Plan
kg	kilograms
km	kilometres
km ²	square kilometres
m	metres
mm	millimetres
MNES	Matters of national environmental significance
MSES	Matters of State environmental significance
NC Act	<i>Nature Conservation Act 1992</i> (Qld)
NSW	New South Wales
OMP	Offset Management Plan
PASS	potential acid sulfate soils
Planning Act	<i>Planning Act 2016</i> (Qld)
Planning Regulation	<i>Planning Regulation 2017</i> (Qld)
PMST	Protected Matters Search Tool
Proponent	Sunshine Coast Regional Council (or Sunshine Coast Council)
Project	Caloundra Transport Corridor Upgrade (CTCU)
QASSIT	Queensland ASS Technical Manual – Soil Management Guidelines (Queensland Government)
Qld	Queensland
RE	Regional Ecosystem
REF	Review of Environmental Factors
RFI	request for information
RL	Reduced Level
SCC	Sunshine Coast Council
SCC Planning Scheme	<i>Sunshine Coast Planning Scheme 2014</i>
SIA	significant impact assessment
SIG	Stakeholder Interest Group
SMP	Species Management Program
SPRAT	Species Profile and Threats
TEC	Threatened Ecological Community
TIC-CO	TMR Transport Infrastructure Contract-Construct Only
TMR	Department of Transport and Main Roads
TSSC	Threatened Species Scientific Community
UXO	Unexploded Ordnance
VM Act	<i>Vegetation Management Act 1999</i> (Qld)

1 Introduction

1.1 Project background

The Sunshine Coast Council (SCC), in partnership with the Department of Transport and Main Roads (TMR), proposes to construct and operate a new integrated transport corridor in Caloundra, Queensland (Qld) referred to as the Caloundra Transport Corridor Upgrade (CTCU) Project (the 'Project' or 'proposed action').

Located approximately 90 kilometres (km) north of Brisbane, the Project is situated within the Sunshine Coast local government area and will provide a new transport link into the Caloundra central business, tourism and development district and surrounding destinations.

On 1 August 2024, the Project was referred to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act).

On 30 October 2024, a delegate for the Commonwealth Minister for the Environment and Water determined the Project to be a 'controlled action' (EPBC 2024/09956), requiring assessment and approval under the EPBC Act due to the potential for significant impacts on Ramsar wetlands (Sections 16 and 17B of the EPBC Act) and listed threatened species and communities (Sections 18 and 18A of the EPBC Act). The referral decision directed the Project to be assessed by preliminary documentation.

Subsequently, on 14 November 2024, a request for information (RFI) was issued by DCCEEW under Section 95A(2) of the EPBC Act to inform DCCEEW's assessment of potential Project impacts, and the evaluation of the proposed Project strategies for avoiding and mitigating any adverse impacts.

1.2 Purpose and scope of the preliminary documentation

This preliminary documentation report has been prepared to directly respond to the RFI issued by DCCEEW on 14 November 2024 as part of the 'controlled action' determination for the Project and in doing so provides additional information on the following:

- Description of the action (refer Section 2)
- State legislative framework and approval requirements (refer Section 2.7)
- Methodology implemented for the ecological assessment, significant impact assessment and cumulative impact assessment (refer Section 3)
- Description of the environment and matters of national environmental significance (MNES) (refer Section 4)
- Description of potential impacts of the action (refer Section 5)
- Proposed avoidance, mitigation and management measures (refer Section 6)
- Significant impact assessments (SIAs), informed by desktop and field investigations (refer Section 7)
- Proposed environmental offsets, including an Offset Proposal and Offset Management Plan (OMP) (refer Section 8)
- Economic and social matters, including cost-benefits and stakeholder consultation (refer Section 9)
- Ecologically sustainable development (refer Section 10)
- Environmental record of the person proposing to take the action (refer Section 11).

This preliminary documentation has been developed in accordance with the Commonwealth *Matters of National Environmental Significance – Significant Impact Guidelines 1.1 – Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment (DotE) 2013a) (MNES Significant Impact Guidelines 1.1).

In accordance with the formal RFI, Appendix A includes a cross-referenced table detailing each of the items requested in the formal RFI (which comprises two parts; Attachments A and B), together with section locations of where to find the responses within this document.

2 Description of the action

2.1 Project objectives and rationale

Caloundra Road has been identified as the fourth most congested road in South East Queensland (RACQ 2023). Further, daily trips within, and to and from, Caloundra are expected to increase significantly by 2041 due to the growth in population, employment and visitors (PSA Consulting 2022). This demand places significant pressure on transport routes accessing the Caloundra central business, tourism and development district which are already experiencing high levels of traffic delays.

In 2019, SCC and TMR signed the Caloundra Access Memorandum of Understanding which included the Project as a jointly delivered contribution to address Caloundra's pressing congestion issues. The Project will reduce traffic congestion at the Caloundra Road roundabout and will have flow on benefits for local roads to surrounding destinations. The Project is expected to reduce the number of vehicles travelling through the Caloundra Road/Nicklin Way roundabout, and alternative roads, including Buccleugh Street, Beerburum Street and Malman Street N, Queen Street, and Elizabeth Street by an estimated 20 per cent.

The new corridor is designed to meet current and forecast traffic demand at opening and over the next 10 years, with infrastructure benefits to cater for the region's growing population, business and tourism. Without this essential new transport link, travel time, traffic congestion and access to active and public transport in Caloundra will continue to worsen in response to forecasted population, business and tourism growth.

The Project's integrated transport corridor upgrade forms part of a long-term plan to provide better access, and improved travel choice to and from Caloundra for public transport users, cyclists, pedestrians, and motorists now and into the future.

The Project objectives are:

- Reduce congestion on Caloundra Road/Nicklin Way intersection and Bowman Road (between Nicklin Way and Bulcock Street)
- Preserve function and the efficiency of existing roads
- Enhance connectivity to central Caloundra, improving accessibility and safety
- Support improvements in public and active transport travel choices
- Support local and State government land use and transport planning objectives
- Minimise social and environmental impacts.

Further detail regarding economic and social costs and benefits are provided in Section 9.1.

2.2 Project description

2.2.1 Overview and key components

The Project comprises 1.6 km of a combination of new and upgraded existing transport infrastructure, to provide a two way/two lane, dual carriageway urban sub-arterial road link connecting Caloundra's central business, tourism and development district between Omrah Avenue and Nicklin Way (a State-controlled road), with connection through to Industrial Avenue, north of the existing Caloundra Road roundabout. Included in the new corridor will be an active integrated transport corridor that accommodates two-way cycle flow and segregated pedestrian footpaths.

To suit road asset ownership, project funding and delivery responsibilities, the Project has been split into three sections:

- Works Package A: Omrah Avenue to Arthur Street, associated intersections and connection works. This section will be funded by SCC to meet local growth, transport infrastructure and community needs.

- Works Package B: Arthur Street to Industrial Avenue (including Nicklin Way), associated intersections and connection works. Also referred to as the 'Nicklin Way/Third Avenue extension, this section will be jointly funded by SCC and State government. SCC is working closely with TMR to deliver this section.
- Works Package C: Arthur Street trunk drainage upgrade. This section will be funded by SCC.

The general location of the Project is shown in Figure 2.1.



Figure 2.1 Caloundra Transport Corridor Upgrade Project location within the wider region

Source: [Caloundra transport corridor upgrade project \(sunshinecoast.qld.gov.au\)](https://sunshinecoast.qld.gov.au)

2.2.2 Works packages

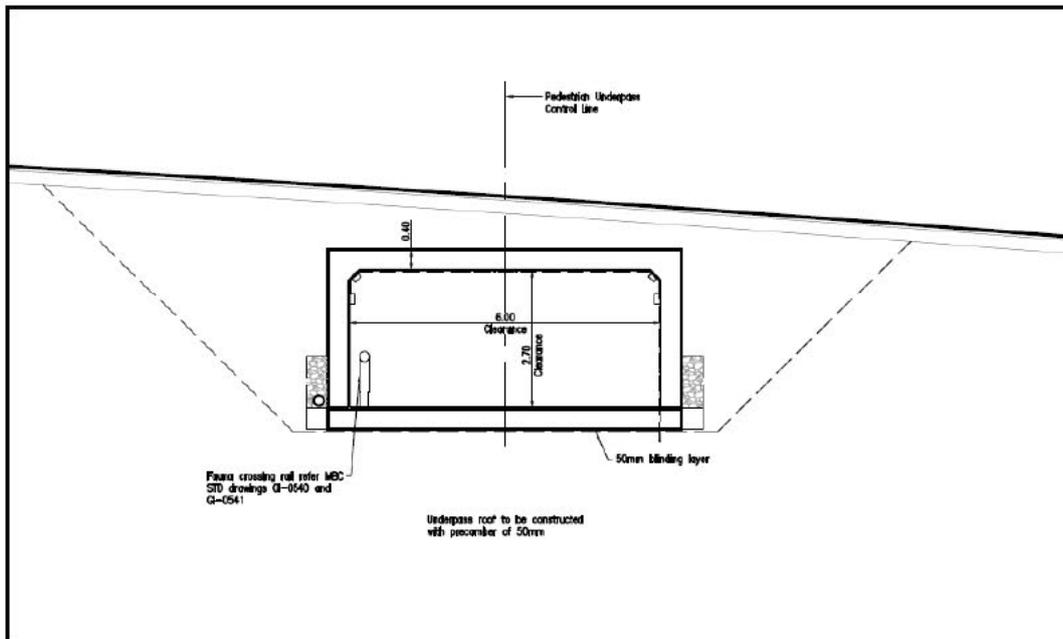
The scope of works for each work package is as follows:

- Works Package A, between Omrah Avenue and Arthur Street:
 - Duplicating existing traffic lanes to provide two lanes in each direction on Oval Avenue and Third Avenue
 - Connecting Oval Avenue with Omrah Avenue via existing Bowman Road and a new road connection through Bicentennial Park
 - Constructing a two-way cycle track and pedestrian pathways
 - Upgrading the following intersections to signalised intersections to improve safety and traffic operations:
 - Bowman Road/Gosling Street
 - First Avenue/Oval Avenue
 - Third Avenue/Oval Avenue
 - Caloundra Shopping Centre access/Oval Avenue

- Provision of pedestrian and cycle upgrades at the following intersections:
 - Olm Street/Oval Avenue
 - Second Avenue/Oval Avenue
 - Nicholls Street/Gosling Street
 - Suller Street, Cowan Street and Omrah Avenue intersections with Bowman Road
- Installation of mid-block pedestrian signals on Bowman Road, north of Omrah Avenue
- Installation of new street lighting and landscaping.
- Works Package B, between Arthur Street and Industrial Avenue (including Nicklin Way):
 - Construction of a new intersection on Nicklin Way
 - Extension of Third Avenue from Nicklin Way to Arthur Street, including a two-way cycle track and pedestrian pathway
 - Connection of Industrial Avenue to Nicklin Way
 - Upgrades to the existing Arthur Street/Third Avenue intersection to a signalised intersection to improve safety and traffic operations
 - New street lighting and landscaping
 - Fauna infrastructure:
 - The Project will install a culvert underpass which will include fauna infrastructure in accordance with the TMR's Fauna Sensitive Transport Infrastructure Delivery Manual (TMR, 2024). The culvert underpass is a 6,000 mm (W) x 3,000 mm (H) reinforced concrete box culvert which is a combined pedestrian fauna underpass. The underpass provides dry passage. In accordance with the DETSI Koala-sensitive Design Guideline 2022 dual purpose culverts with fauna and pedestrians is considered suitable for use as fauna crossing structures. Since the Project includes a large box culvert with fauna furniture the underpass is considered to improve permeability and provide safe movement for fauna such as Koalas (DES 2022). Photograph 2.1 provides an overview cross section of the Project underpass. Further information on the mitigation measures are summarised in Section 6.
 - Fauna exclusion fencing in accordance with TMR standard drawing 1603. Further information on the mitigation measures are summarised in Section 6.
- Works Package C, Arthur Street:
 - Upgrades to the existing truck drainage infrastructure wholly within the existing road pavement area to achieve required flood immunity for the new transport corridor, and provide capacity upgrades to the local storm water network to cater for existing and planned development.

All Project packages will be delivered during one Project construction period, managed by SCC with a single construction contractor (herein referred to as 'the Contractor').

Project design drawings for each works package are provided in Appendix B.



Photograph 2.1 Electricity easement and existing pedestrian path within the Project disturbance footprint (from Nicklin Way looking towards Third Avenue)

2.2.3 Disturbance footprint

The Project disturbance footprint is approximately 16 hectares (ha) comprising the Project permanent (operational footprint) and temporary disturbance footprint (the extent of direct and indirect impacts). Within the Project disturbance footprint is the Project Contractor's limit of work line which comprises temporary direct and indirect impacts during construction only. An overview of the Project disturbance footprint across the whole corridor is shown in Figure 2.2, whilst Figure 2.3 illustrates the extent of both the Project disturbance footprint and Project Contractor's limit of work line at the works package scale.

Approximately 70 per cent of the Project disturbance footprint includes previously disturbed areas associated with existing:

- Electricity infrastructure and easement (high voltage (HV) transmission line) (refer Photograph 2.2)
- Roads and road parcels (State-controlled and local government)
- Urban dwellings already planned for resumption and demolition
- Drainage infrastructure.

Land uses immediately surrounding the disturbance footprint are illustrated on Figure 2.4 and include:

- Residential, predominantly comprising low density, detached dwellings along Oval and Omrah Avenues, as well as medium and high-density dwellings in proximity to Omrah Avenue
- Commercial uses, including the Caloundra RSL, Caloundra Shopping Centre and commercial premises along Bowman Avenue
- Industrial uses on the western side of Nicklin Way along Industrial Avenue
- Open space and recreation areas associated with Ben Bennett Bushland Park, Bicentennial Park, Roy Henzell Park, the Caloundra Croquet Club and Caloundra Cricket Club
- Community and other special uses, including health, aged care and education facilities
- Roads and utility infrastructure.



Photograph 2.2 Electricity easement and existing pedestrian path within the Project disturbance footprint (from Nicklin Way looking towards Third Avenue)



Data sources: Queensland Spatial Catalogue - 2023

- Legend**
- Existing Powerline Easement
 - Work Package A
 - Work Package B
 - Work Package C
 - Disturbance Footprint



City of Moreton Bay,
 Earthstar Geographics, ©
 State of Queensland
 (Department of Resources)
 2024, © State of
 Queensland (Transport and
 Main Roads), 2021

Revision: A

Date: 4/12/2025

A3 scale: 1:5,000



Caloundra Transport Corridor Upgrade

Figure 2.2 Disturbance footprint



Service layers: Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, City of Moreton Bay, Data sources: Queensland Spatial Catalogue - 2023



Legend

- Limit of work line
- Disturbance Footprint
- Indirect impact/edge effect areas
- Proposed Action Footprint**
 - Work Package A
 - Work Package B
 - Work Package C

Revision: A

Date: 4/12/2025

A3 scale: 1:3,000



Caloundra Transport Corridor Upgrade

Figure 2.3 Disturbance footprint (direct and indirect impacts) and limit of work line (direct impacts)

Coordinate system:

© Aurecon 2025



Service layers: City of Moreton Bay, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community; Data sources: Queensland Spatial Catalogue - 2023

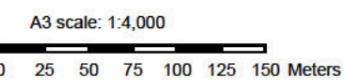


Legend

- Limit of work line
- Disturbance Footprint
- Indirect impact/edge effect areas
- Proposed Action Footprint
 - Work Package A
 - Work Package B
 - Work Package C

Revision: A

Date: 4/12/2025



Caloundra Transport Corridor Upgrade

Figure 2.3 Disturbance footprint (direct and indirect impacts) and limit of work line (direct impacts)



Service layers: Sources: Esri, TomTom, Garmin, FAO, NOAA, UDSG, © OpenStreetMap contributors, and the GIS User Community, City of Moreton Bay, Data sources: Queensland Spatial Catalogue - 2023

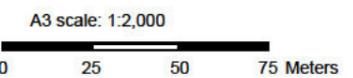


Legend

- Limit of work line
- Disturbance Footprint
- Indirect impact/edge effect areas
- Proposed Action Footprint**
 - Work Package A
 - Work Package B
 - Work Package C

Revision: A

Date: 4/12/2025



Caloundra Transport Corridor Upgrade

Figure 2.3 Disturbance footprint (direct and indirect impacts) and limit of work line (direct impacts)

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Project No: P622936 Map by: AT Export date: 4/12/2025

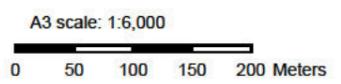


- Legend**
- Disturbance Footprint
 - Tenure**
 - Road Parcels
 - Easement
 - Freehold
 - Lands Lease
 - Reserve
 - State Land

Service layers: City of Moreton Bay, Vector, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community; Data sources: Queensland Spatial Catalogue - 2023

Revision: A

Date: 4/12/2025



Caloundra Transport Corridor Upgrade

Figure 2.4 Tenure and land use

2.3 Project phases

The Project comprises activities across the construction and operational phases. Due the Project design life being at least 100 years, decommissioning plans have not been considered.

2.3.1 Construction phase

During the construction phase, the following activities will be undertaken:

- Clearing and grubbing of vegetation within resumption areas and areas planned for clearing to support the Project permanent works design
- Relocation of public utility plant (underground and above ground) services
- Installation of erosion and sediment control devices
- Earthworks, including excavation and filling
- Site establishment
- Upgrades to the existing stormwater network, including new and additional works
- Construction and upgrade of new and existing permanent road infrastructure
- Construction and upgrade of new and existing footpath and cycle infrastructure
- Installation of road and pedestrian street lighting
- Landscaping.

2.3.2 Operational phase

Once operational, all Package A and Package C permanent works will become assets of SCC, with part of the Package B permanent works (Nicklin Way intersection and approaches) becoming assets of TMR, and the remaining parts of the Package B permanent works becoming assets of SCC.

During the operational phase, the following maintenance activities are anticipated, which will predominantly be undertaken within the new road corridor:

- Vegetation maintenance (e.g. mowing/slashing, weed control, planting/revegetation)
- Clean up of spills and leaks (e.g. from road accidents)
- Disposal of waste/litter/fallen timber
- Repair and replacement of road furniture, including fencing, gates, signage, road safety barrier systems and lighting
- Routine maintenance of fauna mitigation structures, including fauna exclusion fencing and fauna refuge poles
- Line marking, emergency road repairs and resurfacing, including the provision of traffic management/detours, prevention of erosion and runoff
- Routine maintenance of drainage structures and stormwater quality devices, including removal of silt, debris/rubbish and vegetation growth.

2.3.3 Decommissioning (excluded from the proposed action)

The Project is expected to be operational for at least 100 years. The design life of Project structures is up to 100 years to support this operational objective, with the design life of assets ranging between 20 years for the road pavement, through to 50 years for concrete traffic barriers and fencing, pathways, kerb and channel and some drainage structures, and 100 years for drainage culverts, retaining walls and pedestrian underpass structures.

A decommissioning date has therefore not been considered, and likely timing would be too far in the future to allow effective planning to occur at present.

However, if the Project, or elements of it, were subject to plans for decommissioning, it is envisaged that such work would be undertaken in accordance with a decommissioning environmental management plan, or similar, which would be developed by SCC and TMR in consultation with relevant stakeholders and regulatory authorities.

2.3.4 Other Project works excluded from the proposed action

The Project comprises activities across the construction and operational phases. In addition, there are minor works which also form part of the Project but have been excluded from the proposed action. These are:

- Site remediation (hazardous building materials) and demolition works – these works were planned by SCC irrespective of the proposed action in order to manage potential risks associated with graffiti, squatters and exposure to hazardous materials (e.g. asbestos containing materials)
- Geotechnical investigations within previously cleared areas
- Tenure changes and resumption of land parcels required for the Project
- Establishment and use of construction compounds and laydown areas within previously disturbed areas.

Potential impacts from the Project works excluded from the proposed action are being managed with the implementation of appropriate management measures in the Project Environmental Management Plan (Construction) (Project EMP(C)), and in accordance with TMR's technical specifications *MRTS51 Environmental Management* and *MRTS52 Erosion and Sediment Control*.

Project works excluded from the proposed action are unlikely to result in any direct or indirect impacts to MNES due to the minor nature, their location wholly within in previously cleared/disturbed/operational areas and through the implementation of mitigation measures.

These Project works are illustrated on Figure 2.5.

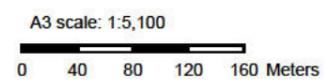


- Legend**
- Geotechnical Sampling Locations
 - Demolished Properties
 - Council reserve land resumption to road parcel
 - Other resumption to road parcel
 - Potential project construction compound sites
 - Disturbance Footprint
 - Threatened Ecological Communities**
 - Lowland rainforest TEC
 - Swamp Sclerophyll TEC

Service layers: City of Moreton Bay, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Data sources: Queensland Spatial Catalogue - 2023

Revision: A

Date: 4/12/2025



Caloundra Transport Corridor Upgrade

Figure 2.5 Additional works not included in the Proposed Action

2.4 Project timing

2.4.1 Milestones undertaken to date

The following key Project milestones have been undertaken to date:

- 2021 – Community feedback sought on concept design
- Late 2022 – Detailed design tender awarded, with preliminary and detailed design commenced
- 2023 – Geotechnical and environmental investigations undertaken, early works, including demolition of council owned properties in readiness (not included in the proposed action)
- Early 2024 – Ongoing early works including demolition works, ground remediation and underground services relocation (not included in the proposed action)
- Late 2024/early 2025 – Completion of final detailed design
- Late 2024/early 2025 – Completion of early works (not included in the proposed action).

2.4.2 Planned milestones

Subject to securing all required Project approvals, the appointment of a Contractor, and other factors such as weather conditions and availability of materials, the Stage 1 (Work Packages A) road works are currently anticipated to commence mid/late 2026 (subject to appointment of a Contractor) with completion estimated in 2028. Whilst a commencement date for the Stage 2 (Works Packages B and C) road works is yet to be confirmed, the overall Project represents a construction period of approximately two years.

Once construction has commenced, works are anticipated to occur from Monday to Saturday during daylight hours, however construction works may occur outside these timings due to requirements of the Project schedule.

Access to private properties will be provided throughout the construction and operational phases of the Project.

2.5 Design options and refinements

2.5.1 Planning history

The need for a second major road corridor into Caloundra town centre was first identified more than two decades ago. Caloundra's priority infrastructure plan of 2003 publicly documented earlier plans to upgrade Oval Avenue and West Terrace to provide an alternative to that part of Caloundra Road that is east of Baldwin Street. This route however did little to address community severance caused by that part of Caloundra Road between Baldwin Street and Nicklin Way.

Area planning conducted in 2013 found that extending Third Avenue to Nicklin Way provided better community outcomes than the original alignment, and this became the basis of master planning for the Caloundra town centre undertaken three years later. The master plan established a vision for a major public transport interchange on the corridor, serviced by a new coastal mass transit service.

The current alignment was formally included in the *Sunshine Coast Council Local Government Infrastructure Plan* and *Sunshine Coast Council Planning Scheme* in 2018. These plans established the foundation for integrated planning subsequently undertaken by the TMR and SCC. All planning activities described above were informed by extensive stakeholder and community consultation.

Route planning supported by multi-criteria analysis (MCA) was undertaken by TMR and SCC in 2018 for Section 1 and Section 2, respectively. Environmental assessments informed this process. The preferred alignment through Ben Bennett Bushland Park selected by TMR utilised a cleared and disturbed powerline corridor to reduce impacts to about two per cent of the park. Likewise, optioneering was undertaken by SCC to reduce impacts to Bicentennial Park.

Detailed design on the full route commenced in 2019 and the concept design was refined following consultation with landowners. Community feedback was sought on the concept design in 2021, and the final design was completed and shared with the community in 2025.

2.5.2 Alternative options

During the concept design phase, the Project developed and evaluated four alternative options to minimise impacts associated with the section of the Project corridor through Ben Bennett Bushland Park. These options were identified based on the outcomes of previous planning completed by SCC and TMR and were assessed for suitability using a MCA that had a high weighting focus on reducing ecological impact within Ben Bennett Bushland Park. The options considered were:

- Option 1 – Aligned intersection
 - The Third Avenue connection and Industrial Avenue connection intersect with Nicklin Way in a traditional “aligned” intersection form. This arrangement resulted in the Third Avenue Connection being positioned opposite the existing Industrial Avenue alignment. As a result, the carriageway alignment was north of the existing HV power lines, utilising half of the existing clearing. This option resulted in some clearing being required on the northern section of Ben Bennett Bushland Park. The alignment was modified to avoid the EPBC Act listed Lowland Rainforest of Subtropical Australia threatened ecological community (TEC).
- Option 2 – Skewed intersection
 - The Third Avenue connection road alignment was shifted further to the south, so the HV power line could be aligned with the centre of the connection road. The carriageway alignment was designed to be predominantly located within existing cleared areas of Ben Bennett Bushland Park, with some clearing required north and south of the carriageway. The focus of this option was to develop the alignment, so the HV power poles could be located within the centre median of the proposed traffic lanes. Feedback from Energex, as the relevant electricity asset owner, determined this option as unfeasible as it did not facilitate safe maintenance of their asset.
- Option 3 – ‘T’ intersection
 - The Third Avenue connection road alignment was shifted to the south of the HV powerlines and to the southern side of the existing clearing extent within Ben Bennett Bushland Park. The focus of this option was to contain vegetation clearing to the southern part of the Ben Bennett Bushland Park, avoiding clearing impacts to the north. This option was considered unsuitable as it did not provide connection to Industrial Avenue.
- Option 4 – Roundabout
 - This option considered the impact on traffic flows that a roundabout at the intersection of Nicklin Way would have, along with the direct disturbance footprint required to accommodate the roundabout and carriageways within the design. This option was initially considered likely to result in a lower direct disturbance footprint to the Ben Bennett Bushland Park with modelled traffic volumes allowing for a three-lane carriageway instead of a four-lane carriageway required for each of the other options. However, as design developed, it was identified that the direct disturbance footprint associated with accommodating a roundabout of sufficient size would have resulted in a significant impact on the Ben Bennett Bushland Park near Nicklin Way.

2.5.3 Four lane requirement

The ultimate four-lane cross-section was selected following an MCA process that examined alternative design options. Four lanes were selected over two lanes for multiple reasons:

- Four through-lanes are required at signalised intersections. The number of lanes provided at intersections along the CTCU is the minimum required by various best practice guidelines, including the Federal Government's *Australian Transport Assessment and Planning* framework. SCC does not provide wider roads than needed to meet demand. Minimising infrastructure footprints not only limits environmental and social issues but also has the economic benefit of minimising the cost of construction, maintenance and asset depreciation.
- East of Arthur Street, the CTCU has several closely spaced intersections that must be signalised to allow safe crossings for pedestrians and cyclists, along with the safe and efficient movement of vehicles. Additional lanes are required for vehicles to wait safely and avoid queuing back through nearby intersections.
- West of Arthur Street, the engineering design by a Registered Professional in Engineering Queensland (RPEQ) found that dropping down to two lanes between intersections on the CTCU would introduce unacceptable safety and operational risks. Issues considered included:
 - Vehicle queueing at each intersection
 - The horizontal and vertical geometry of the road and avoiding merges near to bends
 - Lack of separation from other conflicts (e.g. locations where drivers are required to look over their shoulder to merge when there may be a downstream hazard requiring their focus).

Overall, during the engineering design by a RPEQ it was determined that due to forecast traffic volumes, a raised median was required for all design options for safety. Where there is a raised median, the width of carriageway either side of the median is similar for both two and four lanes. This is because there must be sufficient width to allow motorists to pass a stopped, broken down or disabled vehicle. As such the preferred cross-section for the CTCU Project was determined to be four lanes.

2.5.4 Design refinements

As a result of developing and evaluating these design options, Option 1 (aligned intersection) was selected as the preferred option to be carried forward to detailed design. In addition to adopting Option 1, the portion of the disturbance footprint within the Ben Bennett Bushland Park has been further refined to minimise the extent of vegetation clearing required by:

- **Existing cleared HV corridor** – The Project design has been collocated within the existing cleared HV electricity easement to avoid and minimise the need for extensive vegetation clearing associated with establishing a new road corridor. The existing corridor is maintained to approximately 13 metres (m) in width from Nicklin Way to Third Avenue for approximately 120 m.
- **Locations of HV power poles and overhead lines** – Locations of electricity infrastructure has been negotiated with Energex to avoid the requirement for vegetation clearing for new electricity infrastructure. As a result, new poles have been located between the carriageway and the active transport path, with the active transport path serving as the required safety and maintenance clearance buffer between the electricity infrastructure and adjoining vegetated areas. Existing poles will maintain current buffer distances to vegetation.
- **Retaining walls** – An embankment with a typical 1 on 4 slope requires 8 m of vegetation clearing for 2 m of height compared to a retaining wall of the same height only requiring 0.5 m of vegetation clearing. Despite representing an additional cost, the Project has incorporated retaining walls into the design instead of embankments to minimise the disturbance footprint and the extent of vegetation clearing.
- **Carriageway footprint** – The carriageway cross section has been reviewed and refined with minimum values for lanes and shoulders selected to minimise the disturbance footprint associated with the link road. The alignment has also been revised to follow existing cleared areas where possible to accommodate the design.

- **Use of existing pedestrian paths** – Existing pedestrian pathways have been retained where feasible to minimise the disturbance footprint. Where the construction of new paths is required and where vegetation clearing is unavoidable, impact extents have been minimised where practicable by locating new paths as close to the carriageway as feasible.
- **Underpass** – The design incorporates the provision of an underpass providing access across the corridor to both sides of the Ben Bennett Bushland Park, supporting reasonable continuity being maintained with existing and proposed pedestrian and active transport facilities. This underpass has been designed for pedestrians and active transport users and may be used by fauna.

In addition, pit and pipe drainage has been designed throughout the Project to utilise and connect to existing SCC drainage network where practical to minimise the extent of new drainage infrastructure required (such as table drains, which are typically used on State-controlled roads) and associated vegetation clearing required to accommodate such permanent works.

2.6 Project changes since the EPBC Act referral

As a result of progressing the Project's detailed design, the following changes have occurred in the time since the original Project EPBC Act referral documentation was submitted:

- Inclusion of Works Package C (Arthur Street). Section 1.2.1 of the original Project EPBC Act referral documentation described the proposed action as comprising Works Package A and Works Package B shown in Attachment 1 – MNES Report, Figures 2.3 and 2.4. Whilst some works within Arthur Street were included in the original referral (at the intersection of Third Avenue associated with Works Package A), additional works have been added as described in Section 2.1. Importantly, these works are limited to civil works upgrades to the existing truck drainage infrastructure wholly within the existing road pavement area
- Updated disturbance footprint from approximately 13.56 to 16 ha to account for the addition of the Works Package C works within Arthur Street and for indirect impacts to tree protection zones across the Project corridor
- Minor design changes to intersections, pedestrian pathways and drainage infrastructure within Works Package A that are wholly contained within the disturbance footprint described and illustrated in the original Project EPBC Act referral documentation, including removal of the raised pedestrian crossing at First Avenue/Oval Avenue intersection.
- Refinements to the anticipated construction methodology of works along Bowman Road near the intersection of Omrah Avenue which will result in the requirement for additional vegetation clearing (marine plant) within Bicentennial Park.

2.7 State regulatory planning framework

In addition to the Commonwealth EPBC Act, the Project will trigger the requirement to comply with planning and environmental approval and compliance requirements under various State legislation. However, as SCC are the project proponent and are undertaking the works in partnership with TMR, the Project is being planned and delivered as 'government supported transport infrastructure' which is exempt from assessment for some aspects of development under the *Planning Act 2016* (Qld) (Planning Act). Relevantly, these are:

- Development under a local categorising instrument (i.e. local government planning scheme)
- Vegetation clearing under the *Vegetation Management Act 1999* (Qld) (VM Act).

Under Section 24 of the *Planning Regulation 2017* (Qld) (Planning Regulation), 'government supported transport infrastructure' means:

'infrastructure for transport that is

(a) funded, wholly or partly, by the State or Commonwealth; or

(b) *provided by a person, other than under a development approval or infrastructure agreement, on terms that –*

(i) *are agreed to by the State or Commonwealth; and*

(ii) *are intended to support the commercial viability of the infrastructure.*

Schedule 5 of the Planning Regulation defines 'infrastructure for transport' as including '*transport infrastructure, including transport infrastructure stated in schedule 2 of the Planning Act, definition development infrastructure*'

Relevantly, Schedule 2 of the Planning Act defines 'development infrastructure', as:

(a) *land or works, or both land and works, for-*

(ii) *transport infrastructure, including roads, vehicle lay-bys, traffic control devices, dedicated public transport corridors, public parking facilities predominantly serving a local area, cycleways, pathways and ferry terminals'*

The Project is considered 'government supported transport infrastructure' given:

- It is being partly funded by the State government through TMR and the Cycle Network Local Government Grants Program
- It is for development infrastructure, specifically transport infrastructure comprising roads for vehicle and public transport use as well active transport infrastructure (pedestrian and cycle)
- The portion of the Project being funded by SCC is being delivered in partnership and agreement with TMR with the intent that upgrades to the local road network are necessary to reduce congestion and preserve the function and efficiency of the road network, including Nicklin Way, a State-controlled road.

Table 2.1 details the State legislative requirements relevant to the Project.

Table 2.1 Relevant legislative requirements for the Project

Legislation and Administering Authority	Development Action/Trigger	Approval/Permit/ Licence/ Obligation	Existing information/Project considerations and planning/exemptions	Project stage/ status/ timeframes
<p>Aboriginal Cultural Heritage Act 2003 (Qld) (ACH Act) Department of Women, Aboriginal and Torres Strait Islander Partnerships and Multiculturalism</p>	Undertaking construction works	<p>Duty of Care to take all reasonable and practicable measures to avoid harm to Aboriginal cultural heritage</p>	<p>All Project staff and contractors have a duty of care requirement to ensure the protection of Aboriginal heritage and to implement any mitigation measures as required.</p> <p>A 'Duty of Care Guideline' has been prepared under the ACH Act to assist in ensuring the protection of Indigenous heritage. Whilst compliance with the guideline is not enforced, it affords strict compliance with the Duty of Care under the ACH Act.</p> <p>Cultural heritage assessments have been undertaken to support the Project in meeting its Duty of Care requirements under the ACH Act. Further detail regarding these assessments and proposed avoidance, mitigation and management measures is provided in Section 9.3</p>	All Project stages
		<p>Cultural Heritage Management Plan (CHMP) (voluntary or statutory requirement) or Cultural Heritage Management Agreement (CHMA) (voluntary)</p>	<p>The ACH Act specifies particular instances where a project may trigger the statutory requirement to prepare a CHMP (e.g. when an environmental impact statement is required or as a requirement of another approval, permit, licence under another Act).</p> <p>Where not triggered as a statutory requirement, a project may opt to develop a voluntary CHMP to assist in adhering to the Duty of Care requirements under the ACH Act.</p> <p>The Project does not have a statutory requirement to prepare a CHMP, however a CHMA is currently being established between SCC and the Kabi Kabi First Nation Native Title Claim Group (Kabi Kabi People) who are the registered Aboriginal Cultural Heritage Party for the land within the disturbance footprint.</p>	All Project stages
<p>Acquisition of Land Act 1967 (Qld) (AL Act) Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (DNRMMRRD)</p>	The take of land (or an easement) by a constructing authority for prescribed purposes under Schedule 1 of the AL Act	<p>Acquisition of land by either:</p> <ul style="list-style-type: none"> ■ Voluntary agreement; or ■ Compulsory acquisition. 	<p>Schedule 1 of the AL Act allows the take of land for purposes relating to transportation, which includes for road by a constructing authority, defined in Schedule 2 to be the State, a local government or a person authorised by an Act to take land for any purpose.</p> <p>Both SCC, as the relevant local government, and TMR, acting on behalf of the State are constructing authorities.</p> <p>Council has completed the acquisition of 27 properties and the partial acquisition of 2 properties that are required for the project. Acquisitions commenced in 2018. The majority of properties were acquired through negotiated settlement, with State Government gazettal of 2 properties and 2 partial properties which were unable to be purchased by negotiation completing all acquisition requirements in September 2023. Demolition of properties were undertaken as early works to manage project and Council risks including public safety, and were completed in September 2024.</p>	Project detailed design and pre-construction stages

Legislation and Administering Authority	Development Action/Trigger	Approval/Permit/ Licence/ Obligation	Existing information/Project considerations and planning/exemptions	Project stage/ status/ timeframes
Biosecurity Act 2014 (Qld) (Biosecurity Act) Department of Primary Industries (DPI)	All works	General Biosecurity Obligation upon all persons to take all reasonable and practical measures to prevent or minimise biosecurity risks, including matters such as weeds, pest species, contaminated soil and organic materials	Undertaking construction works, including the movement of materials, plant and equipment on/off and within the Project site has the potential to create a biodiversity risk. The disturbance footprint is located within the Red Imported Fire Ant (Zone 2), sugar cane, papaya ringspot, southern banana, varroa mite and cattle tick biosecurity zones.	Construction stage
	Moving a fire ant carrier from a property within a fire ant biosecurity zone to another property with the same or different zone	Biosecurity Instrumentation Permit (Fire Ants)	The Project's Contractor will be responsible to obtaining any required Biosecurity Instrumentation Permit, subject to confirmation of a final construction methodology. The Project's Contractor will be required to ensure this commitment is detailed in the Project EMP(C) and adhered to for the duration of the Project works. A Pest and Weed Management Plan will be prepared by the Contractor as a sub-plan to the EMP(C), approved by SCC and TMR prior to the commencement of ground disturbance works and implemented for the duration of the Project works. Requirement for BIP or Fire Ant Movement Permit to be confirmed by the Project's Contractor once construction methodologies are finalised (i.e. bulk earthworks requirements including exporting of soil).	
Environmental Offsets Act 2014 (Qld) (Offsets Act) Department of the Environment, Tourism, Science and Innovation (DETSI)	Undertaking a Prescribed Activity for which there will be a significant residual impact on one or more Prescribed Environmental Matters Undertaking development interfering with koala habitat in koala habitat areas both inside and outside koala priority areas	Provision of Offsets in accordance with the Environmental Offsets Policy (Offsets Policy), being: <ul style="list-style-type: none"> ■ Proponent-driven offset; or ■ Financial settlement offset; or ■ Combination of either of the above. Exemption under Schedule 24 of the Planning Regulation from requirement for a Development Permit for Operational Works that are the interfering with koala habitat, which includes relevantly, infrastructure for transport that is transport infrastructure stated in Schedule 5, Part 1.	In accordance with the Environmental Offsets Policy, environmental impacts must be first avoided, then minimised, before considering the use of offsets for any significant residual impacts (SRIs). To avoid duplication of offset conditions between jurisdictions, State and local governments can only impose an offset condition in relation to a prescribed activity if the same or substantially the same matter has not been subject to assessment under the EPBC Act. Prescribed activities include works required to be carried out under a permit, licence or authority, including development assessable under the State Development Assessment Provisions (SDAP). The Project will trigger the requirement to provide offsets for SRIs under the EPBC Act in relation to: <ul style="list-style-type: none"> ■ Coastal Swamp Sclerophyll Forest TEC ■ Koala ■ Grey-headed flying-fox. The Project has the potential to trigger the requirement to obtain State approvals which are 'Prescribed Activities' under the Offsets Act in relation to the removal, destruction and damage of marine plants and waterway barrier works, for which State based offset obligations may apply, subject to confirmation of a final construction methodology.	Construction stage

Legislation and Administering Authority	Development Action/Trigger	Approval/Permit/ Licence/ Obligation	Existing information/Project considerations and planning/exemptions	Project stage/ status/ timeframes
			Whilst exempt from the requirement to obtain a Development Permit for impacts to koala habitat, the Project will be required to comply with the <i>State Government Supported Infrastructure – Koala Conservation Policy</i> (April 2023) (SI Policy) including annual reporting requirements.	
Environmental Protection Act 1994 (Qld) (EP Act) DETSI	All works	The following duties apply to all persons: <ul style="list-style-type: none"> ■ General environmental duty ■ Duty to notify of environmental harm ■ Duty to restore the environment 	The Project's Contractor will be required to ensure EP Act duties and associated mitigation measures are detailed in the Project EMP(C) and adhered to for the duration of the Project works.	All Project stages, however primarily during the construction stage once physical works commence
Fisheries Act 1994 (Qld) (Fisheries Act) DPI	Works involving the removal, destruction or damage of marine plants	Compliance with the ' <u>Accepted development requirements for operational work that is the removal, destruction or damage of marine plants (3 July 2017)</u> ' (ADR Marine Plants) or Development Permit for Operational Works that are the removal, destruction or damage of marine plants	Field investigations have confirmed the presence of marine plants along Bowman Avenue and within Bicentennial Park near the intersection with Omrah Avenue. The Project will seek to comply with ADR Marine Plants, however it is noted that application is considered to be limited given the type and nature of work and therefore approval is considered likely. As such a Development Permit is currently being sought.	Construction stage – prior to clearing works
	Constructing or raising a waterway barrier (temporary or permanent)	Design complies with the ' <u>Works not considered waterway barrier works</u> ' or Design and construction complies with the ' <u>Accepted development requirements for operational work that is the constructing or raising waterway barrier works (23 September 2025)</u> ' (updated ADR WWBW) or the <u>superseded ADR WWBW (23 September 2025) under the transitional period to 30 November 2026</u> or Development Permit for Operational Works that are waterway barrier works (temporary and/or permanent)	Field investigations have confirmed the presence of marine plants along Bowman Avenue and within Bicentennial Park near the intersection with Omrah Avenue. Whilst the area is not mapped as being a waterway for waterway barrier works, the presence of marine plant carries the potential for tidal influence. Consultation with DPI confirmed the area to be a waterway. As such a Development Permit is currently being sought.	Construction stage – prior to relevant works commencing Construction stage – prior to relevant works commencing Construction stage – prior to relevant works commencing

Legislation and Administering Authority	Development Action/Trigger	Approval/Permit/ Licence/ Obligation	Existing information/Project considerations and planning/exemptions	Project stage/ status/ timeframes
Land Act 1994 (Qld) DNRMMRRD	Occupation and use of non-freehold land tenures, and the management of State land	Tenure dealings including the allocation of non-freehold land tenure	TMR is acquiring or dealing with relevant lands for a valid purpose under the <i>Transport Planning and Coordination Act 1994</i> (Qld). TMR has undertaken planning that resulted in the identification of the required lands; the 'Road Opening Process' for Lot 101 on SP238966, Easement A on CG4433, part of Lot 745 on CG6381, Easement C on SP169622, part of Lot 525 on CG813466 and Easement D on SP169623 is governed by the processes in the <i>Acquisition of Land Act 1967</i> (Qld).	Detailed design stage
Native Title (Queensland) Act 1993 (Qld) DNRMMRRD	Occupation and use of non-freehold land tenure	TMR Native Title Assessment Tenure dealings including the allocation of non-freehold land tenure Indigenous Land Use Agreement (QI2024/006) between the Kabi Kabi Peoples Aboriginal Corporation ICN 8996 and the State of Queensland	Portions of the disturbance footprint, predominantly associated with Ben Bennett Bushland Park are located on land within the external boundary of the Kabi Kabi Nation native title area (QC2018/007). TMR is acquiring or dealing with relevant lands for a valid purpose under the <i>Transport Planning and Coordination Act 1994</i> (Qld).	Detailed design stage
Nature Conservation Act 1992 (Qld) (NC Act) DETSI	Clearing of least concern species within a mapped Flora Survey Trigger Area	Exempt Clearing Notification supported by a flora survey of the clearing impact area in accordance with the <i>Flora Survey Guidelines – Protected Plants (NCS/2016/2534)</i>	Survey completed in June 2023. No protected plants were identified within the disturbance footprint. The exempt clearing notification was received in June 2024. Clearing must be completed within three years of the flora survey. Flora survey, associated reporting and a new exempt clearing notification will be required if clearing works are not completed by June 2026 (when the current exempt clearing notification lapses).	Construction stage – prior to clearing works
	Taking, using, keeping or interfering with protected fauna	Compliance with TMR's approved Species Management Programs (SMPs) for tampering with animal breeding places (low risk and high risk SMPs)	Works to be undertaken in accordance with the TMR State-wide low risk SMP (SMP1056, dated June 2022) for tampering for low risk species. The Project's Contractor will be required to ensure works are undertaken in accordance with a High Risk SMP for the vulnerable Wallum froglet. The High Risk SMP will be required to be prepared and approved prior to the relevant works commencing, and be implemented by the Project's Contractor for the duration of the relevant works.	Construction stage – prior to clearing works
Planning Act Department of State Development, Infrastructure and Planning	Undertaking development that a local categorising instrument is prohibited from stating is assessable development	Exempt development under Schedule 6, Part 5, Item 26 of the Planning Regulation	The Project is located within the Sunshine Coast local government area and is subject to the provisions of the <i>Sunshine Coast Planning Scheme 2014</i> (SCC Planning Scheme). As 'Government Supported Transport Infrastructure', the Project cannot be made assessable development under the local government planning scheme. Relevantly, this includes: <i>Schedule 6, part 5, item 26 – infrastructure activities:</i>	Construction stage – prior to works commencing

Legislation and Administering Authority	Development Action/Trigger	Approval/Permit/ Licence/ Obligation	Existing information/Project considerations and planning/exemptions	Project stage/ status/ timeframes
			<p>(1) Development for ancillary works and encroachments for a road carried out by or for the State</p> <p>(2) Development for the construction of the following infrastructure, if the infrastructure is <u>government supported transport infrastructure</u>-</p> <p>...</p> <p>(c) road transport infrastructure; or</p> <p>(d) transport infrastructure</p> <p>(4) Development that –</p> <p>(a) is adjacent to-</p> <p>...</p> <p>(iii) road transport infrastructure; or</p> <p>...</p> <p>(iv) Transport infrastructure</p> <p>(b) is ancillary to the use, maintenance, repair or upgrading of the infrastructure.</p>	
VM Act DNRMMRRD	Vegetation clearing	Exempt clearing work under Schedule 6, Part 1, Item 1(14) and Part 2, Item 5 of the Planning Regulation	<p>The Project, being transport infrastructure that is 'Government Supported Transport Infrastructure' is eligible to undertake clearing of native vegetation as 'exempt clearing works' under:</p> <p>Schedule 6, part 1, item 1 – clearing and other activities or matters for premises generally</p> <p>(14) Clearing vegetation for the construction or maintenance of infrastructure stated in schedule 5, if-</p> <p>(a) the clearing is on designated premises; or</p> <p>(b) the infrastructure is government supported transport infrastructure.</p>	Construction stage – prior to clearing works
Waste Reduction and Recycling Act 2011 (Qld) DETSI	Construction works	Management of waste and potential payment of waste levy	<p>All waste disposed of to a leviable waste disposal site within the levy zone or waste that has been generated within the levy zone and disposed of to a landfill outside the levy zone will attract a State government waste levy. Landfill operators (including local councils and private operators) pay the levy to the State and may elect to pass on the cost of their levy to customers in addition to any standard landfill disposal fee (gate fee).</p> <p>The Project is located within the metro zone for which metro levy area rates are payable and may be passed on by SCC to the Project.</p> <p>All waste reduction, management and recycling opportunities will be addressed by the Contractor within a Waste and Resource Recovery Management Plan (as a sub plan to the EMP(C)) to be prepared and adhered to for the duration of the Project's construction works.</p>	Construction stage

2.8 Land use and tenure

This section describes the history of land use within the disturbance footprint and wider Caloundra locality, with a key focus on the areas now known as Ben Bennett Bushland Park, Gosling Park and Bicentennial Park. Existing land use and tenure arrangements are also described, together with a summary of the future land use intent and tenure within the disturbance footprint as a result of the proposed action.

2.8.1 Historical land use

Caloundra, located on the southern end of the Sunshine Coast, has a history of land use that reflects its transformation from indigenous lands to a popular urban centre. Originally inhabited by the Gubbi Gubbi people, the area was abundant in natural resources and cultural significance. European settlement in the 19th century introduced agricultural practices, primarily focused on timber harvesting and farming, which dominated the landscape for decades. As the region developed, particularly from the mid-20th century onwards, Caloundra transitioned into a residential and tourism hotspot, with increasing investments in infrastructure, such as roads, public amenities, industrial and commercial facilities to accommodate the growing population. The majority of the disturbance footprint is currently primarily composed of road infrastructure, which borders on residential and public park infrastructure.

Ben Bennett Bushland Park

Ben Bennett Bushland Park, located in Caloundra, Queensland, has undergone various phases of land use prior to its designation as a public park. Historically, the area was primarily utilised for timber and agricultural purposes.

In 1969, as Caloundra began to urbanise, the area was excised to Crown land and the local Council appointed as trustee. During this period, the area saw the introduction of infrastructure to support the growing population, including roads and residential housing.

The park was designed to provide green space and recreational facilities for the local community, promoting biodiversity and environmental conservation. Prior to the park's establishment, a limited number of disturbances occurred, including the introduction of non-native species and some commercial activities associated with the surrounding residential developments.

Gosling Park and Bicentennial Park

Gosling Park and Bicentennial Park, both located in Caloundra, share a historical narrative that highlights the area's transition from natural landscapes to community-focused spaces. Originally, these lands were characterised by native vegetation and wetlands, serving as vital habitats for local wildlife and resources for the Indigenous Gubbi Gubbi people. As urban development progressed in the mid-20th century, the areas began their transformation into recreational spaces, marked by the establishment of community facilities and playgrounds. Prior to their development as public parks, both sites underwent disturbances due to residential encroachment and the expansion of infrastructure in the surrounding region. Presently, Gosling Park and Bicentennial Park function as green spaces within the urban landscape, aimed providing recreational opportunities for both residents and visitors.

2.8.2 Existing land use and tenure

The disturbance footprint is located within the SCC local government area and predominantly comprises existing operational road corridors associated with Nicklin Way (State-controlled road) and other local government roads, as well as unformed road and open space through Ben Bennett Bushland Park. Other existing land uses comprise residential and industrial uses within the surrounding Caloundra urban area.

The relevant local planning instrument for the proposed action is the *Sunshine Coast Planning Scheme 2014* (SCC Planning Scheme). In accordance with the SCC Planning Scheme, the following land use zones intersect with the disturbance footprint:

- Conservation Zone (Ben Bennett Bushland Park)
- Specialised Centre Zone
- Major Centre Zone
- Medium Density Residential
- Community Facilities Zone (Council depot)
- Open Space Zone (Bicentennial Park).

The disturbance footprint intersects land comprising a number of tenure types being road reserve (associated with State-controlled, formed and unformed local government roads), Freehold, Reserve (associated with Ben Bennet Bushland Park) and Lands Lease. The disturbance footprint also intersects seven (7) easements.

2.8.3 Future land use and tenure

The disturbance footprint has been developed to utilise the existing State-controlled road (Nicklin Way), local government road corridors (formed and unformed) and electricity infrastructure easements, where possible, in order to minimise potential for changes in land use and the need for property resumptions.

Whilst the majority of the disturbance footprint comprises existing road corridor uses, the overarching impact of the Project on land use will be the change from open space, residential, industrial and infrastructure (electricity) uses to road corridor.

The Project requires the full or partial acquisition of 29 privately held properties within the disturbance footprint to accommodate the permanent road design, with TMR undertaking land acquisition activities associated with the future road reserve through Ben Bennett Bushland Park, and SCC undertaking land acquisition for the balance portion of land required.

To date, partial or full acquisitions have been completed by SCC, with structures removed and the land tenure converted to road reserve along Third Avenue, Oval Avenue, Nicholls Street and Bowman Road. Further acquisitions are still required for balance lots on Third Avenue and Omrah Avenue. All land acquisitions and subsequent tenure arrangements will be completed prior to construction commencing.

Land acquisitions by TMR associated with opening the section of future road reserve through Ben Bennett Bushland Park are currently underway and expected to be finalised in June 2026.

Once operational, the Project State-controlled road assets will be owned and managed by TMR, with the local government road assets owned and managed by SCC.

3 Methodology

3.1 Overview

This section provides detail on the environmental assessment methods used to assess the potential Project impacts on MNES and the significance of those potential impacts. It further covers the studies and reporting completed to date, the additional/revised desktop and field investigations undertaken and details the methodology for significant and cumulative impact assessments.

Informed by and building upon the studies and reporting completed to date (2017-2025) (as reported in the original Project EPBC Act referral), the methodology consists of:

- Revised ecological desktop assessments
- Desktop analysis of existing surface water and groundwater values
- Supplementary ecological field assessments (December 2024, February 2025)
- Additional MUSIC, SOURCE and TUFLOW modelling (Aurecon 2024a; Water Technology 2025)
- Updated likelihood of occurrence assessment (updated since the original Project EPBC Act referral)
- Revised SIAs
- Cumulative impact assessment.

Further detail for each of these components of the methodology is provided in the sections below.

3.2 Project study area

A Project study area was established to assess the direct and indirect impacts associated with the Project. The Project study area has been determined based off a 100 m buffer from the disturbance footprint, where MNES have the potential to occur. Where there were no potential MNES to occur (e.g. preexisting residential developments, transport infrastructure) the area was not considered to form part of the Project study area.

3.3 Studies and reporting completed to date

This preliminary documentation report has been informed by all previous environmental desktop and field assessments and reporting conducted for the Project. Past ecological field assessments were undertaken in May 2017 and June 2023. Table 3.1 provides a summary of all previous environmental assessments completed for the Project. These assessments demonstrate that the area has been extensively studied over time, considering a range of disciplines and stochastic variation.

Table 3.1 Previous environmental reporting completed for the Project

Title	Date	Author	Description/relevance
Environmental Assessment Report, incorporating an Environmental Management Plan (Planning), Environmental Scoping Report (ESR) and Detailed Environmental Assessment	2017 ¹	Aurecon	Assessment of existing environmental factors in accordance with TMR's <i>Environmental Processes Manual</i> . This assessment included on-ground surveys targeting MNES and matters of state environmental significance (MSES) species and their habitats.

Title	Date	Author	Description/relevance
Nicklin Way intersection upgrade MNES self-assessment Report	2017 ¹	Aurecon	EPBC Act self-assessment in accordance with the MNES Significant Impact Guidelines 1.1 (DotE 2013a). Habitat assessments for MNES, conducted within the disturbance footprint. Surveys consisted of vegetation community assessments, TEC validations and flora meander surveys using quaternary assessments, per Neldner et al. v3.2 (2012). TEC validations evaluated TEC presence using key diagnostics criteria and condition thresholds outlined within the EPBC Act approved conservation advice.
Nicklin Way intersection upgrade ESR	2018	Aurecon	ESR prepared in accordance with TMR's <i>Environmental Processes Manual</i> to inform the completion of a more detailed and thorough Environmental Assessment Report during future Project development phases.
Caloundra Transport Corridor Upgrade Cultural Heritage Assessment	2021	Converge Heritage + Community	Analysis of the cultural heritage risks pertaining to the Project Caloundra Road and Nicklin Way Intersection Upgrade Stage 1 – Nicklin Way and Arthur Street Connection Business Case, including a critique of both historical and Indigenous heritage requirements.
Protected Plant Report and Impact Management Plan	2022	Native Foresters	A Protected Plant Report and Impact management plan was conducted for the Caloundra Transport Corridor Upgrade Project.
Preliminary Environmental Assessment	2021	Flow Environmental	A preliminary desktop environmental assessment of the proposed Caloundra Transport Corridor Upgrade to inform the Project concept design phase.
Concept Design Road Traffic Noise Study	2022	Cardno	Assessment and evaluation of the potential noise impact generated by road traffic in a specific area to support the Project concept design phase.
CTCU MNES Assessment	2023	Aurecon	Regional ecosystem (RE) and TEC verification within the Project alignment. Conducted in conjunction with the protected plant assessment (detailed below) over five days by two people in May and June 2023 (Aurecon 2024b). Habitat assessments for MNES to inform the Project EPBC Act referral. Surveys consisted of vegetation community assessments, as per Neldner et al. (2022, version 7.0). TEC validations evaluated TEC presence using key diagnostic criteria and condition thresholds outlined within the EPBC Act approved conservation advice.
Caloundra Transport Corridor Upgrade Protected Plant Assessment Report	2023	Aurecon	Summary of the methodology and findings of targeted flora surveys to address the requirements of the <i>Flora Survey Guidelines – Protected Plants</i> (DES 2020).
Cultural Heritage Risk Assessment	2023	TMR	Analysis of the cultural heritage risks relating to the Nicklin Way Third Avenue Extension Project, including a critique of both historical and Indigenous heritage requirements in accordance with TMR assessment processes.
Caloundra Transport Corridor Upgrade Geotechnical Site Investigation	2023	Chadwick Geotechnics	Detailed assessment of the geological and geotechnical conditions at the Project site intended for the Caloundra Transport Corridor Upgrade Project. The purpose of this investigation was to gather relevant data and information about the subsurface conditions, including soil properties and rock formations, to inform the Project design and construction phases.
Hydraulic Assessment Report	2024	Aurecon	Hydraulic assessment of the detailed design in accordance with design standards and design criteria, utilising a TUFLOW model (adopted and updated from the concept design)

Title	Date	Author	Description/relevance
Review of Environmental Factors (REF)	2024	Aurecon	Assessments of likely potential impacts, design considerations and management requirements to support the Project preliminary and detailed design phases, in accordance with TMR's <i>Environmental Processes Manual</i> .
Environmental Management Plan (Planning) (EMP(P))	2024	Aurecon	Summary of potential Project impacts associated risks (identified in the REF) and the identification of recommendations to be incorporated into the Project design and documentation, in accordance with TMR's <i>Environmental Processes Manual</i> .
Environmental Design Report (EDR)	2024	Aurecon	Documents the responses and decisions of the design Project team against the recommendations made within the EMP(P) and REF, in accordance with TMR's <i>Environmental Processes Manual</i> .
MNES Report	2024	Aurecon	Methodology and findings of ecological assessments (desktop and field investigations), including likelihood of occurrence assessment and SIAs to identify potential Project impacts to MNES along with measures to avoid and reduce potential impacts, to support the Project EPBC Act referral to DCCEE.
CTCU Water Quality Modelling	2025	Water Technology	Methodology, findings, risk assessment and recommendations in relation to integrated MUSIC, SOURCE and TUFLOW FV modelling undertaken to assess potential Project impacts to surface water quality at the Project, wider catchment and downstream receiving environment (Pumicestone Passage) scales during the Project pre-construction, construction and operational phases.

Table note:

1 It is noted that these assessments and subsidiary surveys are older than 5 years, however, these have been included for historical context.

3.4 Hydrology

3.4.1 Surface water and catchments

The methodology to review existing surface water values and assess potential Project impacts at each of the Project, wider catchment and downstream receiving waters of the Pumicestone Passage scales has involved:

- Desktop review of existing information and data (Aurecon)
- Initial MUSIC modelling to inform detailed design (pre- and post-development scenarios) (Aurecon)
- Baseline water quality monitoring and comparison of baseline water quality results to relevant water quality guideline trigger values (Cowie Environmental)
- Integrated MUSIC, SOURCE and TUFLOW modelling to assess Project compliance against the identified water quality objectives and inform the Project water quality risk assessment and mitigation measures. Figure 3.1 illustrates how each of the three models were applied spatially to the disturbance footprint and surrounds.

Further detail on each aspect of the methodology is provided in the sections that follow.

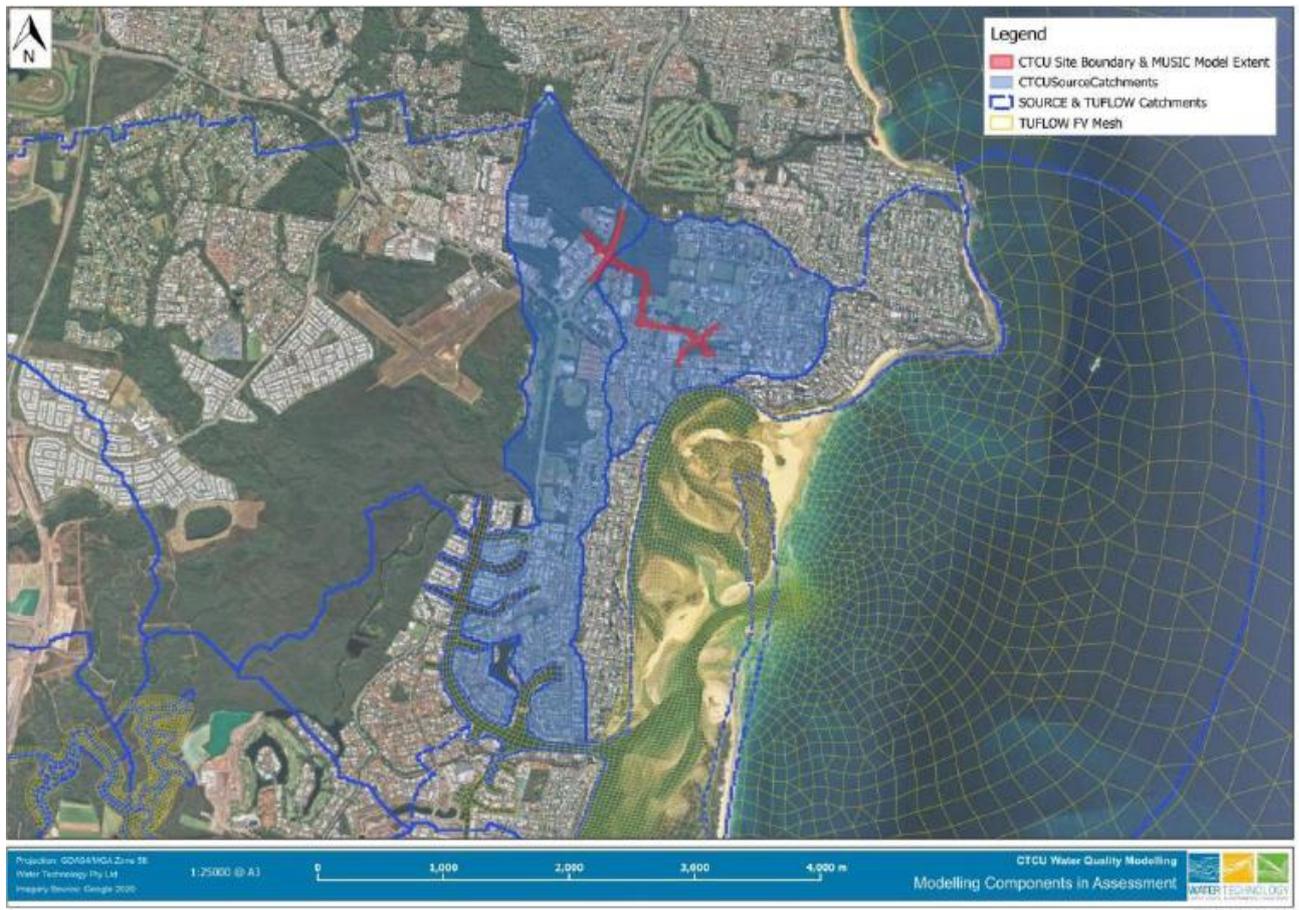


Figure 3.1 Spatial overlay of the three models applied to the Project

Source: Water Technology (2025)

Desktop review and initial MUSIC modelling

A desktop review of existing information and data was undertaken to identify catchments, sub-catchments, and associated waterbodies within and adjacent to the proposed action and existing water quality values. The review has considered:

- Queensland Globe (Queensland Government 2025)
- Watercourse Identification Mapping under the *Water Act 2000* (Qld)
- Waterways for Waterway Barrier Works mapping under the *Fisheries Act 1994* (Qld)
- Pumicestone Passage Environmental Values and Water Quality Objectives under the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (Qld)
- TMR Specifications *MRTS51 Environmental Management* and *MRTS 52 Erosion and Sediment Control* (TMR 2025).

Following the desktop review, and to support stormwater design development and impact assessment, initial MUSIC modelling was undertaken by Aurecon to determine the potential impacts of the Project (post-development), in comparison to the existing case (pre-development) to develop and assess the Project water quality treatment design response for the purposes of informing detailed design development. Model set up and analysis followed a split catchment approach and was undertaken in accordance with relevant guidelines and standards, including:

- SCC Flooding and Stormwater Management Guideline (Version 1, September 2020)
- SCC Planning Scheme Policies (2021)
- MUSIC Modelling Guidelines (Water by Design 2018) (including split catchment approach)
- Water Sensitive Urban Technical Design Guidelines for South-East Queensland (Water by Design 2006)

- Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands (Water by Design 2010)
- IECA Best Practice Erosion and Sediment Control Book 1, 2 and 3 (International Erosion Control Association 2008)
- Queensland Urban Drainage Manual (Queensland Government 2013)
- Austroads publications
- Australian Standards.

The MUSIC model simulated flows, total suspended solids (TSS), total nitrogen (TN), total phosphorus (TP) and gross pollutant (GP) loads resulting in runoff from the Project. The MUSIC model excluded external catchments to the Project and therefore represented direct impacts and mitigation measures within the disturbance footprint.

The MUSIC modelling and analysis for the post-development scenario was informed by applying the following overarching stormwater strategy objectives for the Project (presented in order of priority), having regard to existing disturbance footprint constraints (refer discussion in Section 4.3.4):

- Retention of natural bushland and sensitive environments as much as possible
- Maintain, wherever practical, the existing stormwater flow regime in terms of flows, flood levels, depths and velocities
- Utilise natural surface water quality solutions to treat both road and external catchment runoff, as applicable
- Where disturbance footprint constraints limit/prevent the use of natural surface water quality solutions, the use of end of line proprietary gross pollutant traps is acceptable.

Baseline water quality monitoring and review

Cowie Environmental Services was engaged by SCC to undertake baseline water quality monitoring in streams adjoining the disturbance footprint. Monthly water quality monitoring was undertaken between August 2024 and January 2025.

The primary objectives of the water quality monitoring programme were to:

- Establish a baseline (and associated site-specific water quality objectives) from which potential impacts associated with the proposed action can be monitored during the Project construction and operational phases
- Support the development of a Water Quality Management Plan (WQMP) to monitor and manage potential impacts to the downstream environment of the Pumicestone Passage and Moreton Bay Ramsar Wetland during the Project construction phase.

Monitoring was undertaken at four (4) locations upstream and downstream of the disturbance footprint for the following:

- Insitu parameters using a calibrated multi-parameter water quality sonde:
 - Water temperature
 - Dissolved oxygen ($\mu\text{g/L}$ and % saturation)
 - pH
 - oxidation reduction potential
 - electrical conductivity
- Water samples were also collected at 0.5 m depth and analysed by a NATA accredited laboratory for:
 - pH
 - Turbidity

- Total metals
- Total recoverable mercury
- Nitrate, nitrite, total Kjeldahl nitrogen, and total nitrogen (TN)
- Total phosphorus (TP)
- Total petroleum and total recoverable hydrocarbons
- Benzene, toluene, ethylbenzene, xylenes and naphthalene
- TPH and BTEX volatiles.

To supplement the baseline water quality monitoring, an existing Ecosystem Health Monitoring Program monitoring point, operated by Healthy Land and Water, was utilised as a reference site owing to its available long-term data for a range of parameters.

Sampling and analysis results were compared to trigger values as defined in the Queensland Water Quality Guidelines (QWQG), (DEHP 2009) and the Australian New Zealand Guidelines for fresh and marine water quality (ANZG 2018) for physiochemical and toxicity parameters, respectively.

Figure 3.2 illustrates the Project baseline water quality monitoring locations, showing the:

- Existing four (4) baseline monitoring locations – MP1, MP6, MP7 and MP8 (indicated as blue points)
- Existing Ecosystem Health Monitoring Program long-term monitoring location – E01312 (indicated as a pink point)
- An additional six (6) monitoring locations (indicated as yellow points) proposed to be monitored in addition to the above baseline locations, for the Project construction and operational phases as part of the WQMP.

A discussion of the existing baseline water quality values relevant to the Project is provided in Section 4.3.

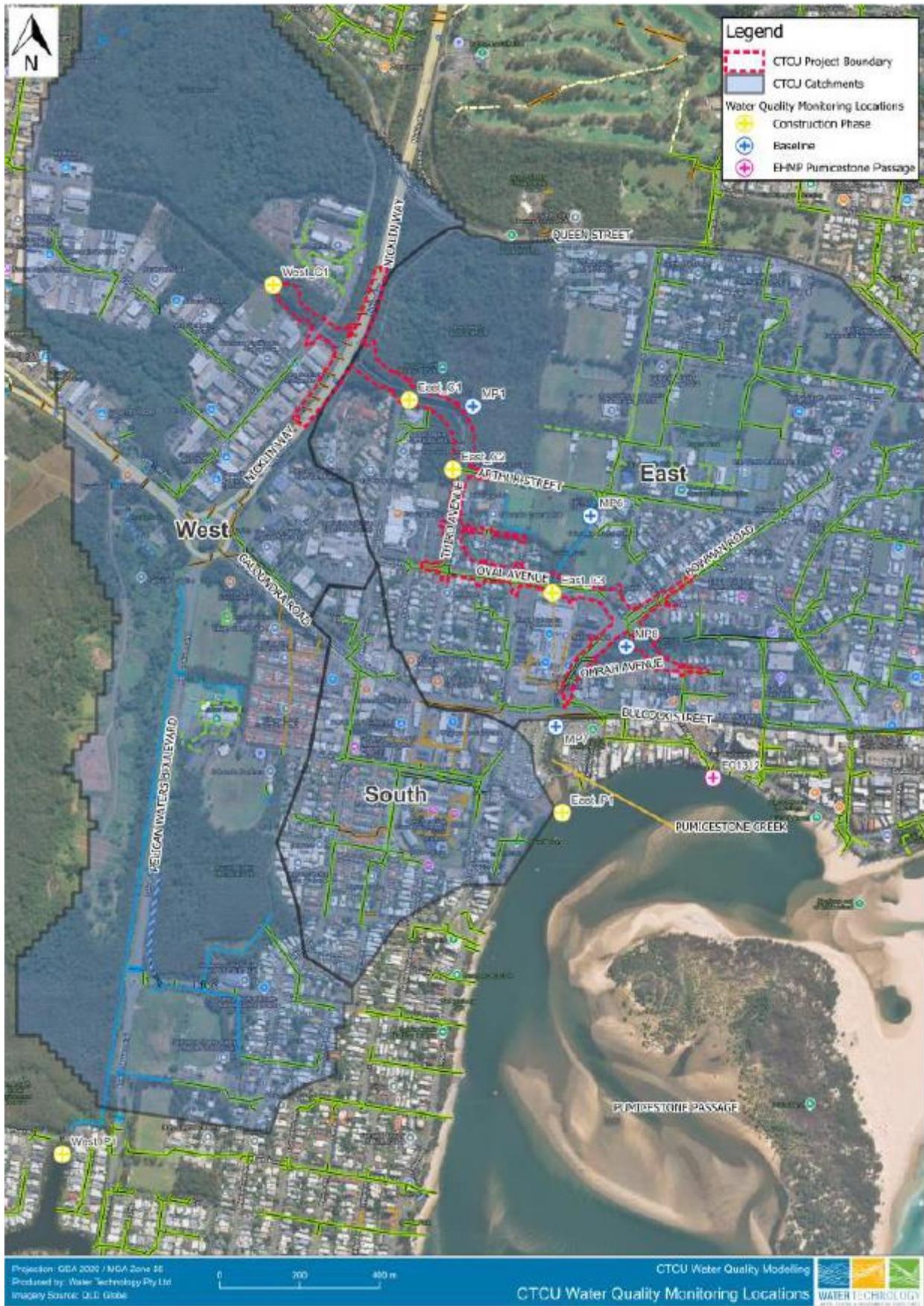


Figure 3.2 Existing baseline and proposed construction phase water quality monitoring locations

Source: Water Technology 2025

MUSIC modelling

Initial pre- and post-development MUSIC models developed for the detailed design (pre- and post-development scenarios) were reviewed by Water Technology and used (with modifications) to further simulate flows, as well as total suspended solids (TSS), TN, TP and gross pollutant (GP) loads resulting from Project runoff for the construction phase. A split catchment approach was integrated into the model based on topography, with drainage to the east, west and south (refer Figure 3.3). Although the 'south' catchment is not directly impacted by the Project, it has been included due to its proximity, and to ensure consideration of catchment change associated with broader potential Project impacts under future scenarios. The nature of the MUSIC model is such that it excludes external catchments to the Project and therefore simulates direct impacts and mitigation measures within the Project disturbance footprint. Outputs from this MUSIC modelling were used to inform the SOURCE model.



Figure 3.3 MUSIC model catchment delineation

SOURCE modelling

A broader catchment SOURCE model (referred to as the Central South-East Queensland (SEQ) catchment model), developed on eWater's SOURCE platform for Healthy Land and Water was then applied to simulate catchment-derived runoff as well as diffuse loads of TSS, TP and TP draining into the Pumicestone Passage from each of the east, west and south catchments. The Central SEQ model applies the SIMHYD ('Simple Hydrology') rainfall-runoff model to simulate runoff volumes. The model simulates the generation of water quality constituents (TN, TP and TSS) using a flow power function, estimating concentrations based on a rating curve that defines the relationship between discharge and concentration. Model parameters were varied across different land uses to reflect variability in runoff and pollution generation associated with each land use type within the catchment.

The following Project specific modifications were made to the standard Central SEQ model:

- Improved catchment and stream network delineation using local stormwater drainage data provided by SCC to more accurately represent drainage conditions within and around the Project disturbance footprint

- Enhanced land use mapping, supplementing the QLUMP 2012 dataset within the standard Central SEQ model with additional land use information derived from a desktop review of recent Google aerial imagery to ensure a more accurate representation of actual land use conditions
- Addition of a new land use category to the model to represent the Project disturbance footprint.

Figure 3.4 illustrates the extent of the SOURCE model catchment area.

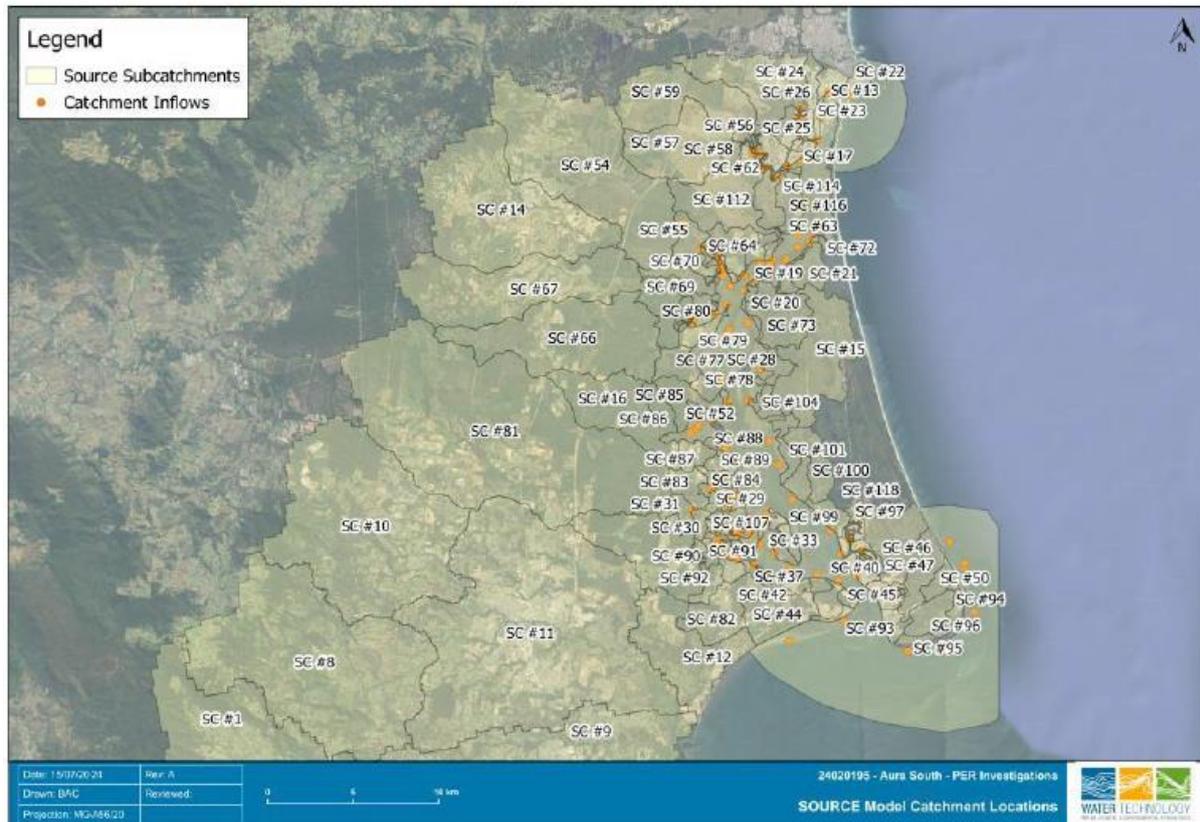


Figure 3.4 SOURCE model catchment area

Source: Water Technology (2025)

TUFLOW FV modelling

The results of the SOURCE model outputs were then used as inputs to a TUFLOW FV receiving water quality model. The model was built from the most recent model of Pumicestone Passage adopted for the Southeast Queensland Healthy Waterways Report Cards on behalf of Healthy Land and Water, which was upgraded to include the new breakthrough channel through the northern tip of Bribie Island (created from recent severe weather events including Tropical Cyclone Seth in 2022). The model covers the following over a 12-month simulated time period:

- Hydrodynamics – simulating water levels, temperature, salinity and velocities, including the effects of meteorology, tidal and catchment flows
- Advection-dispersion – simulating the transport of heat (i.e. temperature), salinity, suspended sediments, and other water quality constituents
- Sediment transport – simulating suspended sediment transport, noting that this is one of the key constituents that influence water quality in the Moreton Bay Ramsar Wetland and potentially impacting environmental values and water quality objectives as a result of the construction and operational phases of the Project
- Water quality – simulating the dynamics of dissolved oxygen, nutrients and phytoplankton, as well as other toxicants of interest (i.e. metals and hydrocarbons).

The TUFLOW FV model extent, incorporating the Bribie Island Northern Boundary (breakthrough channel) and Southern Boundary, is illustrated in Figure 3.5.



Figure 3.5 TUFLOW FV model extent

Source: Water Technology (2025)

The following Project specific modifications and boundary conditions were adopted to the most recent Pumicestone Passage receiving water quality model:

- Updates to the model mesh using recent topographic and bathymetric datasets, and Pumicestone Creek water depth data (obtained from the baseline water quality monitoring) to ensure a better representation of Pumicestone Creek and the confluence with the Pumicestone Passage
- Water levels at model boundaries were forced using measured local State government tide gauge data
- Atmospheric conditions were forced using hourly data from the National Centre for Atmospheric Research
- Water quality at model boundaries was forced using data from the existing Ecosystem Health Monitoring Program long-term monitoring locations (2)
- Potential risk of other toxicants (i.e. metals and hydrocarbons) was modelled and assessed using dilution modelling using a passive and conservative tracer (concentration of 1 mg/L) added to the boundaries of all Project affected catchments.

Model integration, scenarios and risk assessment

Ultimately, the three models were combined to predict impacts to the broader receiving environment within Pumicestone Creek and the Pumicestone Passage. However, it is important to note that there is an overlap between the SOURCE and MUSIC models as both represent the generation of flow and export of pollutant loads to the Pumicestone Passage regional water quality model. To avoid this effect of double counting modelled pollutant loads entering the Pumicestone Passage, the pollutant load outputs from MUSIC were exported as time series data, and then appropriately integrated as point sources into SOURCE and then into TUFLOW FV.

Scenario assessments were undertaken to verify how the modelled Project would affect water quality in Pumicestone Creek and Pumicestone Passage. A total of eight (8) scenarios across the three (3) time horizons of 2024, 2027 and 2041 were modelled:

- Three (3) baseline (pre-construction scenarios), one for each of the 2024, 2027 and 2041 time horizons
- Two (2) construction phase scenarios, reflecting variability in the likely Project maximum extent of disturbed construction area at any given time:
 - Construction scenario 1 (4.3 ha of disturbed construction area)
 - Construction scenario 2 (8 ha of disturbed construction area)
- Three (3) operational phase scenarios, one for each of the 2024, 2027 and 2041 time horizons.

For both the 2027 and 2041 future time horizons, land use and pervious/impervious surface proportions were adjusted to represent anticipated future land use changes/development growth surrounding the Project disturbance footprint. Table 3.2 provides a summary of each modelled scenario.

Once modelling was complete, a risk assessment was then undertaken based on the modelling results to primarily assess risks to water quality in the Pumicestone Passage and inform the development of mitigation measures for risk reduction.

Section 5.2.3 details the findings of the integrated modelling at each of the Project (MUSIC model), wider catchment (SOURCE model) and the downstream receiving environment of the Pumicestone Passage (TUFLOW FV model) and a summary of the key findings of the risk assessment.

Table 3.2 Summary of the integrated pre-construction (baseline), construction and operational phases surface water modelling scenarios

Scenario ID	Scenario name	Scenario description	MUSIC model	SOURCE model	TUFLOW FV model
S1	Baseline - 2024	Pre-construction scenario – existing catchment without the Project	Pre-development	Existing baseline	Existing baseline
S2	Baseline - 2027	Pre-construction scenario – 2027 predicted external catchment growth without the Project	Pre-development	East, west and south catchments as shown in Figure 3.3 and Figure 3.4 with previous fractions representative of expected 2027 growth	No changes to existing baseline except SOURCE model inputs
S3	Baseline - 2041	Pre-construction scenario – 2041 predicted external catchment growth without the Project	Pre-development	East, west and south catchments as shown in Figure 3.3 and Figure 3.4 with previous fractions representative of expected 2041 growth	As above
S4	Construction – Low area	Existing catchment conditions with Low construction area	Pre-development with Low construction area and erosion and sediment control measures in place	Existing baseline	As above
S5	Construction – High area	Existing catchment conditions with High construction area	Pre-development with High construction area and erosion and sediment control measures in place	Existing baseline	As above
S6	Operation - 2024	Operational Project within existing catchment conditions	Post-development	Existing baseline	As above
S7	Operation - 2027	Operational Project within 2027 external catchment growth/land uses	Post-development	East, West and South catchments as shown in Figure 3.3 and Figure 3.4 with previous fractions representative of expected 2027 growth	As above
S8	Operation - 2041	Operational Project within 2041 external catchment growth/land uses	Post-development	East, West and South catchments as shown in Figure 3.3 and Figure 3.4 with previous fractions representative of expected 2041 growth	As above

3.4.2 Flooding

A hydraulic assessment was undertaken as part of the Project detailed design phase to assess the design immunity of the proposed design and resultant hydraulic impacts.

The hydraulic assessment was undertaken using a cut-down version of SCC's Caloundra Master Drainage Study TUFLOW model. This model comprised a rain-on-grid combined 1D/2D TUFLOW model of the catchment (refer Figure 3.6). A rain-on-grid model applies the rainfall and losses to each cell across the hydraulic model domain and the resultant runoff from each cell is routed through the model to calculate the catchment flows and flow characteristics.

For the design event, SCC's Median Intensity Duration Independent Storm as per *The Application of Design Temporal Patterns on the Sunshine Coast* (SCC 2018) was used. The Median Intensity Duration Independent Storm is a single all-duration temporal pattern for a prescribed Annual Exceedance Probability (AEP) that has been derived from the Australian Rainfall and Runoff 2016 ensemble temporal patterns. Under SCC's *Stormwater Management Guidelines*, the use of single presentative temporal patterns for hydraulic modelling is recommended. The Project also adopted a climate change allowance for the year 2100 which included a 20% increase in rainfall and 0.8 m sea level rise as per the SCC Planning Scheme *Policy for Development Works* (SC6.14) (SCC 2014).

The existing hydraulic model included all existing drainage features, including SCC's existing pit and pipe drainage infrastructure greater than 300 mm within the existing catchment. The model adopted a downstream tailwater condition based on the Mean High Water Spring level within the Pumicestone Passage (0.46 m) for present day conditions and adopted a 0.8 m sea level rise for future year 2100 in accordance with the SCC Planning Scheme *Policy for Development Works* (SC6.14) (SCC 2014, effective 24 May 2021).

For the design case, the modelling incorporated the proposed road design and associated drainage infrastructure works, including the installation of two new culvert structures along Bowman Road and Arthur Street together with an upstream extension of the existing culvert under Oval Avenue.

The following design and severe storm assessment scenarios were modelled:

- Design scenarios:
 - Existing and design case (no climate change): 39% AEP
 - Existing and design case (with climate change): 10% AEP, 2% AEP and 1% AEP
- Severe storm assessment scenarios:
 - Existing and design case (with climate change): 100% blockage
 - Existing and design case (no climate change): 0.05% AEP.
- Findings from the detailed design phase hydraulic assessment have been used to inform the Project detailed design. Section 5.2.3 details these findings with relevance to Coastal Swamp Sclerophyll Forest TEC within Ben Bennett Bushland Park, the Pumicestone Passage and Moreton Bay Ramsar Wetland.

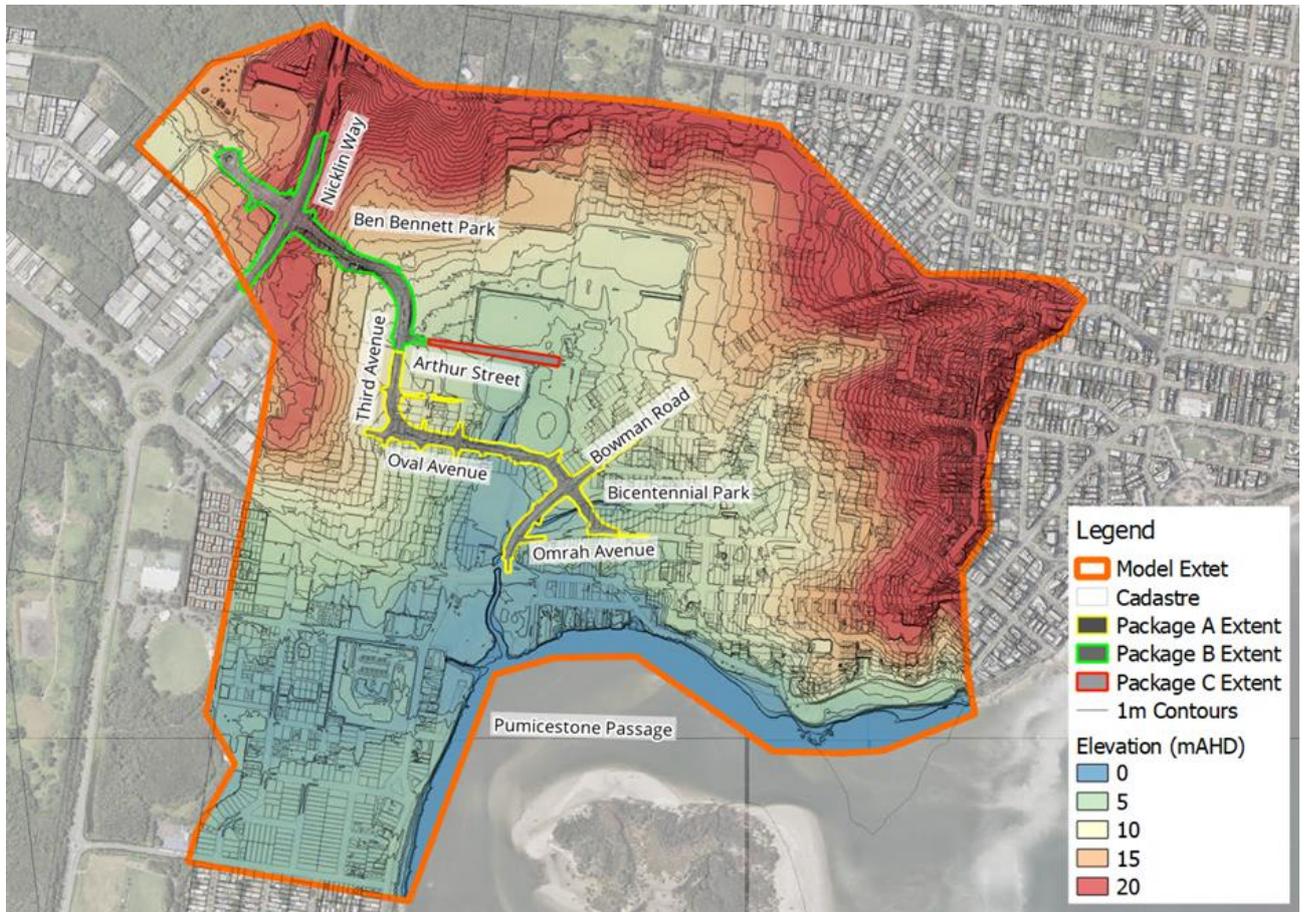


Figure 3.6 Modelled catchment extents

Source: Water Technology 2025

3.4.3 Groundwater

A desktop review of existing publicly available information and data, together with observations of groundwater levels during the Project geotechnical investigations (Chadwick Geotechnics 2023) were undertaken as part of the Project REF in 2024 to identify existing groundwater values within and surrounding the disturbance footprint.

Findings from the groundwater review have been used to inform the Project detailed design. Section 4.3 details these findings with regards to the existing environment, with potential impacts discussed in Section 7.2.

3.5 Topography, geology and soils

A desktop review of existing information and data was undertaken as part of the Project REF in 2024 to identify existing values within and surrounding the disturbance footprint. The review considered:

- Queensland Globe (Queensland Government 2025)
- Australian Soil Resource Information System (ASRIS) Database (Commonwealth Scientific and Industrial Research Organisation (CSIRO) 2022).

The review also considered relevant findings from the Project geotechnical investigations, which were undertaken in June 2023. These investigations consisted of an initial site walk over, test pitting, borehole logging and laboratory testing, including acid sulfate soil (ASS) testing and were undertaken in accordance with AS1726-2017 – *Geotechnical Site Investigations* (Chadwick Geotechnics 2023).

Findings from the desktop review have been used to inform the Project detailed design and assessment of MNES values. Section 4.4 details these findings with regards to the existing environment.

3.6 Ecological desktop assessment

The desktop review of government ecological databases and vegetation mapping was conducted to identify potential ecological values, including TECs, MNES, threatened¹ flora and fauna species, migratory² species, biosecurity and habitat critical to the survival of species which may occur within and adjoining the disturbance footprint.

The following resources were reviewed and assessed for the desktop assessment component of the ecological assessment:

- Aerial photographic images provided by Bing and Google Earth, accessed on a continual basis throughout desktop and fieldwork phases
- Atlas of Living Australia (ALA) (2025)
- EPBC Act Protected Matters Search Tool (PMST) with a buffer of 5 km beyond the disturbance footprint (DCCEEW 2025a)
- Species Profile and Threats (SPRAT) database (DCCEEW 2025c)
- WildNet with a buffer of 5 km beyond the disturbance footprint (DETSI 2025c)
- Protected Plants Flora Survey Trigger Map (DETSI 2025b)
- Batmap accessed for the disturbance footprint (Australasian Bat Society 2021)
- Essential Habitat Mapping (DETSI 2025a)
- DCCEEW National Flying-fox monitoring viewer (DCCEEW 2025b)
- Queensland Globe (Queensland Government 2025)
- Other MSES, including wetlands, waterways and REs.

Desktop assessments were reviewed throughout the field work and reporting process. Following receipt of the DCCEEW RFI (refer Appendix A) an updated PMST report was run (4 July 2025) using a 5 km buffer of the disturbance footprint (refer Appendix D).

3.7 Ecological field assessments

This section details all ecological field assessments undertaken by Aurecon for the Project in the time since the original referral, together with other Project studies considered to inform preparation of this preliminary documentation. Each of these Project assessments and other studies are summarised in Table 3.3. The survey adequacy is discussed in Section 3.7.5.

3.7.1 Survey effort

Field-based ecological assessments were undertaken in May 2017, June 2023, December 2024, January 2025 and November 2025 by a total of four suitably qualified and experienced³ Aurecon ecologists. The surveys involved several field assessments for the study area as well as the proposed offset site. A summary of the survey effort for each of the surveys completed is presented in Table 3.3. Survey locations are presented in Figure 3.7. For the proposed offset site survey locations (refer Appendix I and Appendix J).

¹ Threatened species are species listed as Critically Endangered, Endangered, or Vulnerable under the EPBC Act.

² Migratory species are species listed under one of the following international treaties: China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA), Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) or the Convention on the Conservation of Migratory Species of Wild Animals or Bonn Convention.

³ For the purpose of this document, a suitably qualified and experienced ecologist is someone who has relevant professional qualifications and at least three years' work experience designing and implementing flora and fauna surveys and management plans using relevant protocols, standards, methods and/or literature.

The field assessments were completed by the following suitably qualified personnel:

- Andy Dalton – Senior Ecologist, 20-year experienced botanist and vegetation specialist, Suitably Qualified Person (Protected Plants)⁴, (BSc (Ecology and Conservation Biology))
- James Thorley – Senior Ecologist, 6-years industry experience (BSc (Honours)/ BEnvSc (Minors: Geospatial Analysis; Restoration and Conservation))
- Jiordyn Trinca – Ecologist, 4-years industry experience (BWSc, MConsSc)
- Joe Dunlop – Ecologist, 6-years industry experience (BSc (Ecology and Conservation Biology))

A one-day supplementary targeted fauna survey was undertaken in December 2024. Habitat quality surveys were conducted from December 2024 to November 2025 as per the *Guide to determining terrestrial habitat quality, Version 1.3* (DETSI 2020b) to inform habitat quality and site condition for the Modified Habitat Quality Assessment (MHQA).

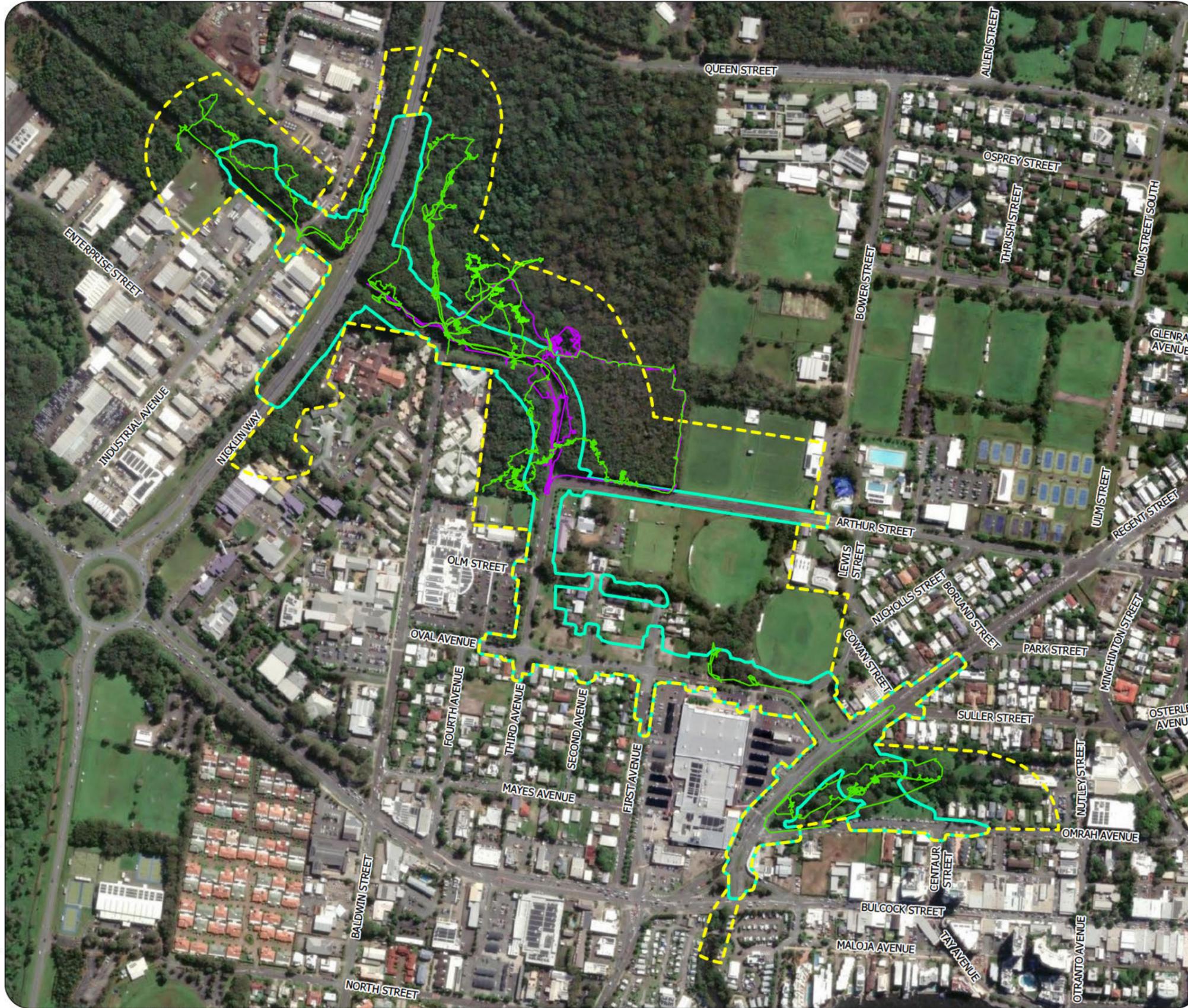
⁴ For the purpose of this document, a suitably qualified person (Protected Plants) is someone who has been certified as meeting the defined criteria of a 'suitably qualified person' under Section 4.2.1 of the *Flora Survey Guidelines – Protected Plants* under the NC Act (DETSI, 2025a).

Table 3.3 Ecological surveys completed for the Project and the proposed offset site to inform this preliminary documentation report

Title/scope	Author, year	Targeted species/values	Sampling effort/ investigation period	Method description/relevance
Project assessments				
Nicklin Way Environmental Assessment Report & MNES self-assessment Report	Aurecon, 2017 and 2018	<p>MNES and MSES flora and fauna values, including:</p> <ul style="list-style-type: none"> ■ State listed threatened flora ■ Acid frogs (<i>Crinia tinnula</i>, <i>Litoria freycineti</i>) ■ Koala ■ Lowland Rainforest of Subtropical Australia TEC ■ General habitat survey. 	<p>Protected plant flora survey in accordance with the <i>Flora Survey Guidelines – Protected Plants, Nature Conservation Act 1992</i> (DEHP 2016) undertaken 26 May 2017.</p> <p>Timed meanders using quaternary assessments, per Neldner et al. v3.2 (2012). Habitat assessments conducted in June 2017.</p> <p>Surveys consisted of vegetation community assessments, TEC validations and flora meander surveys. TEC validations evaluated TEC presence using key diagnostics criteria and condition thresholds outlined within the EPBC Act conservation advice (DAWE 2021a).</p>	<p>Assessment of existing environmental factors in accordance with TMR's <i>Environmental Processes Manual</i>. This assessment included on-ground surveys targeting MNES and MSES species and their habitats.</p> <p>ESR prepared in accordance with TMR's <i>Environmental Processes Manual</i> to inform the completion of a more detailed and thorough Environmental Assessment Report during future Project development phases.</p> <p>EPBC Act self-assessment in accordance with the MNES Significant Impact Guidelines 1.1 (DotE 2013a), <i>EPBC Act referral guidelines for the vulnerable koala</i> (DotE 2013b).</p> <p>Habitat assessments for MNES, conducted within the disturbance footprint. Surveys consisted of vegetation community assessments, TEC validations and flora meander surveys using quaternary assessments, per Neldner et al. v3.2 (2012).</p> <p>TEC validations evaluated TEC presence using key diagnostics criteria and condition thresholds outlined within the EPBC Act conservation advice (DAWE 2021a).</p>
CTCU Protected Plant Survey	Native Foresters, 2022	MNES and MSES flora	Timed meanders searching for threatened flora within 100 m of intersect of habitat and disturbance footprint. Conducted in July 2021.	Targeted surveys conducted in accordance with Queensland Protected Plant Survey Guidelines.
CTCU Protected Plant Assessment Report	Aurecon, 2023	MNES and MSES flora	Timed meanders searching for threatened flora within 100 m of intersect of habitat and disturbance footprint. Conducted in July 2023.	Targeted surveys conducted in accordance with <i>Flora Survey Guidelines – Protected Plants</i> (DES 2020).
CTCU Habitat surveys	Aurecon, 2023	MNES and MSES flora, TEC communities and habitat assessments.	Conducted non-targeted surveys for habitat assessments. Conducted in July 2023.	TEC assessment, RE verification, targeted and opportunistic flora surveys, Habitat assessment surveys, active searches for reptiles and frogs within suitable habitat, Opportunistic searches for wildlife and traces.

Title/scope	Author, year	Targeted species/values	Sampling effort/ investigation period	Method description/relevance
Targeted species survey, including water quality/pH testing	Aurecon, 2025	<ul style="list-style-type: none"> ■ <i>Litoria olongburensis</i> 	<p>Targeted survey 12 person hours – December 2024.</p> <p>Water quality/pH testing undertaken at two sites within Ben Bennett Bushland Park.</p>	<p>A targeted survey was completed to confirm presence of <i>Litoria olongburensis</i> onsite. The survey consisted of searching for frog individuals, spotlighting, static call surveys call playbacks and acoustic recordings.</p> <p>Surveys for <i>Litoria olongburensis</i> undertaken in accordance with the methods detailed in the <i>Draft referral guidelines for the vulnerable wallum sedge frog</i> (Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) 2011d) and <i>Targeted Species Survey Guidelines for the Wallum Sedgefrog (Litoria olongburensis)</i> (Rowland 2013).</p> <p>Water quality/pH testing for habitat suitability of breeding habitat for acid frogs. (i.e. pH of water bodies required for breeding).</p>
Targeted species survey	Aurecon, 2025	<ul style="list-style-type: none"> ■ Koala 	3 SAT surveys	
Targeted species survey, including water quality/pH testing	Aurecon, 2025	<ul style="list-style-type: none"> ■ <i>Cherax robustus</i> 	<p>Targeted survey 12 person hours – December 2024.</p> <p>Water quality/pH testing undertaken at two sites within Ben Bennett Bushland Park.</p>	<p>A targeted survey was completed to confirm presence of <i>Cherax robustus</i> onsite. The survey consisted of searching for individuals and burrows, spotlighting.</p> <p>Water quality/pH testing for habitat suitability of habitat for <i>Cherax robustus</i>. (i.e. pH of water bodies required for breeding).</p> <p>No guidelines for the <i>Cherax robustus</i> currently exist. A nocturnal spotlight search for animal and burrow presence was conducted.</p>
Habitat quality surveys	Aurecon, 2025	Habitat quality	December 2024/January-February 2025, November 2025 two people.	Habitat quality surveys were employed as per the methodology outlined in <i>A Condition Assessment Framework for Terrestrial Biodiversity in Queensland</i> (Eyre et al. 2015), <i>Guide to determining terrestrial habitat quality, Version 1.3</i> (DETSI 2020b) and MHQA. BioCondition plots were deployed to assess the habitat quality of the disturbance footprint and proposed offset site.
TEC validation surveys	Aurecon, 2025	TEC extent	February 2025	TEC extent validated based on on-ground survey investigations addressed in accordance with the respective conservation advice for the Coastal Swamp Sclerophyll Forest TEC (DAWE 2021a) and Lowland Rainforest of Subtropical Australia TEC (DSEWPC 2011a). These surveys occurred at the disturbance footprint and proposed offset site.
Koala occupancy surveys in Caloundra Transport Corridor Upgrade area	UniSc Australia, 2025	Koala	February 2025	Koala occupancy surveys for the disturbance footprint which included bioacoustics and Koala scat detection dog methodology.

Title/scope	Author, year	Targeted species/values	Sampling effort/ investigation period	Method description/relevance
Other Project studies				
Racecourse Road Bushland Reserve Flora Assessment	Brush Turkey Enterprises, 2013	Flora and vegetation	Ground truthing of the vegetation communities and threatened flora and weed species was undertaken by recognised field botanists in March 2013	Appraisal of existing ecological and floristic information relating to the Racecourse Road Bushland Reserve (i.e. the proposed offset site), and the presentation of additional field survey to describe the flora and ecosystems of the area. This study informs the proposed offset site.
Bobbie Sattler Reserve Fauna Survey and Habitat Assessment	Native Foresters, 2015	Mammals and reptiles	The surveys targeted terrestrial and arboreal mammals, bats and reptiles, including MNES and MSES species surveyed over 4 weeks in 2014 and 2015 with six ecologists	Part of a preliminary inventory assessment of mammals and reptiles at Bobbie Sattler Reserve (adjacent to the proposed offset site at Racecourse Road Bushland Reserve).
Sunshine Coast Council Drone Survey	Endeavour Veterinary Ecology (EVE), 2023	Koala	Targeted Koala surveys conducted with thermal imagery drones in May 2023	A thermal drone survey was completed to assess the presence of Koalas in SCC managed reserves of Caloundra and Caloundra West, Sunshine Coast.



Service layers: City of Moreton Bay, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Data sources: Queensland Spatial Catalogue - 2023



- Legend**
- Track Log
 - Spotlighting survey effort
 - Track Log
 - Disturbance Footprint
 - Study Area*

*Study area has been determined based off a 100 m buffer from the disturbance footprint, where MNES have the potential to occur. Where there were no potential MNES likely to occur (i.e. preexisting residential developments) the area was not considered to form part of the Study area

Revision: A

Date: 4/12/2025

A3 scale: 1:6,000



Caloundra Transport Corridor Upgrade

Figure 3.7 Ecology field survey locations

3.7.2 Vegetation and habitat assessments

Vegetation community assessments and habitat assessments were undertaken to describe the type and condition of the communities within the disturbance footprint. The outcomes of the assessment were used to inform the likelihood of occurrence assessment for listed threatened species and TECs, within and surrounding the disturbance footprint.

Vegetation community assessment

A quaternary-level assessment of vegetation communities was conducted following the methodology outlined by Neldner et al. (2022). This included ground-truth verification of existing State vegetation mapping (i.e., regional ecosystems) to confirm and, where necessary, update the classification and distribution of vegetation communities within the disturbance footprint.

TEC assessment

The ground-truth field survey for the TECs within the Project study area included:

- Validation of the condition threshold and extent of TECs addressed in accordance with the respective Conservation Advice for the Coastal Swamp Sclerophyll Forest TEC and Lowland Rainforest of Subtropical Australia TEC
- Assessment of water features and habitat values
- Defining the extent of disturbed⁵ and undisturbed⁶ areas
- Opportunistic encounters (observed/heard).

Habitat assessment

The parameters measured during the habitat assessments included:

- Context regarding landscape features (e.g. connectivity, proximity to water)
- Terrestrial flora species present, including canopy, shrub and ground-layer height
- Condition (e.g. weeds, evidence of disturbance and invasive species)
- Breeding and roosting habitat features (e.g. hollow bearing trees, nests and caves)
- Foraging sources (e.g. flowering tree species, Allocasuarina cones, etc)
- Microhabitat presence (e.g. woody debris, leaf litter, decorticating bark, bare ground, soil cracks, surface rock, rocky outcrops)
- Wetland and/or waterway presence (i.e. presence of aquatic vegetation, water depth and condition)
- Signs of threatened species (i.e. such as scats, scratches and track marks)
- Water quality assessments to determine suitability for acid frogs.

⁵ Disturbed areas include those areas associated with existing infrastructure and roads as described in Section 2.2.3.

⁶ Undisturbed areas include all other areas that have not previously been developed.

Weed surveys

To determine the risk of weed-related edge effects for the CSSF TEC and Lowland Rainforest TEC, three 100 m transects were placed perpendicular to the current edge of the CSSF TEC boundary at the impact site, and the representative weed percentage cover was measured in 1 m x 1 m plots every 5 m. Each plot was positioned to represent the weed cover for the subsequent 5 m interval (e.g. the plot at 0 m represents 0 to 5 m from the edge, the plot at 5 m represents 5 to 10 m, and so on). In addition to the plot-based measurements, the distance along the transect where the edge effect weeds ceased was recorded to define the penetration limit of the weed incursion. The observer slowly walks the transect line, looking for the target weeds on both sides of the transect. The cessation point of edge effect weeds is taken at the exact point where the species are no longer detectable. Three transect sites were established to quantify the existing weed incursion, strategically chosen to represent the two TECs: one transect for the Lowland Rainforest TEC and two transects for the CSSF TEC. Notably, the transect established for the Lowland Rainforest TEC also spanned the initial extent of the buffering CSSF TEC, allowing for concurrent measurement of both communities at that transect.

3.7.3 Protected plant surveys

The Project disturbance footprint intersects the Protected Plants Flora Survey Trigger Map (DETSI 2025b). Therefore a Protected Plants Flora Survey was completed between 13 June 2023 and 16 June 2023 to identify threatened flora species (i.e. listed under the EPBC Act and NC Act) which may have been present within a 100 m buffer of the disturbance footprint.

The timed meander survey methodology defined in Section 6.2.2 of the Queensland *Flora Survey Guidelines* (DES 2020) was used to identify and locate potentially occurring threatened flora species within the clearing impact area. The timed meander survey methodology involved the following:

- The selection of a starting point and the time noted
- To maximise the coverage of potential Critically Endangered, Endangered, Vulnerable and Near threatened (CREVNT) flora species habitat, the vegetation community was traversed in a random manner
- Any CREVNT flora species observed during the random meander were recorded along with samples and locational data (potential CREVNT species observations were recorded for later confirmation)
- The time was recorded every 2 to 5 minutes during the survey
- The survey ceased once no new flora species had been recorded for a period of 30 minutes or the entire area of habitat type within the clearing impact area was surveyed, whichever occurred first.

Timed meanders were undertaken at the rates per area of habitat type specified in Section 6.2.2 of the *Flora Survey Guidelines* (DES 2020), that is:

- Areas of habitat type less than 2 ha: one timed meander
- Areas of habitat type between 2 ha and 10 ha: two timed meanders.

3.7.4 Targeted species surveys

As part of the Project ecological field assessments a number of targeted species surveys have been completed. The three species that were targeted include Wallum sedge frog (*Litoria olongburensis*), (Koala *Phascolarctos cinereus*) and Sand Yabby (*Cherax robustus*). These species were chosen for targeted surveys to respond to the DCCEEW request for information and inform the MHQA methodology. Other likely or potential species were not surveyed as background data on the species collected during the EPBC referral was sufficient to inform assessment using the precautionary principle. These are summarised in the subsections below.

Wallum sedge frog (*Litoria olongburensis*)

Searches for Wallum sedge frog were undertaken generally in accordance with the survey methodology as described in:

- Survey guidelines for Australia's threatened frogs: Guidelines for detecting frogs listed as threatened under the EPBC Act (Department of the Environment, Water, Heritage and the Arts (DEWHA) 2010b)
- Draft referral guidelines for the vulnerable Wallum sedge frog, *Litoria olongburensis* (DSEWPC 2011d) and Targeted Species Survey Guidelines for the Wallum sedge frog (*Litoria olongburensis*) (Rowland 2013).

The diurnal survey involved active searches in suitable habitat areas, including overturning of rocks and disturbance of leaf litter, the day of the 8th and 9th December 2024 by foot within suitable habitats and vegetation communities. The spotlighting survey was completed on 8 December 2024, 6.00 pm until 10.00 pm by two qualified ecologists. No rainfall was recorded on the survey day or the prior three days, with the last significant rainfall being 29 mm on 1 December 2024 and 14 mm on 2 December 2024 (recorded at Caloundra Airport) (BOM 2025). The daily maximum temperature was 29.5°C and the daily minimum was 22.3°C (recorded at Sunshine Coast Airport) (BoM 2025).

Water quality testing was also undertaken to determine habitat suitability for the Wallum sedge frog to inform the extent of suitable habitat to be surveyed, as per the Draft referral guidelines for the vulnerable Wallum sedge frog, *Litoria olongburensis* (DSEWPC 2011d). Following determination of the results from the water quality assessment, no repeat surveys were conducted on the grounds as potential habitat was not present for the Wallum sedge frog.

Sand yabby (*Cherax robustus*)

A nocturnal spotlight search for Sand yabby and burrow presence was conducted in conjunction with the frog surveys described above. Other crustacean, in particular other *Cherax* spp., were also noted to assess potential interspecific competition factors. Surveys for the presence of burrows, Sand yabby and other related *Cherax* species were also conducted during the spotlighting.

Water quality testing was also undertaken to determine habitat suitability for the Sand yabby to inform the extent of suitable habitat to be surveyed. Following determination of the results from the water quality assessment, no repeat surveys were conducted on the grounds as potential habitat was not present for the Sand yabby.

Koala (*Phascolarctos cinereus*)

Five methods were employed to survey specifically for the Koala, these included conservation dog scat detection surveys, spotlighting, thermal drone surveys, koala occupancy using bioacoustics and Koala scratch and scat searches. The methods for each survey type are listed in the sections below.

Conservation dog scat detection surveys and Koala occupancy surveys using bioacoustics (University of Sunshine Coast)

The University of Sunshine Coast completed Koala occupancy surveys within and surrounding the disturbance footprint and Ben Bennet Bushland Park which included bioacoustics and Koala scat detection dog methodologies.

Acoustic data was recorded over the period 6 February to 18 February 2025, which coincides with an increase in vocalisation during the Koala breeding season in summer months.

Detection dog surveys occurred on the 7 February, 10 February, 11 February and 18 February 2025, totalling 30.4 km of searched transects.

The findings of the conservation dog scat detection and acoustic detection surveys are detailed in Appendix K.

Spotlighting

Aurecon conducted one night of spotlighting within and surrounding the disturbance footprint in December 2024. A *Pteropus* sp. was observed flying overhead; however, identification to the species level could not be ascertained. Applying the precautionary principle, the species was assumed to be the Grey-headed flying-fox (*Pteropus poliocephalus*). No other threatened species were observed during the course of the surveys.

Thermal Drone Surveys (Endeavour Veterinary Ecology)

Endeavour Veterinary Ecology (EVE) completed a drone survey to assess the presence of Koalas in SCC managed reserves of Caloundra, Caloundra West, and the broader Sunshine Coast region in 2023. The survey area included Ben Bennett Bushland Park. Further details of the thermal drone surveys are provided in Appendix M.

Koala scratch and scat searches

Opportunistic area searches for Koala scats and other signs such as scratches were conducted in conjunction with general surveys completed in July 2023.

3.7.5 Habitat quality surveys

The unpublished MHQA methodology was chosen as the preferred and most thorough method of assessing habitat quality within the impact area and proposed offset site. MHQA adapts the methodology outlined in the Queensland *BioCondition Assessment Manual (Version 2.2)* (Eyre *et al.* 2015) and the *Guide to determining terrestrial habitat quality (Version 1.2)* (DEHP 2017). MHQA introduces an additional habitat factor, species stocking rate, in order to satisfy the requirements of EPBC Act Offset Policy Principles.

The method utilises benchmark scores to ensure assessments are measured to a known standard, repeatable and consistent in determining habitat quality. Two rounds of habitat quality assessments were conducted within the Project study area and at the proposed offset site by two suitably qualified ecologists in December 2024, and January/February 2025, and November 2025.

This MHQA approach is appropriate for both Koala and GHFF as it quantifies available habitat features. Attributes such as the density of large trees, the quality and extent of foraging and shelter habitat, are weighted in scoring within each Assessment Unit (AU). Surveys for the Koala were incorporated into justification for species stocking rate attributes in accordance with *A review of Koala habitat assessment criteria and methods* (Youngentob *et al.* 2021). The specific methods deployed for Koala surveys located within the study area included thermal drone surveys, bioacoustic monitoring and Koala scat detection dogs.

Initial confirmation that the Coastal Swamp Sclerophyll Forest TEC occurs within the proposed offset site was undertaken using the criteria identified in the key diagnostics and condition threshold outlined in the conservation advice (DAWE 2021a). The location of appropriate habitat for the Coastal Swamp Sclerophyll Forest TEC subject to the Project OMP within the proposed offset site boundary is mapped in Appendix I.

3.7.6 Assessment units

In determining habitat quality scores, habitat areas are first delineated into AUs. An AU refers to an area or a group of areas within the MNES area (i.e. the proposed offset site or impact area) that is homogenous in vegetation community classification (i.e. RE) and broad condition state (i.e. remnant, regrowth, non-remnant). Each AU reflects a particular community with similar structure, function and quality of habitat. Sampling sites were then selected for each AU and site-based attribute data and species habitat attribute data was collected at each sampling site.

Vegetation assessments were undertaken in accordance with Neldner *et al.* (2022) and comprised quaternary assessments to determine RE and broad condition status. Sample site locations were chosen within a representative AU. AUs consist of relatively homogeneous vegetation patches characterised by a distinct RE and broad condition state.

For the impact area the following two AUs were observed:

- AU1 – representative of RE 12.2.7 (*Melaleuca quinquenervia* open forest on sand plains) in a remnant broad condition status
- AU 2 – representative of RE 12.9-10.14 (*Eucalyptus pilularis* tall open forest on sedimentary rocks) in a remnant broad condition status
- AU 6 – representative of Gallery rainforest (notophyll vine forest) on alluvial plains.

3.7.7 Survey adequacy

Table 3.4 summarises the survey adequacy for each of the target species. The target species were determined through the likelihood of occurrence assessment (refer Appendix E). Those species found to have a potential or likely likelihood of occurrence within the disturbance footprint were included for targeted surveys.

Table 3.4 Survey adequacy for targeted species surveys

Target species	Survey guidelines	Survey requirements	Sampling technique and effort	Survey adequacy response
<i>Lathamus discolor</i> Swift parrot	<i>Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act</i> (DEWHA 2017)	Minimum survey effort by area or transect surveys or targeted survey is 20 hours over 8 days . Area or transect searches during early morning or afternoon when birds are most active, with slow-moving vehicle transects effective in large areas by listening for distinctive calls. Conduct surveys from March to July on the mainland, focusing on heavily flowering eucalypts for targeted detection (DEWHA 2017).	No targeted surveys completed for this species. A precautionary method was employed using habitat as a proxy for the species' presence. General surveys were undertaken to determine presence; surveys were not undertaken in accordance with survey guidelines.	Targeted survey has not adequately addressed survey requirements, however sufficient information has been gathered to inform impact assessment.
<i>Calyptorhynchus lathami lathami</i> Glossy black-cockatoo	<i>Targeted species survey guidelines - Glossy black-cockatoo Calyptorhynchus lathami</i> (Hourigan 2012)	Minimum survey effort recommended is 5 hours over 1 day for diurnal bird surveys or 20 hours over 4 days for foraging and nesting signs (per 50 ha of area). Diurnal surveys on foot through transects through areas where <i>Allocasuarina</i> trees, water bodies and large hollow bearing eucalypts are present, encompassing a dusk or dawn survey. Searches for orsts and foraging signs (Hourigan 2012).	No surveys completed for this species. A precautionary method was employed using habitat as a proxy for the species' presence. General surveys were undertaken to determine presence; surveys were not undertaken in accordance with survey guidelines.	Targeted survey has not adequately addressed survey requirements, however sufficient information has been gathered to inform impact assessment.
<i>Coeranoscincus reticulatus</i> Three-toed snake-tooth skink	<i>Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act</i> (DSEWPC 2011e)	Crepuscular burrowing species may be recorded by turning over sheltering objects like rocks or fallen timber and using pitfall traps. Catch rates are expected to be low. Because active searching depends on suitable shelter sites, it should be combined with pitfall trapping for more effective detection (DSEWPC 2011e).	No surveys completed for this species. A precautionary method was employed using habitat as a proxy for the species' presence. General surveys were undertaken to determine presence; surveys were not undertaken in accordance with survey guidelines.	Targeted survey has not adequately addressed survey requirements, however sufficient information has been gathered to inform impact assessment.
<i>Phascolarctos cinereus</i> Koala	<i>Terrestrial Vertebrate Fauna Survey Guidelines for Queensland</i> (Eyre et al. 2022) <i>EPBC Act referral guidelines for the vulnerable koala</i> (DotE 2013b) (repealed) A review of koala habitat assessment criteria and methods (Youngentob 2021).	No single technique or widely accepted method to survey Koalas (Youngentob 2021). The <i>Terrestrial Vertebrate Fauna Survey Guidelines for Queensland</i> recommend searches for scats (faecal pellets), found at the base of trees, and scratch marks on trees (distinctive for the Koala). It also recommended the use of Wildlife Detection Dogs (Eyre et al. 2022). Direct observation techniques, transect and point surveys, spotlighting, Koala detection dogs, mark-resight or mark-recapture, thermal detection drones, radio-tracking and camera traps are recommended, as well as indirect survey techniques such as scat surveys, spot assessment techniques (SAT), call playback and landscape nutritional quality surveys may be used (Youngentob 2021).	Diurnal surveys of incidental fauna sightings and secondary indications of potential presence, including scats, scratches, diggings, tracks or other signs. Two ecologists over three days. Two ecologists spotlighting for one night for two hours. Koala occupancy surveys for the disturbance footprint which included bioacoustics and Koala scat detection dog methodology. Two ecologists over one day. Thermal drone surveys targeting Koala.	Guideline requirements met.

Target species	Survey guidelines	Survey requirements	Sampling technique and effort	Survey adequacy response
<i>Pteropus poliocephalus</i> Grey-headed flying-fox	<i>Survey guidelines for Australia's threatened bats</i> (DEWHA 2010a)	<p>A review of known flying-fox camps should be conducted prior to the survey.</p> <p>Daytime field surveys are recommended. Flying-foxes are recognised easily from a distance while they roost or are in flight and have distinctive audible calls that are heard most frequently in the early morning or under sunny conditions. Other signs include their distinctive odour and droppings. Both the ground and foliage should be examined for flying-fox scats.</p> <p>Field surveys conducted by qualified botanist to confirm vegetation communities within the disturbance footprint and presence of food plants.</p> <p>Night time surveys include conducting walking transects (100 m apart) looking for feeding and flying bats as well as detecting their smell. Alternative methods may include night-time audio recordings made at selected sites or fruiting food plants within the disturbance footprint (DEWHA 2010a).</p>	<p>Vegetation community assessments to determine presence of suitable habitat and food trees.</p> <p>Spotlight surveys undertaken during spring and summer surveys looking for nocturnal species, including feeding flying-foxes.</p> <p>Two ecologists spotlighting for two hours for one night.</p>	Guideline requirements met. Species potentially detected during spotlighting surveys.
<i>Potorous tridactylus tridactylus</i> Long-nosed potoroo (northern)	<i>Survey guidelines for Australia's threatened mammals</i> (DSEWPC 2011e)	<p>Survey techniques for detecting the species in areas up to 5 ha include daytime searches for suitable habitat and signs of activity. Additional methods include collecting predator scats, soil plot surveys, and baited camera traps with peanut butter, rolled oats, and truffle or walnut oil.</p> <p>An integrative approach combining direct detection (spotlighting, cage trapping, hair sampling) with searches for traces and predator scat surveys is advised, as different techniques may be more effective depending on the location (DSEWPC 2011e).</p>	No surveys completed for this species. A precautionary method was employed using habitat as a proxy for the species' presence.	Targeted survey not completed, however sufficient habitat information has been gathered to inform impact assessment.
<i>Cherax robustus</i> Sand yabby	No survey guidelines specific to Sand yabby, however consideration given to draft referral guidelines for four threatened Tasmanian burrowing crayfish (DSEWPC 2011c)	<p>Surveys to visually locate burrows within suitable habitat is recommended. The minimum search effort is 1 hour per 1 ha.</p> <p>Once burrows are located, if more than one crayfish species may be present, burrows should be excavated to determine species. Crayfish should be identified to species level in field and released on site. Once species identified, the remaining burrows in microhabitat can be assumed to contain the same species and no further excavation is required (DSEWPC 2011c).</p>	Diurnal and spotlighting surveys conducted by two ecologists over 2 days and one night. The disturbance footprint and surrounds were surveyed for presence of burrows and Sand yabby or other related species.	Surveys considered adequate for the presence/absence of species and sufficient information has been gathered to inform impact assessment.

Target species	Survey guidelines	Survey requirements	Sampling technique and effort	Survey adequacy response
<i>Pandion haliaetus</i> Osprey	<p><i>Draft referral guidelines for 14 birds listed as migratory species under the EPBC Act (DotE 2015a)</i></p> <p><i>Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act (DEWHA 2017)</i></p> <p>There are no survey guidelines specific to the Osprey</p>	<p>Area searches on foot in suitable habitat in and around the Project study area. Detection by sightings, calls and signs of occupancy (DEWHA 2017; DotE 2015a). Ospreys should be surveyed through observations from vantage points, area searches on foot, transect surveys from vehicles to detect birds or nests (large survey areas), transect surveys from boats along suitable coastal habitat, or aerial surveys to detect birds or nests (large survey areas) (DotE 2015a).</p>	<p>Area searches on foot in suitable habitat in and around the disturbance footprint. Detection by sightings, calls and signs of occupancy.</p>	<p>Surveys considered adequate for the presence/absence of species. Species detected.</p>
<i>Litoria olongburensis</i> Wallum sedge frog	<p><i>Draft referral guidelines for the vulnerable wallum sedge frog (DSEWPC 2011d).</i></p> <p><i>Targeted Species Survey Guidelines for the Wallum Sedgefrog (Litoria olongburensis) (Rowland 2013).</i></p>	<p>Aural surveys during calling periods for the species (September to April), after rainfall, and from sunset into the evening.</p> <p>Repeated visual surveys if aural surveys are not successful. A minimum of three surveys to be completed during optimal survey conditions or until the species is detected. The first visual survey best undertaken 6-8 weeks after significant rainfall and taken at least one month apart, along transects, with one 50 m x 2 m transect per 2 ha of suitable habitat and at a minimum of one person-hour of survey per transect.</p>	<p>A targeted survey conducted by two ecologists over two days and one night in December to confirm presence of <i>Litoria olongburensis</i> within the disturbance footprint and surrounds. Survey consisted of searching for frog individuals, spotlighting, static call surveys call playbacks and acoustic recordings. Undertaken in accordance with the referred species guidelines.</p> <p>Water quality/pH testing for habitat suitability of breeding habitat for acid frogs. (i.e. pH of water bodies required for breeding).</p>	<p>Replication surveys in line with species survey guidelines discontinued as a result of the findings from the water quality readings indicating a lack of suitable habitat.</p>

3.8 Updated likelihood of occurrence assessment

As part of the desktop reviews, an assessment of the likelihood of occurrence of TECs, threatened, and migratory species as listed under the EPBC Act was undertaken. The assessment covered the Project study area to inform the field investigations.

The likelihood of occurrence assessment was conducted using information from a review of database resources such as vegetation mapping, species occurrence records, approved conservation advice, recovery plans, draft referral guidelines and listing advice. Information collected during the ecological field survey, including habitat data and species observations, were used to revise the likelihood of occurrence assessment. As part of the DCCEEW RFI (item 3.2) for this document, a new PMST result was required. This is included in Appendix D. The likelihood of occurrence assessment (updated where required based on the new PMST results) is provided in Appendix E.

A 'likelihood of occurrence' rating was assigned to threatened species listed under the EPBC Act. These ratings have been determined using a combination of factors, including:

- PMST likelihood of occurrence ratings
- Records of species presence within the disturbance footprint or within 5 km of the disturbance footprint, obtained from the State specific databases and Queensland Globe
- Information contained on the SPRAT on the DCCEEW website
- Previous reports relevant to the disturbance footprint.

The definitions used to determine likelihood of occurrence for species are provided in Table 3.5.

Table 3.5 Likelihood of occurrence definitions for MNES species

Likelihood of occurrence rating	Definitions
Known	Species recorded within the disturbance footprint during field survey.
Likely	Suitable habitat is present, and species are likely to utilise the disturbance footprint for important lifecycle functions such as foraging and breeding. Species has been recorded previously or is abundant (>1 record per km ²) in similar habitat sites in the surrounding 5 km.
Potential	Minimal (≤1 record per km ²) records of the species within 5 km. Potential habitat for the species is present. Species may utilise the area for foraging habitat but is unlikely to be reliant upon resources due to an abundance of similar habitat features in the surrounding area.
Unlikely	No records of the species. Species is unlikely to utilise habitat due to habitat constraints, geographic limitations or outside of known distribution, or has been confirmed absent from impact area from targeted survey.

The SIA in Section 7 incorporated species specified as controlling provisions in the DCCEEW Request for Information, along with threatened species with a known, likely, or potential MNES impact summarised in Table 3.6. This has been updated in line with the DCCEEW request for a new PMST result as described above.

Table 3.6 Likelihood of occurrence for known, likely and potential MNES species

Species name	Common name	EPBC Act	Likelihood of occurrence
Threatened species			
<i>Calyptorhynchus lathami lathami</i>	Glossy black-cockatoo	Vulnerable	Potential
<i>Coeranoscincus reticulatus</i>	Three-toed snake-tooth skink	Vulnerable	Potential
<i>Lathamus discolor</i>	Swift parrot	Critically Endangered, Marine	Potential
<i>Phascolarctos cinereus</i>	Koala	Endangered	Potential
<i>Potorous tridactylus tridactylus</i>	Long-nosed potoroo (northern)	Vulnerable	Potential
<i>Pteropus poliocephalus</i>	Grey-headed flying-fox	Vulnerable	Known

3.9 Habitat mapping

Habitat mapping was undertaken for six EPBC Act listed threatened species that were identified as having potential or likely to occur within the disturbance footprint. The habitat mapping was informed by the accumulation of conservation advice, previous studies and additional field investigations undertaken, including ground-truthed habitat surveys using the habitat criteria for each species listed above. The habitat mapping criteria used for defining the potential habitat for the six species is justified in Table 3.7

Table 3.7 Habitat mapping criteria for the potential or likely to occur fauna species

Species	Habitat criteria
Koala	Koala foraging, resting and breeding habitat includes any forest (remnant, regrowth and modified vegetation communities) containing species that are Koala food trees (trees of the genus <i>Eucalyptus</i> , <i>Corymbia</i> and <i>Angophora</i>). Koala habitat for dispersal consists of areas that may act as secondary habitat for movement between primary habitats, including isolated trees, linear strips of vegetation and cleared areas that connect primary habitat areas. This includes the power easements, roadside vegetation and areas of pavement, where movement is not obstructed by barriers (refer Figure 4.11 and Figure 7.5).
Grey-headed flying-fox	Any forest (remnant, regrowth and modified vegetation communities) containing important winter and spring species such as <i>Eucalyptus tereticornis</i> , <i>E. pilularis</i> , <i>E. robusta</i> , <i>E. siderophloia</i> , <i>Banksia integrifolia</i> , <i>Castanospermum australe</i> , <i>Grevillea robusta</i> , <i>Melaleuca quinquenervia</i> or <i>Syncarpia glomulifera</i> . Areas identified as potential habitat for this species are indicated in Figure 4.11 and Figure 7.8.
Long-nosed potoroo	Any sclerophyll forest where there is dense understorey observed. Areas identified as potential habitat for this species are indicated in Figure 4.11 and Figure 7.4.
Swift parrot	Areas of forest containing large, abundantly flowering <i>Eucalyptus tereticornis</i> and <i>Eucalyptus robusta</i> . Areas identified as potential habitat for this species are indicated in Figure 4.11 and Figure 7.4.
Glossy black-cockatoo	Areas of contiguous forest containing <i>Allocasuarina</i> and <i>Casuarina</i> species. Areas identified as potential habitat for this species are indicated in Figure 4.11 and Figure 7.4.
Three-toed snake-tooth skink	Any sclerophyll forest where there is dense leaf litter observed. Areas identified as potential habitat for this species are indicated in Figure 4.11 and Figure 7.4.

Habitat maps have been prepared using ArcGIS desktop, with the disturbance footprint boundaries and cadastral data sourced from SCC and Queensland Spatial, respectively. ESRI World Topographic Map and World imagery has been used in the overview figures. For the habitat assessment figures where greater detail is required, Nearmap imagery captured in May 2021 has been used as the base imagery.

3.10 Significant impact assessment

SIAs have been completed for all MNES assessed as 'known to occur', 'likely to occur', and 'potential to occur' (refer Table 3.6).

The SIAs were based on the potential direct impacts within the disturbance footprint, as well as the potential Project indirect impacts in the local and regional context. The SIAs were conducted in accordance with the MNES Significant Impact Guidelines 1.1.

The assessment of significant impacts on the identified MNES for the proposed action are based on:

- The design and layout of the Project within the disturbance footprint
- Current known information about the MNES (sourced from relevant approved conservation advice and national recovery plans) as detailed in each subsection relevant to the species
- Habitat values and habitat mapping for the MNES species within and surrounding the disturbance footprint based on detailed desktop assessment and observations in the field.

Results from the SIAs are discussed in Section 5.

3.11 Cumulative impact assessment

3.11.1 Approach

A cumulative impact assessment (CIA) has been undertaken to identify and assess the potential cumulative impacts to MNES that may occur as a result of the Project development in conjunction with other identified existing or proposed projects in the region or vicinity of the Project.

When multiple projects occur within close proximity (5 km), the potential arises for cumulative impacts which may:

- Differ from those of an individual project when considered in isolation
- Be positive or negative
- Vary in severity and/or duration having regard to the spatial and temporal overlap of projects within a defined area.

Cumulative impacts can:

- Occur at a local, regional or national level
- Accumulate with time
- Exacerbate the scale, frequency, duration and intensity of impacts in isolation or in combination.

The approach used to identify and assess potential cumulative impacts is as follows:

- Definition of the CIA study area and selection criteria of assessable projects
- Identification of assessable projects within the CIA study area that meet one or more of the selection criteria and their potential overlap with the Project, either spatially or temporally (e.g. construction and/or operation phase)
- Undertaking of a qualitative assessment to:
 - Identify potential cumulative impacts
 - Assess the significance of potential cumulative impacts (low, medium, high)
 - Propose additional mitigation measures where cumulative impacts were deemed to be of medium or high significance.

3.11.2 Definition of cumulative impact study area and selection criteria

The CIA adopts a study area that comprises the disturbance footprint together with an approximate 5 km buffer area (the CIA study area).

The CIA is based on information available at the detailed design stage of the proposed action and considers other projects (as assessable projects) within the CIA study area to determine the Project's likely contribution to overall potential cumulative impacts on relevant MNES at the local and regional scale.

These assessable projects are those that have been referred to DCCEE for a controlled action determination under the EPBC Act or that are currently being assessed as a 'controlled action' under the EPBC Act for one or more MNES common to the Project. These assessable projects have been identified based on desktop searches of the EPBC Act Public Portal and other publicly available project related information, completed on 24 April 2025.

The assessment is focussed on cumulative MNES impacts of the proposed action and does not attempt to assess any social or economic impacts resulting from the development.

3.11.3 Matters assessed as part of the cumulative impact assessment

The CIA only assesses only those MNES that have been identified as having the potential to be impacted by the proposed action in accordance with the MNES Significant Impact Guidelines 1.1, within the controlling provisions for the Project. The CIA assesses the Project's contribution to overall impacts in relation to the following matters:

- Coastal Swamp Sclerophyll Forest TEC
- Koala
- Grey-headed flying-fox.

All other matters that are not controlling provisions for the proposed action and/or have not resulted in a potential significant impact, have been excluded from the CIA. These matters are considered to result in a negligible impact for the Project's overall project cumulative impacts.

The CIA has been undertaken by assigning one of the following significance classifications for each MNES:

- High – The proposed action's contribution to cumulative impacts is considered likely to exacerbate threatening processes affecting the intrinsic characteristics and structural elements of the environmental value. While replacement of unavoidable losses is possible, avoidance through appropriate design responses is preferred to preserve its intactness or conservation status.
- Moderate – The proposed action's contribution to cumulative impacts is considered likely to result in degradation of the environmental value due to the scale of the impact or its susceptibility to further change even though it may be reasonably resilient to change. The abundance of the environmental value ensures it is adequately represented in the region, and that replacement, if required, is achievable.
- Low – The proposed action's contribution to cumulative impacts is considered likely to be limited to temporary or transient impacts to environmental value of local importance, and that will not adversely affect viability provided standard environmental management controls are implemented.
- Negligible – The proposed action's contribution to cumulative impacts does not result in any noticeable change and will have negligible effect on environmental values. This typically occurs where activities are located in existing disturbed areas.

Section 7.6 presents the findings of the CIA, including details of the assessable projects considered.

4 Description of the environment and matters of national environmental significance

4.1 Overview

This section provides a discussion of the referable MNES included in the DCCEE RFI. As per the DCCEE RFI an updated PMST was completed, and the results are contained in Appendix D. Where suitable, the following subsections provide results of (targeted) field surveys and habitat mapping completed (as detailed in Section 3).

The disturbance footprint and Project study area consists of a matrix of urban built environment, urban green space, and isolated remnant and non-remnant vegetation. The majority of the vegetation within the disturbance footprint consists of open sclerophyll forest and swamp sclerophyll forest. Open forest habitat consists of *Eucalyptus pilularis* tall open forest with a thick shrubby understorey. The swamp sclerophyll forest consists of *Melaleuca quinquenervia* and *Eucalyptus robusta* with a thick shrub layer and dense ground layer.

Waterways and aquatic habitat are not present within the disturbance footprint, with the closest being Tripcony Inlet located approximately 23 m downstream from the disturbance footprint's southern boundary (refer Figure 4.1). Tripcony Inlet is mapped as a Ramsar Wetland of International Importance (Moreton Bay), Nationally Important Wetland (Pumicestone Passage) and Protected Area (Marine) and provides suitable habitat for aquatic species of flora and fauna. Under present conditions stormwater is discharged from the disturbance footprint into Tripcony Inlet via stormwater infrastructure. This infrastructure primarily consists of concrete-lined drains and more natural forms (with rocks and vegetation) in the section south from Bowman Road.

Throughout the disturbance footprint, there are levels of disturbance from an existing HV electricity easement, walking/access tracks, non-native flora species as well as residential development.

4.2 Moreton Bay Ramsar Wetland

The Moreton Bay Ramsar Wetland is located in and around Moreton Bay, north-east, east, and south-east of Brisbane, Queensland. It extends approximately 110 km from Bribie Island in the north to the northern wall of the Gold Coast Seaway in the south, and is 35 km at its widest point, east to west (DETSI 2023).

Covering more than 120,000 ha, the Moreton Bay Ramsar Wetland includes one of the largest, hydrologically diverse estuarine bays in Australia and is semi-enclosed by large sand island barriers (DESI 2019; DETSI 2023). It includes most of Moreton Island, as well as portions of North and South Stradbroke Islands, Bribie Island, the southern Bay Islands, waters and tributaries of Pumicestone Passage, some intertidal and subtidal areas of the western and southern sections of the Bay, estuarine and sandy channels of the Broadwater region, marine areas and sand banks within the central and northern sections of the Bay, and some ocean beach habitats (DETSI 2023).

The Moreton Bay Ramsar Wetland meets all nine criteria required to be designated as a 'Wetland of International Importance' and in addition to its large size, is noted for its diversity of wetland habitats, connectivity between wetland types as well as diverse flora and fauna, including threatened species and ecological communities. It contains seagrass, tidal flats and subtidal areas, saltmarsh, mangroves and coral communities, freshwater wetlands, as well as ocean beaches and dunes. It supports:

- More than 50,000 waterbirds, representing at least 43 shorebird species and at least 28 migratory shorebird species
- Over 1% of the estimated flyway population of at least nine migratory shorebird species
- A range of internationally, nationally, State and local significant species of fish, acid frogs, water mouse, insects and freshwater invertebrates (DETSI 2023).

Given its significant geographical extent, diversity and ecosystem services, the Moreton Bay Ramsar Wetland is delineated into four areas, which includes, relevantly, Area 1 – Bribie Island, Pumicestone Passage, Deception Bay and the Caboolture River (DETSI 2023).

The disturbance footprint is located outside, but upstream to the Moreton Bay Ramsar Wetland boundary, approximately 23 m from the southern most extent of the disturbance footprint at the intersection of Bowman Road and Bulcock Street and along Omrah Avenue.

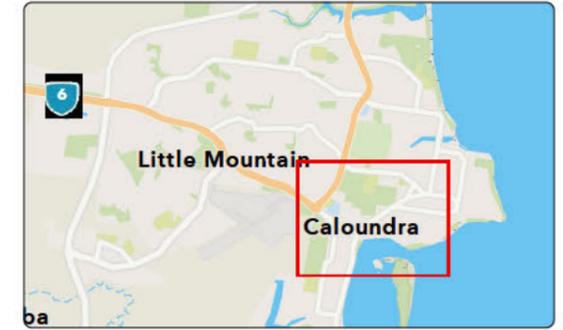
Figure 4.1 illustrates the location of the Moreton Bay Ramsar Wetland boundary in relation to the disturbance footprint.

Further detail regarding catchment, surface water and groundwater values within and surrounding the disturbance footprint, including in relation to the Moreton Bay Ramsar Wetland is provided in Section 4.3.

The potential Project impacts to the Moreton Bay Ramsar Wetland values are discussed in Section 5.2.3.



Service layers: City of Moreton Bay, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community; Data sources: Queensland Spatial Catalogue - 2023



Legend

-  Disturbance Footprint
-  Moreton Bay Ramsar Wetland
-  Study Area*

Revision: A

Date: 20/11/2025



Caloundra Transport Corridor Upgrade

Figure 4.1 Moreton Bay Ramsar Wetland location

Coordinate system: GDA2020 MGA Zone 56

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4.3 Hydrology and water quality

4.3.1 Catchment context

The Project is located within the Pumicestone Creeks sub-catchment of the Moreton water plan area under the *Water Plan (Moreton) 2007* (Qld) and the Pumicestone Passage basin (basin 141) under the EP Act. The Pumicestone Creek sub-catchment encompasses Lamerough Creek, Bells Creek and Mellum Creek which are all located greater than 1.5 km to the west and south of the disturbance footprint.

The Pumicestone Creek sub-catchment is primarily influenced by overland flow flooding and drains from the north towards the intersection of Bowman Road and Bulcock Street via open drains and underground drainage networks before discharging to Pumicestone Passage via existing constructed drainage infrastructure located adjacent to and upstream of the Moreton Bay Ramsar Wetland. The western side of Nicklin Way drains separately, with overland flow within this section being conveyed to an open channel that flows south-west of the disturbance footprint.

4.3.2 Environmental values and water quality objectives

Within the Pumicestone Passage Basin, the disturbance footprint is contained within the Bells and Lamerough Creeks Environmental Value Zone (eastern and western portions of the Project catchment) and the Pumicestone Passage Estuary and Intertidal Wetlands Environmental Value Zone (which includes downstream extent of the Project pipe network). The Pelican Waters Canal Environmental Value Zone is also located in proximity and is relevant as it receives inflows from the western portion of the Project catchment (Water Technology 2025).

The *Pumicestone Passage Environmental Values and Water Quality Objectives* established under the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP (Water and Wetland Biodiversity)) identify the environmental values relevant to each zone and set the management goals and water quality objectives to support these environmental values. The environmental values relevant to each of the Environmental Value Zones of the Pumicestone Passage are shown in Figure 4.2.

PUMICESTONE PASSAGE (Refer plan WQ1413)	Environmental values ¹⁻⁵											
	Aquatic ecosystem	Irrigation	Farm supply/use	Stock water	Aquaculture	Human consumer ⁵	Primary recreation ⁵	Secondary recreation ⁵	Visual recreation ⁵	Drinking water ⁵	Industrial use	Cultural and spiritual values
Environmental Value Zone (listed alphabetically)												
Bells and Lamerough Creeks	✓	✓	✓	✓		✓	✓	✓	✓			✓
Pumicestone Passage Estuary and Intertidal Wetlands	✓				✓	✓	✓	✓	✓			✓
Pelican Waters Canals	✓					✓		✓	✓			✓

Figure 4.2 Pumicestone Passage Basin – relevant environmental values within and adjoining the disturbance footprint

Relevant regional water quality objectives for each of the Pumicestone Creek Estuary, Upper Pumicestone Creek (Bells and Lamerough Creeks) and Pelican Waters Canals, are defined in the EPP (Water and Wetland Biodiversity), with objectives for toxicants defined in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG 2018) and the *Queensland Water Quality Guidelines* (DEHP 2009). These water quality objectives will need to be considered when implementing avoidance, mitigation and management measures to potential impacts to downstream receiving waterways during the Project construction phase in accordance with *MRTS51 Environmental Management* and *MRTS52 Erosion and Sediment Control*.

Table 4.1 provides a summary of the Environmental Value Zones of the Pumicestone Passage, a description of their spatial extent, the existing water quality as classified under the EPP (Water and Wetland Biodiversity) and the corresponding existing and proposed Project monitoring locations (as discussed in Section 3.4.1).

Table 4.1 Pumicestone Passage waters and Project monitoring locations

Location	Extent	EPP (Water and Wetland Biodiversity)	Water quality classification	Monitoring locations
Pumicestone Creek Estuary	Open channel – Estuary – downstream extent of Project pipe network	Pumicestone Passage Lower Estuary Section 2 - North	Lower Estuary, High Ecological Value (HEV)	MP7 E01312 + construction locations
Upper Pumicestone Creek (Freshwater)	East and West catchments	Bells and Lamerough Creeks	HEV	MP1, MP6, MP7, MP8 + construction locations
Pelican Waters Canals	Canals – receives inflows from West catchment	Pelican Waters Canals	Moderately Disturbed (MD)	Construction locations

Source: Water Technology (2025)

4.3.3 Baseline water quality monitoring results

As part of the Project baseline water quality monitoring programme, Cowie Environment undertook a comparison of the Project baseline water quality monitoring data against the relevant regional water quality objectives (Water Technology 2025). Most water quality parameters were found to be within the recommended guideline values for the region. Parameters found to exceed guideline values were consistent throughout the six-month monitoring period. These parameters were:

- pH
- Turbidity
- Ammonia, nitrate and nitrite, Total Kjeldahl nitrogen and TN
- TP
- Total aluminium
- Total zinc.

Table 4.2 provides a summary of the results of several key parameters and guideline values for monitoring point 7 (MP7) as a representative sample of across all the Project monitoring locations.

Baseline water quality monitoring results will be used by the Contractor to derive site specific water quality objectives upon which to monitor and manage potential construction phase impacts.

Potential impacts, including the Project design considerations to avoiding/minimising impacts to receiving downstream environments, are discussed in Section 5.2.3, with mitigation measures, including the Project WQMP and site-specific water quality objectives discussed in Section 6.

Table 4.2 Monitoring point 7 (MP7) baseline water quality data summary

Parameter	Units	Guideline values	26/08/2024	02/09/2024	02/09/2024	14/10/2024	11/11/2024	09/12/2024	08/01/2025	Average
pH		8.0-8.1-8.2 ^a	7.89	7.89	5.28	7.47	7.91	7.53	7.55	7.36
Turbidity ^a	NTU	3-5-9 ^a	4.9	2.3	3.2	6.8	3.4	5.3	5	5.4
TN ^a	µg/L	180-220-280 ^a	500	500	800	500	500	1300	900	900
TP ^a	µg/L	10-16-21 ^a	50	50	10	60	60	50	80	43.5
Copper ^b	µg/L	1.3 ^b	5	5	1	5	5	3	2	2.6
Aluminium ^b	µg/L	37 ^b	80	80	270	280	20	170	150	221
Zinc ^b	µg/L	8 ^b	27	26	25	31	26	16	13	20

Table notes:

- a Aquatic ecosystem water quality objective for the Pumicestone Passage Lower Estuary Section #2-North. Parameters are shown as a range of 20th, 50th and 80th percentiles to be maintained or achieved. Water Quality Objectives are shown for low flow conditions (Electrical Conductivity > 45,000 µS/cm).
- b Toxicants-Marine Waters, slightly disturbed to moderately disturbed ecosystems (ANZG 2018).

4.3.4 Surface waters and stormwater

The Queensland Government Watercourse Identification Mapping, which maps watercourses, drainage features and 'yet to be mapped' features regulated under the *Water Act 2000* (Qld), identifies that there are no watercourses, drainage features or 'yet to be mapped' features that intersect the disturbance footprint.

Similarly, there are no waterways for waterway barrier works mapped under the *Fisheries Act 1994* (Qld) that intersect the disturbance footprint. One mapped tidal waterway for waterway barrier works is located approximately 190 m downstream to the south of the disturbance footprint associated with Tripcony Inlet and the Pumicestone Passage.

As detailed in Section 3.4.2, a hydraulic assessment was undertaken as part of the Project detailed design phase to assess the design immunity of the proposed design and resultant potential hydraulic impacts to surrounding areas and the downstream receiving environment of Pumicestone Passage and Moreton Bay Ramsar Wetland.

The disturbance footprint is located within a predominantly urbanised area. At some locations the application of stormwater solutions is heavily constrained by:

- Project need to avoid/minimise disturbance within the Ben Bennett Bushland Park and Bicentennial Park
- Level constraints between the proposed road corridor and existing terrain
- Limited space within the disturbance footprint when considering existing infrastructure and uses
- A need to ensure any proposed stormwater infrastructure can be practically accessed and maintained
- Existing flood levels and frequent inundation due to tidal influence.

The proposed action intersects the existing floodplain at four locations at Ben Bennett Bushland Park between Arthur Street and Nicklin Way, Oval Avenue, Bicentennial Park and Industrial Avenue connection (refer Figure 4.3).

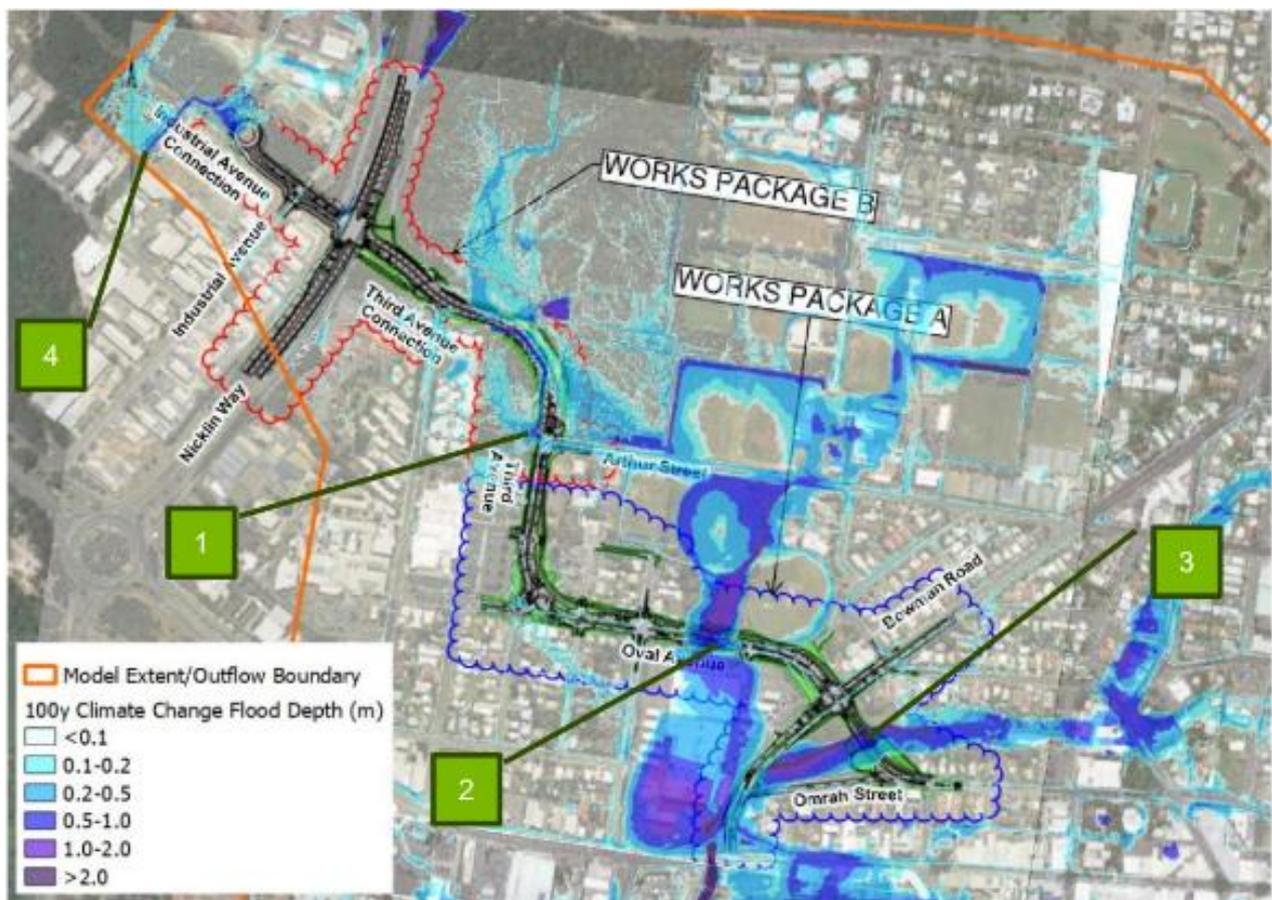


Figure 4.3 Existing 1% AEP floodplain and proposed action intersection

The existing hydraulic conditions within the disturbance footprint and surrounds are as follows:

- Within Work Package A:
 - The overland flow from the Caloundra RSL upstream of Oval and Third Avenue intersection drains into a vegetated channel at the downstream end of the carpark which discharges into the drainage network at Third Avenue. The network crosses to the southern carriageway of Oval Avenue and discharges via the existing 3/1,650 mm RCPs to the network underneath Stocklands Shopping Centre site.
 - The capacity of the existing drainage network at Third Avenue is exceeded in the 10% (2100) AEP event. The surcharging flow runs along the northern carriageway of Oval Avenue and discharges into the Oval Avenue cross culvert. At the southern end of the intersection, an existing flow path occurs through residential properties towards Second and First Avenue.
 - The existing 3/1,650 mm diameter crossing at Oval Avenue upstream of Stockland Shopping Centre conveys flow from Oval Avenue and from the upstream catchment discharging from Gosling Park. The crossing discharges into the existing drainage network underneath the Stockland Shopping centre before discharging into Pumicestone Creek at Bowman Road. The existing crossing has less than 39% AEP immunity along the northern carriageway.
 - The intersection of Omrah Avenue and Bowman Road has less than 10% (2100) AEP immunity and is impacted by overland flow from Bicentennial Park and the Stockland Shopping Centre. In the 10% (2100) AEP event, the existing flow overtops Bowman Road, and discharges to Pumicestone Creek.
- Within Work Package B:
 - Existing flow paths within this section come from the undeveloped area associated with Bennett Bushland Park and flow south down across to Arthur Street. West of Nicklin Way, the catchment falls to the west and overland flow falls away from the rest of the catchment towards the south.
- Within Work Package C:
 - Arthur Street is inundated by flow from Ben Bennett Bushland Park, the Caloundra Rugby Club grounds and from upstream residential areas. The existing road has less than 39% AEP immunity and contains an existing 750 mm diameter trunk drainage network that outlets to the downstream vegetated channel. This channel conveys flow down to Oval Avenue. The road contains a sag point upstream of the channel which corresponds to the largest ponded depths along the road.

The existing 1% AEP flood extents (without the Project) are shown in Figure 4.4.

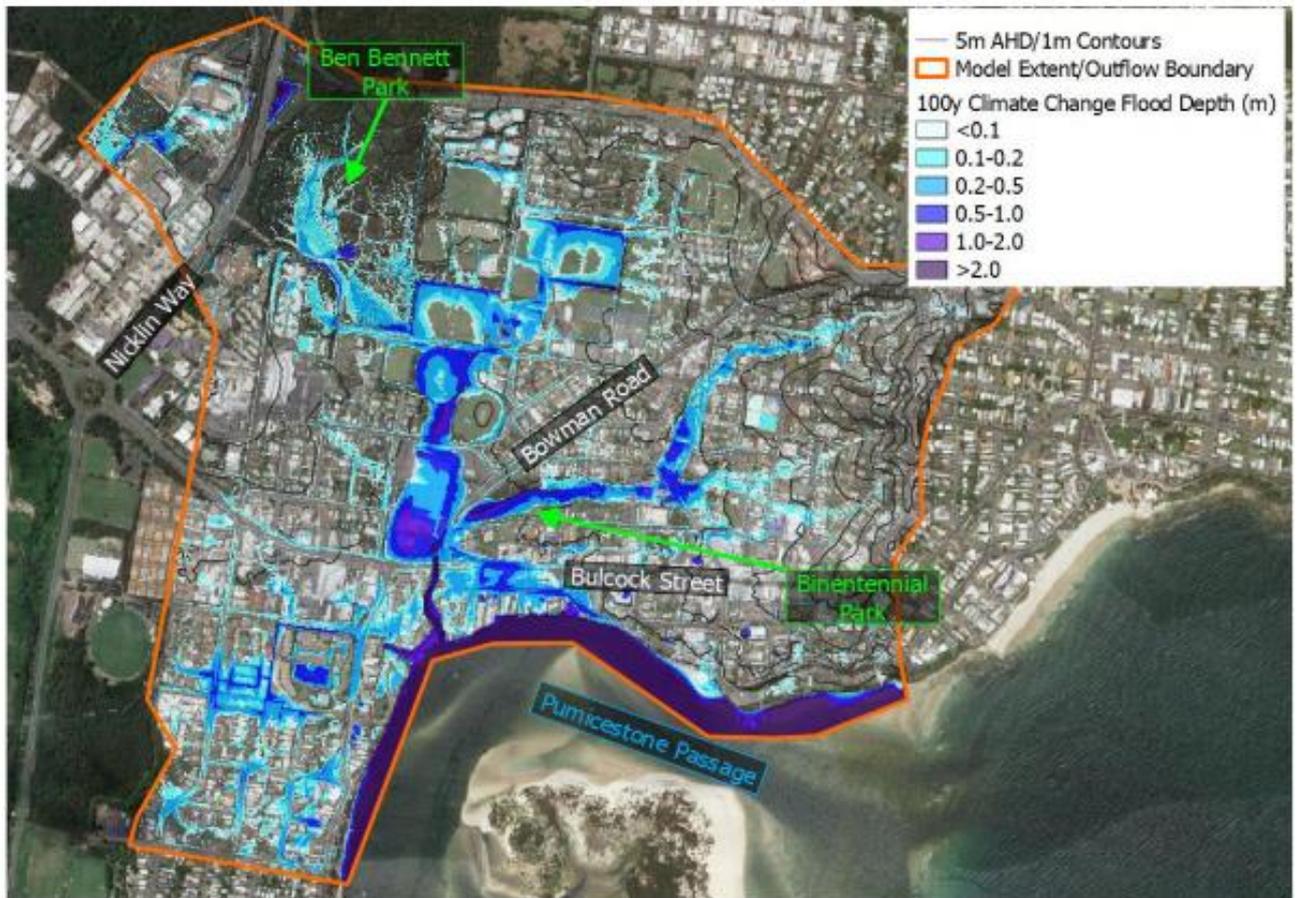


Figure 4.4 Existing 1% AEP floodplain extent

Section 6 provides a summary of the avoidance, minimisation and mitigation measures relating to surface water and stormwater.

4.3.5 Groundwater

A total of 16 registered groundwater bores are located within 1 km of the disturbance footprint (Queensland Government 2025). These include both private registered bores and Queensland Government groundwater investigation and monitoring bores, and range in depth from 6.5 to 72 m (Queensland Government 2025). None of these registered bores are located within the disturbance footprint.

In June 2023, geotechnical site investigations were undertaken to inform the Project detailed design. As part of these investigations, drilling and test pitting was undertaken at locations across the disturbance footprint, with groundwater encountered at seven (7) locations across the disturbance footprint, primarily within Works Package A (five (5) of the seven (7) Works Package A sites). Across these locations groundwater was encountered at depths that varied from 1.3 to 2.7 m below ground level (Aurecon 2023a). Investigation reporting however noted the survey was undertaken prior to the annual dry season (July to September) and during a time (June 2023) when recorded rainfall amounts were unusually low, meaning readings are unlikely to be representative of the upper limit, and groundwater levels likely to be higher during the wet season (Aurecon 2023a).

4.4 Topography, geology and soils

4.4.1 Topography

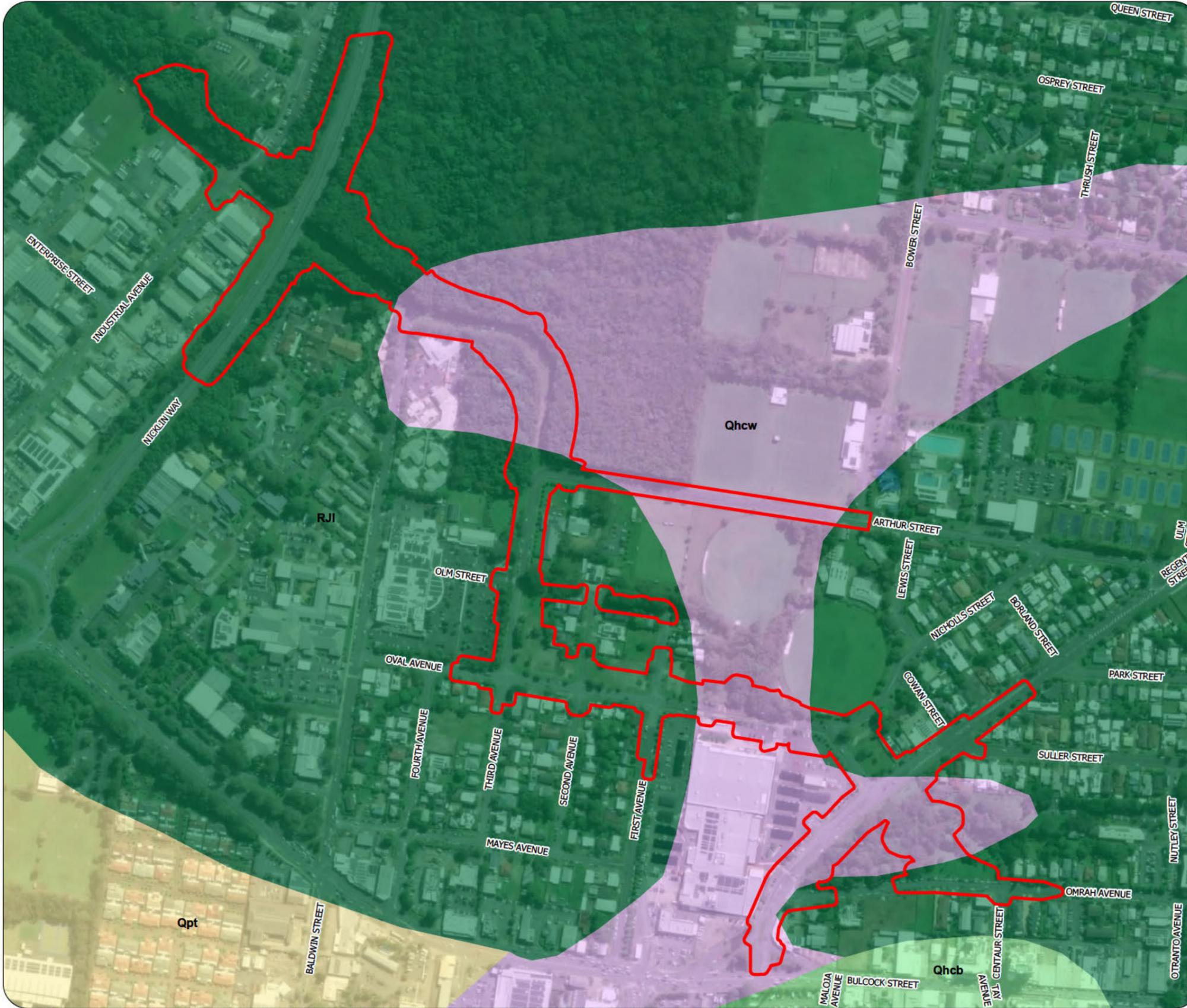
The Project is located within a low-lying coastal locality with the landscape within and surrounding the disturbance footprint being generally flat with localised undulations corresponding with drainage channels. Minor rolling is present to the west of the Project alignment. The area within the disturbance footprint generally falls to the south-east from Nicklin Way (Reduced Level (RL) 23.0 m Australian Height Datum (AHD) to Bowman Road (RL 12.0 m AHD). To the north-west, the disturbance footprint generally falls from Nicklin Way to Industrial Avenue (RL 12 m AHD) (Aurecon 2024e).

4.4.2 Geology

As per the online Queensland Globe 1:100,000 scale map, the regional geology of the area is described as being based upon the sedimentary rocks of the Nambour Basin (refer Figure 4.5). Surface geology is predominantly underlain by late Triassic to early Jurassic Landsborough Sandstone which is often characterised by Lithofeldspathic labile, quartzose sandstone, siltstone, shale, minor coal and ferruginous oolite marker (Aurecon 2024e).

Other geological units in the wider area comprise Holocene aged mud, Holocene aged sand and Pleistocene aged miscellaneous unconsolidated sediments. In terms of placement, the younger Quaternary aged material overlap the older Landsborough Sandstone, and thus the Landsborough Sandstone is present at a depth below the Quaternary aged materials (Aurecon 2024e).

Whilst the disturbance footprint is situated primarily on Landsborough Sandstone, which weathers into residual soil, a portion of the footprint located along Oval Avenue and the first half of the new roadway through Ben Bennett Bushland Park crosses areas of Holocene aged mud, which has been logged and described as alluvium during geotechnical investigations (Aurecon 2024e). The areas within Bicentennial park have also been logged and described as alluvium during geotechnical investigations (Aurecon 2024e).



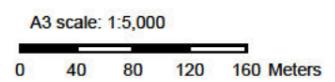
Service layers: City of Moreton Bay, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, © State of Queensland (Department of Natural Resources and Mines, Manufacturing, and Regional and Rural Development), 2025; Data sources: Queensland Spatial Catalogue - 2023



- Legend**
- Disturbance Footprint
 - Detailed surface geology**
 - Landsborough Sandstone (RJI)
 - Qhcb-QLD (Qhcb)
 - Qhcbw-QLD (Qhcbw)
 - Qpt-QLD (Qpt)

Revision: A

Date: 20/11/2025



Caloundra Transport Corridor Upgrade

Figure 4.5 Regional geology

4.4.3 Soils

Soil types

Australian Soil Resource Information System (ASRIS) mapping identifies the soils within and immediately surrounding the disturbance footprint as being Chromosols to the north, grading to Hydrosols in the south. Chromosols are defined by a strong texture contrast between A and B horizons and are among the most widespread soils used for agriculture in Australia. Hydrosols are soils in which the greater part of the profile is saturated for a least 2 to 3 months of the year (Aurecon 2024e).

Acid sulfate soils

ASS contain iron sulphides, mainly in the form of pyrite, with the potential to produce sulfuric acid when exposed to the air. They tend to be produced in iron-rich and sulphate -rich environments, often found in coastal and waterlogged areas. Potential ASS (PASS) occur when they are undisturbed, stable and non-acidic. When exposed to oxygen from human activities such as land reclamation or natural processes such as erosion, pyrite oxidation is triggered, leading to actual ASS (AASS) formation.

The SCC Planning Scheme mapping identifies portions of land within and adjacent to the disturbance footprint at or below 5 m AHD around Roy Henzell Park, the Caloundra Shopping Centre and further south towards the coast. Remaining portions of the disturbance footprint are mapped as land above 5 m AHD and below 20 m AHD.

A review of the ASRIS ASS risk mapping indicated there is no known occurrence of ASS within the disturbance footprint. Land immediately to the east of the disturbance footprint is considered to have a low probability of ASS, increasing to higher probability of ASS to the south-east, at the Caloundra Shopping Centre (refer figure 4.6).

A review of the Queensland Globe ASS layers (Queensland Government 2025) indicates a potential to encounter ASS at some locations within the disturbance footprint (refer Figure 4.6). Field screening tests were carried out within locations mapped as potential ASS (refer Figure 4.6) as part of the Project geotechnical investigations (Chadwick Geotechnics 2023).

Field screening test results are assessed against pH levels to indicate the presence of AASS and PASS. These qualitative indicator levels are as follows:

- pH field (pH_F) < 4.0 indicates AASS
- pH oxidised (pH_{FOX}) < 3.0 indicates PASS.

Field screen tests concluded that PASS is present at AU02, AU04, TP10 and BH05, however, no AASS is present. Field screening test results are summarised in Table 4.3.

Table 4.3 Field screen test results summary

Location	Depth start (m)	Depth end (m)	pH _F	pH _{FOX}	Reaction ratings
AU01	0.50	0.75	6.4	4.6	4
AU01	1.00	1.25	5	4	2
AU01	1.75	2.00	5.3	3.6	2
AU01	2.50	2.75	5.5	4.1	4
AU02	0.75	1.00	4.8	3.3	4
AU02	1.25	1.50	4.7	2.8	3
AU02	1.50	1.75	5	3.8	2
AU02	2.25	2.50	5.1	3.7	3
AU03	0.25	0.50	6	3.6	2
AU03	0.75	1.00	5.3	3.2	2

Location	Depth start (m)	Depth end (m)	pH-F	pH-FOX	Reaction ratings
AU03	1.25	1.50	5.1	3.8	2
AU03	2.00	2.25	5.3	3.2	2
AU04	0.75	1.00	6.7	3.2	4
AU04	1.25	1.50	6.1	2.9	4
AU04	1.75	2.00	6.7	1.6	2
AU04	2.75	3.00	7.2	4.6	4
AU05	0.25	0.50	7	3.5	4
AU05	0.50	0.75	6.6	4.2	4
AU05	0.75	1.00	5	4.6	2
AU05	1.00	1.25	5.3	4.4	2
TP10	0.50	0.75	4.9	3.4	2
TP10	1.50	1.75	4.4	2.1	4
TP10	2.00	2.25	4.5	3.3	3
TP10	2.50	2.75	4.8	3.9	4
TP11	0.25	0.50	8	5.5	4
TP11	1.00	1.25	7	5.2	4
TP11	1.50	1.75	4.8	3.1	3
TP11	2.25	2.50	5.3	3.9	4
BH05	0.50	0.75	4.4	2.4	2
BH05	1.00	1.25	4.6	2.8	2
BH05	1.75	2.00	4.4	2	2
BH05	2.50	2.75	5.4	2.7	4
BH05	3.50	3.75	5.5	3.7	4

Table notes:

Field Screen uses the following fizz rating to classify the rate the samples reacted to the peroxide: 1.0 - No reaction to slight; 2.0 - Moderate reaction; 3.0 - Strong reaction with persistent froth; 4.0 - Extreme reaction.

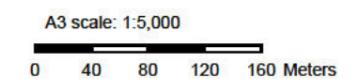


Service layers: City of Moreton Bay, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Data sources: Queensland Spatial Catalogue - 2023



- Legend**
- Geotechnical Investigation Locations
 - Disturbance Footprint
 - Acid sulfate soil category**
 - LP Land <=5m AHD with low probability of ASS
 - SDL Disturbed land with probability of ASS

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Caloundra Transport Corridor Upgrade
Figure 4.6 Acid sulfate soils with geotechnical investigation locations

4.5 Vegetation communities

4.5.1 General description of vegetation

The Project study area (refer Section 3.2) is predominantly located within a highly modified urban environment, dominated by the existing road corridor and adjacent residential, commercial and industrial land uses. The Project study area traverses areas of remnant vegetation.

Field surveys confirmed the presence of four distinct habitat types within the Project study area:

- Open forest habitat dominated by *Eucalyptus pilularis* tall open forest with an average 60% canopy cover. The shrub layer consisted of small rainforest trees such as *Planchonella chartacea*, and *Psychotria loniceroides*, and vines such as *Flagellaria indica* and *Smilax australis* with a 20% cover. The groundcover was variable in density, dominated by ferns such as *Blechnopsis orientalis* and *Pteridium esculatum*. Where this habitat was observed it was found to be analogous with the Queensland RE 12.9-10.14.
- Swamp sclerophyll consisted of *Melaleuca quinquenervia* (Broad-leaved paperbark) dominated forest with an average 40% canopy cover. The shrub layer consisted of species such as *Acacia* spp., and *Alphitonia excelsa* with a 50% cover. The groundcover consisted of a mix of grass, sedge and fern species such as *Baloskion tetraphyllum*, *Gahnia* spp., and *Calochlaena dubia*. Where this habitat was observed it was found to be analogous with the Queensland RE 12.2.7 and consistent with the key diagnostic characteristics and condition thresholds of the Coastal Swamp Sclerophyll TEC (refer Section 4.5.2). It was noted that the extent of this vegetation community extended further than State mapping indicated for RE 12.2.7. The southern extent of Ben Bennett Bushland Park, adjacent to Third Avenue, was mapped as RE 12.9-10.14 (tall open forest habitat), however this patch was observed to be analogous with RE 12.2.7 (Swamp sclerophyll). The vegetation community was also observed to extend further to the north of Ben Bennett Bushland Park.
- Notophyll vine thicket consisted of a mixture of various rainforest canopy species such as *Livistona australis* and *Argyrodendron trifoliolatum* with a 70% average canopy cover. Understorey species consistent with a rainforest habitat included *Drypetes deplanchei*, *Syzygium luehmannii*, and *Beilschmiedia obtusifolia*. Where this habitat was observed, it was found to be analogous with the Queensland RE 12.3.1a and consistent with the key diagnostic characteristics and condition thresholds of the Lowland Rainforest of Subtropical Australia TEC (refer Section 4.5.2). It was noted during surveys that the southern extent of this vegetation community was inconsistent with the state mapping. *Eucalyptus robusta* and *Melaleuca quinquefolia* was observed to be dominant by ground-truth surveys.
- Fragmented urban vegetation consisting of modified parks and gardens that provide habitat for species such as the Grey-headed flying-fox and Koala. This vegetation group was observed to contain isolated patches of mature native species such as *Eucalyptus tereticornis*, *Eucalyptus robusta* and *Melaleuca quinquenervia*. This community was observed to be highly modified and fragmented, with either very low or no understorey or canopy cover.

Where discrepancies were noted in the observed vegetation extents and the Queensland RE mapping, boundaries were validated using GPS extents.

The majority of the vegetation within the Project study area consists of open sclerophyll forest and swamp sclerophyll forest. Throughout the Project study area, there were minor levels of disturbance from existing HV electricity easement, walking/access tracks and non-native flora species.

The four ground-truthed Queensland REs associated with the above listed habitat types are summarised in Table 4.4 and presented in Figure 4.7.

Table 4.4 Regional Ecosystems ground-truthed within and adjoining the disturbance footprint

RE	Short description	VM Act status	Biodiversity status	Relevance to disturbance footprint	Relevance to MNES
12.3.1a	Gallery rainforest (notophyll vine forest) on alluvial plains	Endangered	Endangered	Present on the boundary of the disturbance footprint but not intersected within Ben Bennett Bushland Park	Potential habitat for multiple MNES rainforest flora and fauna specialists. The ground-truthed extent of this regional ecosystem was found to be consistent with the extent, key diagnostic characteristics and condition thresholds of the Lowland Rainforest of Subtropical Australia TEC (refer Section 4.5.2)
12.2.7	<i>Melaleuca quinquenervia</i> open forest on sand plains	Least concern	No concern at present	Present at two locations in the centre of the disturbance footprint, intersected by an unnamed road off West Terrace and Arthur Street	Potential habitat for the Swift parrot, Koala, South-eastern glossy black-cockatoo, Long-nosed potoroo and Grey-headed flying-fox. The ground-truthed extent of this regional ecosystem was found to be consistent with the extent, key diagnostic characteristics and condition thresholds of the Coastal Swamp Sclerophyll TEC (refer Section 4.5.2)
12.9-10.14	<i>Eucalyptus pilularis</i> tall open forest on sedimentary rocks	Least concern	No concern at present	Present over the north-western extent of the disturbance footprint	Potential habitat for the Koala, Three-toed snake-tooth skink, and Grey-headed flying-fox
12.9-10.17d	<i>Eucalyptus crebra</i> +/- <i>E. tereticornis</i> , <i>Corymbia tessellaris</i> , <i>Angophora spp.</i> and <i>E. melanophloia</i> woodland on sedimentary rocks	Of concern	Of concern	Present at the far north-eastern end of the Project study area (but not within the disturbance footprint)	Potential habitat for the Koala, Three-toed snake-tooth skink, and Grey-headed flying-fox



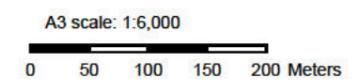
Service layers: City of Moreton Bay, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community; Data sources: Queensland Spatial Catalogue - 2023



- Legend**
- Disturbance Footprint
 - Study Area*
- Ground-truthed Regional Ecosystem**
- 12.2.7
 - 12.3.1a
 - 12.9-10.14
 - 12.9-10.17d
 - Regrowth 12.2.7
 - Regrowth 12.9-10.14

*Study area has been determined based off a 100 m buffer from the disturbance footprint, where MNES have the potential to occur. Where there were no potential MNES likely to occur (i.e. preexisting residential developments) the area was not considered to form part of the Study area

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Caloundra Transport Corridor Upgrade
Figure 4.7 Ground-truthed Regional Ecosystem mapping

4.5.2 Threatened ecological communities

The EPBC Act PMST (4 July 2025) identified that five TECs have potential to occur within the 5 km search radius. These TEC and their assessed likelihood of occurrence within the disturbance footprint and Project study area are summarised in Table 4.5. Of the five TECs, two TECs were observed within the Project study area (refer Figure 4.8), including:

- The Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland TEC (Coastal Swamp Sclerophyll Forest TEC) was confirmed during site assessment to be present within the Project study area. A total of 1.43 ha of vegetation analogous to this TEC was present within the disturbance footprint.
- Vegetation analogous to the Lowland Rainforest of Subtropical Australia TEC was observed directly north-east of and near the border of the disturbance footprint. A total of 1.66 ha of this TEC was observed approximately 7.3 m to the north of the disturbance footprint.

Table 4.5 Likelihood of occurrence for Threatened Ecological Communities

Threatened Ecological Communities	EPBC Act status	Likelihood to occur within the disturbance footprint
Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland ecological community	Endangered	Unlikely: Vegetation observed within the Project study area was not found to align with the key diagnostic criteria of the TEC.
Coastal Swamp Sclerophyll Forest	Endangered	Known: Vegetation observed within the Project study area was found to align with the key diagnostic criteria of the TEC.
Lowland Rainforest of Subtropical Australia	Critically Endangered	Unlikely: Although vegetation observed within the Project study area was found to align with the key diagnostic criteria of the TEC, this was only present adjacent to the disturbance footprint at Ben Bennet Park. Field survey confirmed TEC not to be present within the disturbance footprint.
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Unlikely: Vegetation observed within the Project study area was not found to align with the key diagnostic criteria of the TEC.
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	Endangered	Unlikely: Vegetation observed within the Project study area was not found to align with the key diagnostic criteria of the TEC.

Coastal Swamp Sclerophyll Forest TEC

A total of 1.43 ha of the Coastal Swamp Sclerophyll Forest TEC was observed directly within the disturbance footprint and is contiguous with a larger patch of 8.2 ha in size. The conservation advice for the TEC (DAWE 2021a) states that contiguous patches can include small scale (<30 m) variations and disturbances, such as the pathway (up to 21 m in width) that currently traverses through the patch (refer Photograph 2.2). The area of vegetation was assessed against the key diagnostic characteristics described in Section 2.1 and the condition thresholds described in Table 2 of the conservation advice for the TEC (DAWE 2021a). The key diagnostic characteristics and condition thresholds assessment are shown in Table 4.6.

Table 4.6 Assessment of disturbance footprint characteristics against the key diagnostic characteristics and condition thresholds for the Coastal Swamp Sclerophyll Forest TEC

Key diagnostic characteristic	Assessment criteria description	Assessment of criteria characteristics within the disturbance footprint
Geographic location	Restricted to coastal catchments. Occurs on the mainland and islands near to the coast (within 20 km) from South East Queensland to south-eastern New South Wales (NSW) within Interim Biogeographic Regionalisation for Australia Bioregions South East Queensland (SEQ), NSW North Coast, Sydney Basin, South East Corner (Bateman subregion).	Yes – Occurs in SEQ within 1 km of the coast.

Key diagnostic characteristic	Assessment criteria description	Assessment of criteria characteristics within the disturbance footprint
Elevation	Typically below 20 m above sea level (ASL), occasionally up to 220 m ASL on hill slopes with perched swamps or high-water table.	Yes – Area of interest is between 8 to 15 m ASL.
Soil type	Hydric soils that are waterlogged or intermittently inundated for 1 to 3 months per year (seasonally). Formed by unconsolidated alluvial, marine or aeolian sediments, stained black/dark grey by humus. Soil type aids but biological composition is primary for identification.	Yes – Area of interest reflective of RE 12.2.7, which is landzone 2 (quaternary coastal dunes and beaches) and intermittently inundated.
Hydrology	Inundation patterns ranging from intermittent to episodic; natural hydrological regime intact or managed to maintain ecology.	Yes – Natural hydrological regime appeared intact.
Vegetation structure	Varies from tall closed to open forest or woodland to dense shrubland; minimum crown cover at least 10%, typically 50-70%.	Yes –open forest.
Canopy dominance	From SEQ to Sydney Basin Bioregion: canopy dominated or co-dominated by <i>Melaleuca quinquenervia</i> and/or <i>Eucalyptus robusta</i> . Other <i>Melaleucas</i> may dominate locally (<i>M. dealbata</i> , <i>M. biconvexa</i> , <i>M. ericifolia</i>).	Yes – Canopy dominated by <i>M. quinquenervia</i> .
Other canopy/ sub-canopy Species	May include species like <i>Casuarina glauca</i> , <i>Banksia</i> spp., <i>Callistemon salignus</i> , <i>Corymbia intermedia</i> , <i>E. tereticornis</i> , <i>E. longifolia</i> , <i>E. botryoides</i> , <i>Livistona australis</i> , <i>Lophostemon</i> spp.	Yes – Some of these species are present but not dominant across a patch.
Understorey composition	Typically diverse hydrophytic ground layer with tall sedges (e.g. <i>Gahnia</i> spp.), ferns, graminoids, herbs e.g. <i>Imperata cylindrica</i> . Halophytic species may be present near estuarine sites but should not dominate.	Yes – Ground layer composition varies but contains <i>Gahnia</i> spp., ferns, graminoids and herbs.
Presence of halophytic species	Ecological community is not present if halophytic species dominate the ground layer such as <i>Apium prostratum</i> , <i>Atriplex cinerea</i> , <i>Chenopodium glaucum</i> , <i>Rhagodia candolleana</i> , <i>Samolus repens</i> . Halophytic dominance typically indicates estuarine or saltmarsh vegetation, not this forest type.	No – Not dominant if present.
Condition class thresholds		
Patch size (thresholds)	The smallest patch size identifiable is 0.25 ha; breaks up to 30 m between vegetated areas can be included as one patch. Breaks greater than 30 m indicate separate patches. Patch size in the decision-matrix is divided into: <ul style="list-style-type: none"> ■ Large: ≥ 5 ha ■ Medium: ≥ 2 ha and < 5 ha ■ Small–contiguous: ≥ 0.25 ha and < 2 ha and contiguous (within 30 m) to another ≥ 5 ha remnant ■ Small–isolated: ≥ 0.5 ha and < 2 ha, but not contiguous to a ≥ 5 ha remnant. 	Patch is 8.2 ha in size. Patch size is considered to be large.
Biotic thresholds	Ground-layer non-native cover in the decision-matrix is divided into: <ul style="list-style-type: none"> ■ High condition: < 20 % non-native ■ Good condition: 20 to 50 % non-native ■ Moderate condition: 50 to 80 % non-native ■ Low condition: > 80 % non-native. 	Non-native species are below 20% of total ground layer vegetation cover*, making this patch in “good condition”.

Source: DAWE (2021a)

Table note:

* Ground layer vegetation cover refers to total perennial ground layer vegetation cover for the patch of the ecological community. Includes vascular plant species with a lifecycle of more than two growing seasons. It includes herbs (graminoids and forbs), grasses, shrubs, and juvenile plants of canopy species, but does not include annual plants, cryptogams, leaf litter or exposed soil.

An assessment against the condition thresholds of the TEC provided in the conservation advice, determined that the patch is Class A (non-native species <20% and at least 5 ha) (DAWE 2021a).

The potential Project impacts to the Coastal Swamp Sclerophyll Forest TEC are discussed in Section 5.

Lowland Rainforest of Subtropical Australia TEC

A total of 1.66 ha of Lowland Rainforest of Subtropical Australia TEC was observed approximately 7.3 m to the north of the disturbance footprint. The patch was assessed against the key diagnostics and condition thresholds of the listing advice for the community (DSEWPC 2011b). The key diagnostic characteristics and condition thresholds assessment is shown in Table 4.7.

Table 4.7 Assessment of disturbance footprint characteristics against the key diagnostic characteristics and condition thresholds for the Lowland Rainforest of Subtropical Australia TEC

Key diagnostic characteristic	Assessment criteria description	Assessment of criteria characteristics at patch at Ben Bennett Park	Assessment of criteria characteristics at patch at Bicentennial Park
Geographic location	Distribution of the ecological community is primarily in the NSW North Coast and South Eastern Queensland bioregions.	Yes – Occurs in SEQ.	Yes – Occurs in SEQ.
Soil	Occurs on soils derived from basalt or alluvium; or enriched rhyolitic soils; or basaltically enriched metasediments.	Yes – Area of interest reflective of RE 12.3.1, which is landzone 3 (recent Quaternary alluvial systems) and confirmed by core sampling (Aurecon 2024e)	Yes – Area of interest reflective of RE 12.3.1, which is landzone 3 (recent Quaternary alluvial systems) and confirmed by core sampling (Aurecon 2024e)
Altitude and rainfall	Typically occurs at an altitude less than 300 m ASL and typically in areas with high annual rainfall (>1300mm).	Yes – Occurs between 15 to 20 m ASL. Caloundra receives an average annual rainfall of 1,578 mm.	Yes – Occurs between 15 to 20 m ASL. Caloundra receives an average annual rainfall of 1,578 mm.
Distance from coast	Typically, more than 2 km inland from the coast.	Adequate – 1.15 km north and 2.75 km west of the coast.	Adequate – 1 km west of the coast.
Structure and composition	Typically, a tall (20 to 30 m) closed forest, often with multiple canopy layers. Typically, has high species richness (at least 30 woody species listed in Appendix A of the listing advice (DSEWPC 2011a)). No significant eucalypt dominance: Not sclerophyll forest. Emergent eucalypts might be present, but shouldn't dominate. Lacks fire-adapted structure: No thick grassy understorey like in open forests.	Yes – Patch is tall, closed forest with high species richness. Emergent eucalypts are present but do not dominate the patch and grass understorey is low.	No – Patch is tall, closed forest however lacks woody species richness. Some Eucalyptus presence.
Condition class thresholds			

Key diagnostic characteristic	Assessment criteria description	Assessment of criteria characteristics at patch at Ben Bennett Park	Assessment of criteria characteristics at patch at Bicentennial Park
Patch type	Evidence of remnant vegetation and regeneration status: A: Natural remnant evident by persistence of mature residual trees listed in Appendix B of the listing advice (DSEWPC 2011a) B: Some residual trees listed in Appendix B of the listing advice present plus evidence of either natural regeneration and/or regeneration with active management C: A non-remnant patch that has recovered through natural regeneration and/or supplementary planting that has stature and quality that is reflective of the description of the TEC (closed canopy, 20 to 30m tall, of representative species).	Patch outside the disturbance footprint meets criteria of 'A', found to contain natural remnant evident by persistence of mature residual trees.	Patch outside the disturbance footprint meets criteria of 'B', found to contain some residual trees listed in Appendix B.
Patch size	Patch size (excluding the buffer zone) to be: A: ≥ 0.1 ha B: ≥1 ha C: ≥2 ha.	Patch outside of the disturbance footprint is 1.66 ha.	Patch is 1.94 ha.
Canopy cover (over entire patch)	Canopy cover of the emergent/canopy/subcanopy is ≥ 70%.	Canopy cover outside of the disturbance footprint is greater than 70%.	Canopy cover is greater than 70%.
Species richness (over entire patch)	Species richness may: A: Contain ≥ 40 native woody species from Appendix A of the listing advice (DSEWPC 2011a) B-C: Contains ≥ 30 native woody species from Appendix A of the listing advice (DSEWPC 2011a).	Patch meets criteria of 'B-C', found to contain 31 native woody species.	Patch does not meet criteria for native woody species.
Percent of total vegetation cover that is native	Percentage of native vegetation may: A: ≥ 70% of vegetation is native B-C: ≥ 50% of vegetation is native.	Patch meets criteria of 'A', found to contain more than 70% of native vegetation cover.	Patch meets criteria of 'A', found to contain more than 70% of native vegetation cover.

Source: DSEWPC (2011a)

The patch was found to have a canopy cover greater than 70%, 31 native woody species from Appendix A of the listing advice (DSEWPC 2011a), and more than 70% native vegetation cover. The patch was consistent with 'Patch type A' of the condition threshold within the listing advice (DSEWPC 2011a).

Table 4.8 Key characteristic woody species⁷ as listed in listing advice for the TEC observed within the patch at Ben Bennett Park

Species	Common name
<i>Acmena smithii</i>	Lillypilly satinash
<i>Alphitonia excelsa</i>	Soap tree
<i>Archontophoenix cunninghamiana</i>	Bangalow palm
<i>Brachychiton acerifolius</i>	Flame tree

⁷ Woody species are trees, shrubs or vines that contain wood or wood fibres that consist mainly of hard lignified tissues. Excluded from woody species are graminoids, other herbs and non-woody vine (DSEWPC 2011a)

Species	Common name
<i>Breynia oblongifolia</i>	Coffee bush
<i>Calamus muelleri</i>	Lawyer vine
<i>Castanospermum australe</i>	Black bean
<i>Cissus antarctica</i>	Native grape vine
<i>Cissus hypoglauca</i>	Five-leaf water vine
<i>Cleistanthus cunninghamii</i>	Cleistanthus
<i>Cordyline rubra</i>	Red-fruited palm lily
<i>Diospyros pentamera</i>	Myrtle ebony
<i>Elaeocarpus obovatus</i>	Hard quandong
<i>Eupomatia bennettii</i>	Small bolwarra
<i>Ficus watkinsiana</i>	Stangler fig
<i>Ficus macrophylla</i>	Large-leaved fig
<i>Glochidion ferdinandi</i>	Cheese tree
<i>Gmelina leichhardtii</i>	White beech
<i>Gossia bidwillii</i>	Python tree
<i>Jagera pseudorhus</i>	Foambark
<i>Livistona australis</i>	Cabbage tree palm
<i>Neolitsea australiensis</i>	Bolly gum
<i>Notelaea longifolia</i>	Mock olive
<i>Pararistolochia praevenosa</i>	Richmond birdwing vine
<i>Parsonsia straminea</i>	Monkey rope
<i>Pittosporum revolutum</i>	Hairy pittosporum
<i>Polyscias elegans</i>	Celery wood
<i>Smilax australis</i>	Barbed-wire vine
<i>Syzygium australe</i>	Scrub cherry
<i>Syzygium floribundum</i>	Weeping lilly pilly
<i>Wilkiea huegeliana</i>	Veiny wilkiea

Table 4.9 Key characteristic woody species⁸ as listed in listing advice for the TEC observed within the patch at Bicentennial Park

Species	Common name
<i>Castanospermum australe</i>	Black bean
<i>Cissus antarctica</i>	Native grape vine
<i>Ficus coronata</i>	Sandpaper fig
<i>Ficus watkinsiana</i>	Stangler fig
<i>Ficus macrophylla</i>	Large-leaved fig
<i>Glochidion ferdinandi</i>	Cheese tree
<i>Livistona australis</i>	Cabbage tree palm
<i>Parsonsia straminea</i>	Monkey rope
<i>Pittosporum revolutum</i>	Hairy pittosporum

⁸ Woody species are trees, shrubs or vines that contain wood or wood fibres that consist mainly of hard lignified tissues. Excluded from woody species are graminoids, other herbs and non-woody vine (DSEWPC 2011a)

Species	Common name
<i>Smilax australis</i>	Barbed-wire vine

The potential impacts to the Lowland Rainforest of Subtropical Australia TEC are discussed in Section 5.

4.5.3 Weeds

Weed species along the periphery of the CSSF TEC boundary primarily consist of non-native grasses, notably signal grass (*Urochloa mutica*). Analysis of the three 100 m transects revealed that weed invasion was highly concentrated in the immediate vicinity of the TEC edge, with minimal deep penetration (refer Figure 4.9).

The maximum linear extent of weed penetration recorded was extremely shallow across all three transects ranging from 1.1 to 2.4 m (refer Table 4.10).

No measurable weed cover (0%) was recorded in any plot beyond 2.4 m in all three transects. This data strongly supports the observation that weed-related edge effects are intensely localised, posing a risk of weed incursion to the first 3 m of the new extent TEC but having negligible impact deeper within the habitat.

Table 4.10 Edge effect extent, coverage and diversity for the three transect sites

Edge effect weed coverage (m)	Transect 1 (CSSF and Lowland Rainforest TEC) -26.797103, 153.121243		Transect 2 (CSSF TEC) -26.797385, 153.122499		Transect 3 (CSSF TEC) -26.797911, 153.122928	
	Weed coverage (%)	Weed diversity	Weed coverage (%)	Weed diversity	Weed coverage (%)	Weed diversity
0-10	3	3	95	7	100	4
10-20	0	0	0	0	0	0
20-30	0	0	0	0	0	0
30-40	0	0	0	0	0	0
40-50	0	0	0	0	0	0
60-70	0	0	0	0	0	0
80-90	0	0	0	0	0	0
90-100	0	0	0	0	0	0
Cessation point of weeds along transect line	1.7 m		2.4 m		1.1 m	

4.6 Threatened flora

The PMST results (4 July 2025) listed 21 flora species with the potential to occur using a 5 km search radius of the disturbance footprint. No additional threatened flora species were recorded through WildNet or ALA. No threatened flora species under the EPBC Act were identified within the disturbance footprint during the targeted ecological field survey conducted in June 2023, December 2024 January/February 2025 and November 2025 (Aurecon 2023b).

The detailed likelihood of occurrence assessment which was completed for threatened flora species with the potential to occur within the disturbance footprint is provided within Appendix E. The outcome of the assessment showed that there are no threatened flora species which are known or considered to have a likely or potential likelihood of occurrence within the disturbance footprint.

Due to no threatened flora species being identified within the disturbance footprint and no threatened flora species are known or considered to have a likely or potential likelihood of occurrence within the disturbance footprint, this document contains no Project impact assessment on threatened flora species.



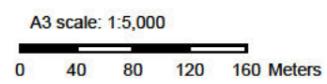
Service layers: City of Moreton Bay, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community; Data sources: Queensland Spatial Catalogue - 2023



- Legend**
- Weed transects**
- Transect 1
 - Transect 2
 - Transect 3
- Disturbance Footprint
- Extent of Coastal Swamp Sclerophyll Forest TEC
- Extent of Lowland Rainforest of Subtropical Australia TEC

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Figure 4.9 Weed transect locations to measure current edge effects for Coastal Swamp Sclerophyll TEC and Lowland Rainforest TEC

4.7 Threatened fauna

4.7.1 Fauna species

A total of 82 threatened fauna species listed under the EPBC Act were recorded in the PMST search using a 5 km search radius of the disturbance footprint (refer Appendix D). No additional threatened fauna species listed under the EPBC Act were recorded through WildNet or ALA. For the purpose of this report, pelagic species (e.g. whales, tuna), Antarctic species (e.g. petrels, albatross), and vagrant species have been excluded due to the absence of suitable habitat within the disturbance footprint, or unlikely occurrence of the species in SEQ. Species that utilise estuarine environments, freshwater or marine environments were included. A total of 52 threatened fauna species remained for assessment (refer Appendix E).

A summary of the threatened fauna species listed under the EPBC Act which are considered to have a likely or potential likelihood of occurrence within the disturbance footprint are presented in Table 4.11. One species, Grey-headed flying-fox (*Pteropus poliocephalus*), was observed to occur within the disturbance footprint. Two species unlikely to be present within the disturbance footprint have been included to address the DCCEE RFI (refer Table 4.11 table note). Field surveys undertaken for the Project did not identify any threatened fauna within the disturbance footprint. The detailed likelihood of occurrence assessment on which Table 4.11 is based is provided within Appendix E.

Table 4.11 Summary of fauna species considered to have a likely or potential likelihood of occurrence

Scientific name	Common name	EPBC Act status	Likelihood
Birds			
<i>Calyptorhynchus lathami lathami</i>	Glossy black-cockatoo	Vulnerable	Potential
<i>Lathamus discolor</i>	Swift parrot	Critically Endangered	Potential
Mammals			
<i>Phascolarctos cinereus</i>	Koala	Endangered	Potential
<i>Potorous tridactylus tridactylus</i>	Long-nosed potoroo (northern)	Vulnerable	Potential
<i>Pteropus poliocephalus</i>	Grey-headed flying-fox	Vulnerable	Known
Reptiles			
<i>Coeranoscincus reticulatus</i>	Three-toed snake-tooth skink	Vulnerable	Potential
Crustacean			
<i>Cherax robustus</i>	Sand yabby	Vulnerable	Unlikely*
Amphibian			
<i>Litoria olongburiensis</i>	Wallum sedge frog	Vulnerable	Unlikely*

Table note:

* These species have no suitable habitat present within the disturbance footprint; however they have been included to address the RFI from DCCEE.

4.7.2 Fauna habitat

Information on habitat preferences was gathered using current conservation advice (i.e. material contained within the Commonwealth's SPRAT database) as outlined in Section 3.9. Habitat mapping was prepared for the following six threatened fauna species as assessed in the likelihood of occurrence as 'known', 'likely' or 'potential' to occur within the disturbance footprint:

- Koala
- Grey-headed flying-fox
- Long-nosed potoroo
- Swift parrot
- Three-toed snake-tooth skink

- South-eastern glossy black-cockatoo.

The habitat mapping for Koala, Sand yabby and Wallum sedge frog were further informed by the field observations and government data sources (as outlined in the below subsections) (refer Figure 4.11).

The habitat mapping was prepared to assist in quantifying impacts to suitable habitat. Habitat mapping for each threatened species is provided in Section 7. A description of the habitat for each threatened species assessed in the LoO as 'Likely' or 'Potential' is provided in Table 4.12.

Koala habitat

Under the EPBC Act, habitat for the Endangered Koala includes any land with attributes required for the species to meet the needs of survival and reproduction, such as presence of feed trees, connectivity to other habitat, or located near areas with known Koala populations (DAWE 2022a). Habitat that may be unoccupied but can be recolonised should also be considered as habitat. Koala habitat often includes:

- Forests or woodlands, especially with a high proportion of feed tree species, and may include remnant or non-remnant vegetation
- Roadside and railway vegetation and paddock trees
- Safe intervening ground for travelling between trees and patches to forage, shelter and reproduce
- Access to vegetated corridors or paddock trees to facilitate movement between patches (DAWE 2022a).

Suitable habitat for foraging, breeding, and dispersal for Koalas were assessed during the field investigation. Remnant, regrowth and non-remnant vegetation communities were considered in this habitat assessment. The field survey found suitable Koala habitat associated with the tall open forest and swamp sclerophyll communities, as well as isolated vegetation patches to the south of the Project study area around Bicentennial Park. Important Koala foraging tree species observed included *Eucalyptus pilularis*, *Eucalyptus tereticornis*, *Eucalyptus robustus*, *Corymbia intermedia*, *Eucalyptus microcorys* and *Eucalyptus propinqua*.

Following the field surveys, detailed habitat mapping identified areas across the disturbance footprint that may provide habitat for the species. Areas of habitat were selected based on the habitat description within the *National Recovery Plan for the Koala* (DAWE 2022c), defined by the availability and nutritional quality of food trees, presence of suitable resting trees and microclimates, age structure of vegetation, history, and impediments to dispersal (DAWE 2022c).

It is noted that targeted surveys completed for the Koala (outlined in Sections 3.7.4 and 4.7.3) found no Koalas within or surrounding the disturbance footprint. It is likely that if Koalas still persist in the local area they would be restricted by existing threats to movement, including the Nicklin Way State-controlled road (vehicle strike) and residential development (domestic dog attacks). The Department of Transport and Main Roads have not received reports of Koalas (dead, injured or alive) on Nicklin Way (DTMR pers comms 2025).

Further detailed discussion regarding the Koala habitat values within the disturbance footprint and the SIA for the Koala are provided in Section 7.4.2.

Sand yabby

Habitat for the Sand yabby (*Cherax robustus*), in line with the conservation advice (TSSC 2023), is found in coastal wallum (sandy, lowland areas). The Sand yabby prefers acidic, soft, tannin-stained freshwater marsh, swamps, fens, lakes, and small creeks, often surrounded by *Melaleuca* (paperbark) and dominated by sedges. The species creates burrows in moist sandy soil where it spends most of its time. The species is known from large sand islands (e.g. K'gari), with infrequent recordings of the species on the mainland in isolated patches (TSSC 2023).

A freshwater pond was recorded 10 m north of the disturbance footprint which contained potential suitable habitat for the Sand yabby (refer Figure 4.10). There were no direct sightings of Sand yabby during the surveys. Another species of *Cherax* spp., *Cherax depressus* (Orange-fingered yabby), was observed in a submerged burrow. It is noted that whilst overlap in habitat can occur between species of *Cherax* spp., interspecific competition can play a part in competitive exclusion and could provide an explanation to the observed absence or lack of detection of Sand yabby within the disturbance footprint (Lynas et al. 2007).

Due to the potential presence of suitable habitat for the Sand yabby a water quality monitoring assessment and a targeted survey was completed in December 2024 (refer Section 4.7.3). The water quality readings taken at the time of the survey found the onsite pH to be around 6.6 to 6.8, however it is noted that the Sand yabby is limited to acidic waters (pH of 3.3 to 5.3) (Brooks 1987). It is unlikely that suitable habitat for the Sand yabby exists within or surrounding the disturbance footprint.

Wallum sedge frog

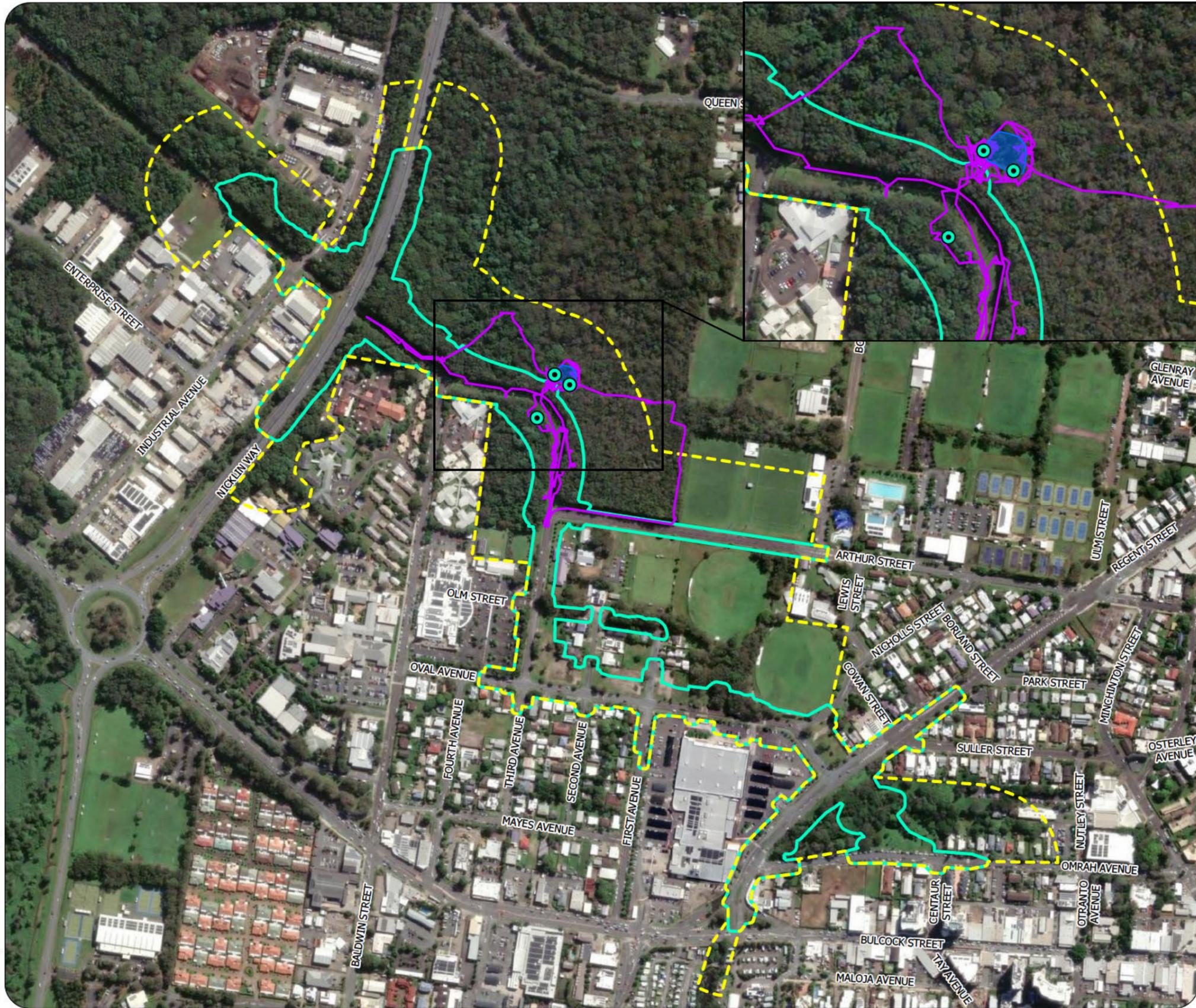
Habitat for the Wallum sedge frog (*Litoria olongburensis*), in line with the *National recovery plan for the wallum sedgefrog and other wallum-dependent frog species* (Meyer et al. 2006), consists of freshwater wetlands and associated vegetation communities occurring on low nutrient sandy soils along the east coast of Australia, from near Bundaberg south to Jervis Bay. The species prefers heath vegetation, sedges, and acidic (pH < 6.0) swamps and lakes which provide essential breeding habitat.

Due to the potential presence of suitable habitat for the Wallum sedge frog a targeted survey was completed in December 2024 (refer Section 3.7).

During the targeted survey spotlighting, three species of frog (*Litoria tyleri*, *Litoria fallax* and *Lymnodynastes peroni*) were observed surrounding and within a water feature (small pond) just outside of the disturbance footprint (refer Figure 4.10). *Litoria fallax*, which was found within the disturbance footprint in large numbers (>50), is a generalist species and has been known to display interspecific competitive exclusion with the Wallum sedge frog (Filer et al. 2023; Filer 2021). In contrast to *Litoria olongburensis* and *Litoria fallax* are rarely found in wallum habitat where pH levels are too low.

Further, water quality readings taken at the time of the survey found the onsite pH to be around 6.6 to 6.8, whereas *Litoria olongburensis* prefers water pH values between 3.4 to 6 (Filer et al. 2023). No suitable habitat for the Wallum sedge frog exists within or a 100 m surrounding the disturbance footprint, and as such the vegetation found in the disturbance footprint is unlikely to provide dispersal habitat. As a result of the findings from the water quality readings indicating a lack of suitable habitat, further temporal replication surveys as defined by the species survey guidelines were discontinued.

The fauna habitat value information in this section has been utilised in the assessment on potential Project impacts (refer Section 5) and the SIAs (refer Section 7).



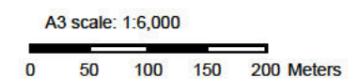
Service layers: City of Moreton Bay, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, City of Moreton Bay; Data sources: Queensland Spatial Catalogue - 2023



- Legend**
- Water quality monitoring points (pH)
 - Survey track (Dec 2024)
 - Water feature
 - Study Area*
 - Disturbance Footprint

*Study area has been determined based off a 100 m buffer from the disturbance footprint, where MNES have the potential to occur. Where there were no potential MNES likely to occur (i.e. preexisting residential developments) the area was not considered to form part of the Study area

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Figure 4.10 Survey effort and findings from targeted survey for Sand yabby and Wallum sedge frog

Table 4.12 Habitat for significant fauna species identified within and/or adjacent to the disturbance footprint

Scientific name	Common name	Habitat recorded	Conservation status	Habitat values observed	Photo
Birds					
<i>Calyptorhynchus lathamii</i>	South-eastern glossy black-cockatoo	Potential foraging and dispersal habitat (<i>Allocasuarina</i> spp. and <i>Casuarina</i> spp.)	Vulnerable (EPBC Act and NC Act)	Habitat in the form of scattered forage tree species of <i>Casuarina</i> and <i>Allocasuarina</i> were observed within and fringing the disturbance footprint in low densities (<5 trees per ha) within the ground-truthed area of RE 12.2.7. These were generally of smaller size (including juvenile and sub-adults) and provided low or no fruiting potential when surveyed. Therefore, where these species occurred within the disturbance footprint, they were considered to represent only lower quality/marginal foraging opportunities to the species compared to preferential stands of <i>Casuarina</i> and <i>Allocasuarina</i> outside of the disturbance footprint (Charles et al., 2025). It is noted that Glossy black-cockatoos prefer to use larger feed trees with abundant fruit when available as part of foraging resource strategy, as such it is unlikely for the species to be currently using the smaller <i>Allocasuarina</i> / <i>Casuarina</i> trees within the disturbance footprint (Guy Castley, pers comms January 2025). While smaller trees could increase in size over time, the impact assessment should be limited to current conditions. Areas of identified habitat are indicated in Figure 4.11.	
<i>Lathamus discolor</i>	Swift parrot	Potential foraging habitat	Critically endangered (EPBC Act) Endangered (NC Act)	Preferred foraging trees (<i>Eucalyptus robusta</i> , <i>Eucalyptus pilularis</i> or <i>Eucalyptus tereticornis</i>) were identified as present across the disturbance footprint (predominantly in the ground-truthed area of RE 12.2.7) and are known to provide suitable foraging habitat for this species. Areas of identified habitat are indicated in Figure 4.11.	

Scientific name	Common name	Habitat recorded	Conservation status	Habitat values observed	Photo
Mammals					
<i>Phascolarctos cinereus</i>	Koala	Potential foraging, resting and breeding habitat and dispersal habitat	Endangered (EPBC Act and NC Act)	<p>Suitable foraging, resting and breeding habitat for the Koala occurs across the disturbance footprint where locally important Koala trees such as <i>Eucalyptus</i>, <i>Corymbia</i>, <i>Melaleuca</i>, <i>Lophostemon</i> and <i>Angophora</i> trees occur. Preferable habitat occurs where eucalypts and gum-species are located in vegetated areas that are intact, such as in the centre and north-east of the disturbance footprint (ground-truthed RE 12.2.7 and RE 12.9-10.14), and in areas of suitable regrowth vegetation. Individual stands of trees of these genera outside of in-tact vegetation are also considered to be suitable habitat. Rainforest vegetation, like the lowland rainforest identified, is not considered to provide habitat value to the Koala.</p> <p>As defined in Table 3.7, Koala habitat for dispersal consists of areas that may act as secondary habitat for movement between primary habitats, including isolated trees, linear strips of vegetation and cleared areas that connect primary habitat areas. This included the power easements, roadside vegetation and areas of pavement, where movement is not obstructed by barriers. Areas of identified habitat are indicated in Figure 4.11 and Figure 7.5.</p>	 <p>Suitable foraging, resting and breeding habitat</p>  <p>Dispersal habitat example</p>
<i>Pteropus poliocephalus</i>	Grey-headed flying-fox	Foraging habitat	Vulnerable (EPBC Act)	<p>Summer and winter flowering species belonging to the genus of <i>Corymbia</i>, <i>Eucalyptus</i>, <i>Callistemon</i> and <i>Melaleuca</i> are present in areas across the disturbance footprint. All areas where species belonging to these genera occur in high densities will provide year-round foraging resources and habitat for the species. Identified areas within the disturbance footprint containing verge-planted large flowering <i>Melaleucas</i> (and <i>Callistemon</i>) and areas with <i>Grevillea</i> and <i>Xanthostemon</i> may also provide foraging resources for the species. These species occur within the ground-truthed areas of RE 12.2.7 and 12.9-10.14 and in vegetation that is non-remnant within the disturbance footprint. Fringing RE 12.3.1a may also provide habitat where these summer and winter flowering species exist. Areas of identified habitat are indicated in Figure 4.11.</p>	
<i>Potorous tridactylus trisulcatus</i>	Long-nosed potoroo (northern)	Potential breeding, foraging and dispersal habitat	Vulnerable (EPBC Act)	<p>The species has a preference of habitats that have a dense canopy and shrub cover and a dense ground layer possessing low floristic diversity (DAWE, 2022b). Areas across the disturbance footprint in sclerophyll forest (RE 12.2.7) where there is a presence of a dense understorey and ground species containing ferns, sedges, grass-trees, and low shrubs such as melaleucas is considered to be potential breeding, foraging and dispersal habitat for the species. Fringing RE 12.3.1a may also provide habitat value where there is a dense understorey. Areas of identified habitat are indicated in Figure 4.11.</p>	

Scientific name	Common name	Habitat recorded	Conservation status	Habitat values observed	Photo
Reptiles					
<i>Coeranoscincus reticulatus</i>	Three-toed snake-tooth skink	Potential sheltering and dispersal habitat	Vulnerable (EPBC Act)	Habitat for the species include areas where dense leaf litter exists to provide potential sheltering and dispersal habitat. Areas in the disturbance footprint, particularly sclerophyll forest (RE 12.9-10.14) and the fringing rainforest area (RE 12.3.1a) where the vegetation community provides dense leaf litter and fallen logs, is considered habitat for the species. Areas of identified habitat are indicated in Figure 4.11.	

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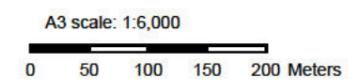
Project No: P622936 Map by: AT Export date: 5/12/2025



- Legend**
- Disturbance Footprint
 - Study Area*
 - Potential habitat for Koala (foraging, resting and breeding habitat)
 - Potential habitat for Grey-headed flying-fox
 - Potential habitat for Long-nosed potoroo
 - Potential habitat for Swift parrot
 - Potential habitat for Glossy black-cockatoo
 - Potential habitat for Three-toed snake-tooth skink
 - Dispersal habitat for Koala

*Study area has been determined based off a 100 m buffer from the disturbance footprint, where MNES have the potential to occur. Where there were no potential MNES likely to occur (i.e. preexisting residential developments) the area was not considered to form part of the Study area

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Figure 4.11 Habitat mapping for MNES species within the disturbance footprint

4.7.3 Targeted survey results

This section presents the targeted survey results conducted to inform impact assessment and to gather data relevant to species stocking rates for the MHQA methodology.

Detection dogs 2025

The University of Sunshine Coast completed Koala occupancy surveys within and surrounding the disturbance footprint and Ben Bennet Bushland Park which included bioacoustics and Koala scat detection dog methodologies.

Acoustic data was recorded over the period 6 February to 18 February 2025, which coincides with an increase in vocalisation during the Koala breeding season in summer months. All 14 deployed acoustic recorders successfully recorded at least 11 full nights of data each. Screening of these recordings resulted in no Koala bellow detections at any of the 14 sites during the deployment period.

Detection dog surveys occurred on the 7 February, 10 February, 11 February and 18 February 2025, totalling 30.4 km of searched transects, and resulted in no Koala scats being detected. Further details of the results of the surveys are found in Appendix K.

Koala drone surveys 2023

EVE completed a drone survey to assess the presence of Koalas in SCC managed reserves of Caloundra, Caloundra West, and the broader Sunshine Coast region in 2023. The survey area included Ben Bennett Bushland Park. No Koalas were detected during the surveys. The survey detected a range of mammal species, both arboreal and terrestrial, including local species of possum, gliders, macropods and echidnas. Further details of the results of the surveys are found in Appendix M.

Spotlighting

Aurecon conducted one night of spotlighting within and surrounding the disturbance footprint in December 2024. Heavy rains had occurred in the days prior to the spotlighting and weather conditions on the night of the surveys were clear with a temperature of 25°C. Three species of frogs and one toad were visually and aurally observed, *Litoria tyleri*, *Lymnodynastes peroni*, *Litoria fallax* and *Rhinella marina*. It is noted that *Litoria fallax* are generalists and are noted to display interspecific acoustic competition with acid frog species where they co-occur (Filer 2023). Water quality assessments determined the water collected from the Project study area produced a reading of pH of around 6.6 to 6.8 indicating the habitat within the disturbance footprint was not suitable for *Litoria olongburensis* or *Cherax robustus*. No *Litoria olongburensis*, *Cherax robustus* or suitable habitat for the species was observed within or immediately surrounding the disturbance footprint. Burrows were noted within the Project study area, however these were observed to be used by a competing species, *Cherax depressus* (Orange fingered yabby).

4.8 Migratory fauna

A total of 77 migratory species listed under the EPBC Act were recorded in the PMST search using a 5 km search radius of the disturbance footprint (refer Appendix D). As per the description in the likelihood of occurrence assessment (refer Appendix E) pelagic, Antarctic species (petrels, albatross), and vagrants have been excluded. Further excluded are species that are listed as threatened under the EPBC Act (covered in Section 4.7). Considering these exclusions, a total of 23 migratory species remained.

As the controlled action decision for the proposed action did not include listed migratory species as a controlling provision, migratory species are not discussed further in this report.

5 Potential impacts

Potential impacts to MNES may occur during the proposed action, comprising either direct impact (e.g. through vegetation loss) or indirect impacts (e.g. through introduction of weeds). Potential direct and indirect impacts resulting from the Project are described in the sections below.

5.1 Potential Project direct impacts

5.1.1 Vegetation clearance and loss of habitat for conservation significant species and communities

The proposed action is located within an urban environment and approximately 70% supports a mosaic of residential areas and developed areas, including existing road corridors and industrial areas as well as areas of non-remnant and regrowth vegetation.

Despite historical and ongoing land uses within the disturbance footprint, areas of ecological value generally remain in remnant vegetation which is associated with Ben Bennett Bushland Park, Gosling Park and Bicentennial Park. Due to the location of this vegetation, clearance is unavoidable for the Project.

Potential impacts resulting from the proposed Project vegetation clearing may include:

- Reduced patch size of vegetation communities potentially compromising the viability of the community and associated habitat
- Loss of habitat causing a reduction in biological diversity or loss of local populations and genotypes
- Increase in edge effects, increase in light and noise penetration, alterations in microclimates, and increased weed/pest incursion
- Loss of floristic diversity and the food resources this provides such as foliage, flowers, nectar, fruit and seeds
- Destruction of abiotic features necessary to support vegetation communities and habitat types.

Table 5.1 outlines the maximum extent of impacts proposed to occur to vegetation communities within the disturbance footprint.

Table 5.1 Approximate areas of field verified TECs that may be removed by the Project

Vegetation community	Maximum direct impact area (ha)
Coastal Swamp Sclerophyll Forest TEC (Endangered)	1.43 ha
Lowland Rainforest of Subtropical Australia TEC (Critically Endangered)	0 ha

During the field surveys, 1.43 ha of vegetation analogous to the Coastal Swamp Sclerophyll Forest TEC (Endangered) was ground-truthed directly within the disturbance footprint and will be impacted by the proposed action. The TEC met the condition threshold for Class A patch, as per the conservation advice for this TEC. This area is contiguous with a larger patch 8.2 ha in size (refer Figure 5.2).

Direct disturbance/clearance of the Lowland Rainforest of Subtropical Australia TEC (Endangered) is not proposed. However, vegetation analogous to this TEC (approximately 1.66 ha) is approximately 7.3 m to the north of the disturbance footprint and approximately 0.58 ha of vegetation within the 50 m buffer surrounding the Lowland Rainforest of Subtropical Australia TEC will be removed (refer Section 5.2.1).

Indirect impacts to both TECs are detailed in Section 5.2.11.

Measures to avoid, minimise and mitigate potential impacts to the TECs are outlined in Section 6.

The vegetation clearance and loss of TECs impacts (direct and indirect) have been incorporated into the TEC SIAs (refer Section 7.3).

5.1.2 Removal of listed threatened species and habitat

Flora

As discussed in Section 4.5.3, no listed threatened flora species under the EPBC Act were identified within the disturbance footprint during the ecological field surveys conducted in June 2023 and December 2024. Also no threatened flora species are known or considered to have a likely or potential likelihood of occurrence within the disturbance footprint.

Fauna

No listed threatened fauna species under the EPBC Act were identified within the disturbance footprint during the ecological field surveys conducted in June 2023 and December 2024.

It is noted that suitable habitat for listed threatened fauna species under the EPBC Act were identified within the disturbance footprint during the ecological field surveys. Table 5.2 outlines the maximum area of listed threatened fauna species habitat under the EPBC Act that could be removed by the Project.

Table 5.2 Maximum areas of field verified listed threatened fauna species habitat that may be removed by the Project

Species	EPBC Act status	Potential habitat utilisation	Maximum direct impact area (ha)
Swift parrot (<i>Lathamus discolor</i>)	Critically Endangered	Foraging and dispersal	1.41
Koala (<i>Phascolarctos cinereus</i>)	Endangered	Foraging, resting and breeding	4.65
Grey-headed flying-fox (<i>Pteropus poliocephalus</i>)	Vulnerable	Foraging and dispersal	5.20
South-eastern glossy black-cockatoo (<i>Calyptorhynchus lathami lathami</i>)	Vulnerable	Foraging and dispersal	1.43
Long nosed potoroo (northern) (<i>Potorous tridactylus tridactylus</i>)	Vulnerable	Foraging and dispersal	1.43
Three-toed snake-tooth skink (<i>Coeranoscincus reticulatus</i>)	Vulnerable	Foraging and dispersal	3.14

Measures to avoid, minimise and mitigate potential Project impacts to the aforementioned threatened fauna are outlined in Section 6.

SIAs and spatial mapping to assess potential Project direct and indirect impacts to relevant threatened fauna are provided in Sections 7.4 (for Critically Endangered and Endangered species) and Section 7.5 (for Vulnerable species).

Conservation significant fauna species that are known, likely or have the potential to occur within the disturbance footprint are summarised below.

Swift parrot

Preferred foraging trees (*Eucalyptus robusta*, *E. pilularis* or *E. tereticornis*) were identified as present across the disturbance footprint and are known to provide suitable foraging habitat for this species.

A maximum of 1.46 ha of potential Swift parrot habitat is proposed to be impacted by the Project. Given the existing disturbances in the surrounding area, the Project will not result in habitat fragmentation in the context of this species. All other key threats to this species are unlikely to be increased beyond current levels.

The species is a migrant and is expected to be highly mobile and able to utilise habitats outside the disturbance footprint based on available resources.

Koala

Suitable habitat for foraging, breeding, and dispersal for the Koala was assessed during the field investigation. Remnant, regrowth and non-remnant vegetation communities were considered in this habitat assessment. The field survey found suitable Koala habitat associated with the tall open forest and swamp sclerophyll communities, as well as isolated vegetation patches to the south of the Project study area around Bicentennial Park. Important Koala foraging tree species observed included *Eucalyptus pilularis*, *E. tereticornis*, *E. robustus*, *Corymbia intermedia*, *E. microcorys* and *E. propinqua*.

No evidence of this species, including potential scats and signs, were observed within the disturbance footprint or wider Project study area during the field surveys.

A maximum of 4.65 ha of Koala habitat is proposed to be impacted by the Project. Removal of this habitat is expected to have only a low impact as no Koalas were identified or have been historically identified within the area and there is suitable habitat directly surrounding the disturbance footprint which is to remain intact during and post Project works.

Grey-headed flying-fox

The Grey-headed flying-fox requires foraging resources and roosting sites. Summer and winter flowering species belonging to the genus of *Corymbia*, *Eucalyptus*, *Callistemon* and *Melaleuca* are present in areas across the disturbance footprint which are suitable foraging habitat for the species. There are no Grey-headed flying-fox camps located within the disturbance footprint. The disturbance footprint is located within a 20 km radius of a Nationally important roost site (refer Section 7.5.4).

A maximum of 5.20 ha of Grey-headed flying-fox habitat is proposed to be impacted by the Project. Removal of this habitat is likely to impact foraging habitat to the species.

South-eastern glossy black-cockatoo

Habitat in the form of scattered forage tree species of *Casuarina* and *Allocasuarina* were observed within and fringing the disturbance footprint in low densities (<5 trees per ha). The trees were generally of smaller size (including juvenile and sub-adults), and provided low or no fruiting potential when surveyed. Therefore, where these species occurred within the disturbance footprint, they were considered to represent only lower quality/marginal foraging opportunities to the species.

A maximum of 1.47 ha of South-eastern glossy black-cockatoo habitat is proposed to be impacted by the Project. Removal of this habitat is unlikely to impact foraging habitat to the species.

Long nose potoroo

Habitat in form of sclerophyll forest where there was a presence of a dense understorey and ground species containing ferns, sedges, grass-trees, and low shrubs, such as melaleucas, is considered to be potential breeding, foraging and dispersal habitat for the species.

No evidence of this species, including potential scats and signs, were observed within the disturbance footprint or wider Project study area during the field surveys.

A maximum of 1.47 ha of Long nose potoroo habitat is proposed to be impacted by the Project. Due to the highly modified and disturbed urban landscape, the majority of remnant vegetation is unlikely to represent important habitat and is not located within an area of important populations. Removal of this habitat is unlikely to have an impact to the species as it will not reduce the habitat patch to below 0.1 km² (requirement for the species).

Three-toed snake-tooth skink

Areas in the disturbance footprint, particularly sclerophyll forest and the fringing rainforest area where the vegetation community provides dense leaf litter and fallen logs, is considered habitat for the species.

No evidence of this species, including potential scats and signs, were observed within the disturbance footprint or wider Project study area during the field surveys.

A maximum of 3.14 ha of Three-toed snake-tooth skink habitat is proposed to be impacted by the Project. Due to the highly modified and disturbed urban landscape, the majority of remnant vegetation is unlikely to represent important habitat and is not located within an area of important populations. Removal of this habitat is unlikely to impact foraging habitat to the species.

The removal of listed threatened species and habitat impacts for the fauna species above and associated habitat have been incorporated into the relevant threatened fauna species SIAs (refer Section 7).

5.1.3 Fauna injury and mortality

Vegetation clearance during the Project construction phase has the potential to cause injury and mortality to local fauna. This potential impact will be proportionate to the extent of vegetation removed and its habitat potential to support species.

Fauna may also be injured or killed during the Project construction and operational phases through:

- Strike from moving construction machinery/vehicles and operational traffic – key issue for ground dwelling species, particularly those with poor mobility
- Entrapment in habitat during removal – a key issue during construction phase tree felling for species that use tree hollows or hollow logs for roosting
- Entrapment in trenches/holes – a key issue during construction phase for ground dwelling species (reptiles and small mammals), particularly those that are active at night and cannot detect trenches to avoid.

Arboreal or terrestrial conservation significant fauna such as Koala, are the most susceptible to injury and mortality as a result of the Project. Vehicle strike is a key threatening process for Koala (DAWE, 2022a). To avoid and minimise the impacts of vehicle strike and disruption of dispersal/movement during operation, fauna exclusion fencing will be installed to deter access to the Project and guide fauna towards designated safe fauna crossing locations and wildlife movement solutions (refer Section 6).

Measures to avoid, minimise and mitigate potential Project direct impacts to threatened fauna species and associated habitat are discussed in Section 6.

The potential fauna injury and mortality impacts and the implementation of mitigation measures have been incorporated into the relevant TEC and threatened fauna species SIAs (refer Section 7).

5.2 Potential Project indirect impacts

5.2.1 Habitat fragmentation and loss of connectivity

The disturbance footprint is located within an urban environment where habitats have already been subject to disturbance, fragmentation, weed incursion and edge effects. The proposed Project clearing works are situated directly parallel and adjacent to an existing barrier/habitat fragmentation (e.g. Nicklin Way State-controlled road).

Direct removal of terrestrial fauna habitat, or severing existing movement corridors for species such as Koala, has the potential to result in adverse impacts to fauna species. The direct removal of terrestrial habitat has the potential to reduce the carrying capacity of a defined area to support species. This has the potential to result in increased negative inter and intra-specific interactions and subsequent reductions in species vitality. In addition, habitat removal is likely to result in modulations to fauna and flora populations at all trophic levels, with the potential to lead to local extinctions or population explosions. The severing of existing movement locations along the disturbance footprint area can act as an entry point of non-native species that may further degrade existing habitat and fauna values.

Habitat fragmentation can isolate populations by causing barriers to the dispersal of plant seeds and fruit. The quality of persisting habitats can be substantially degraded by edge effects associated with increased exposure to light, noise, runoff, sedimentation, erosion and weed and pest infestation.

The Project during operational has the potential to result in some fragmentation associated with the patch of potential Koala habitat within the disturbance footprint. Whilst approximately 0.66 ha of Koala habitat within the south-west of the disturbance footprint has the potential to be impacted as a result of fragmentation by the Project, this is not likely to be any potential risk to Koala survival as the Project will be fully fenced with exclusion fencing in areas where Koala habitat exists. An underpass containing specific structures to facilitate the safe passage of species such as Koala, is proposed that will maintain connectivity within a north south direction.

The proposed action has the potential to fragment the Coastal Swamp Sclerophyll Forest TEC into two remaining patches due to proposed clearing works. Therefore the 0.66 ha TEC patch has been included in the Project total significant residual impact area (i.e. 2.09 ha).

As discussed in Section 2.5, the proposed action infrastructure siting has been developed and refined to maximise the use of disturbed areas. Where reasonable and practicable, co-location and micrositing of existing infrastructure and disturbance footprints (e.g. align with the existing HV transmission line), to avoid and minimise further vegetation clearing wherever feasible.

The habitat fragmentation and loss of connectivity impacts and implementation of mitigation measures have been incorporated into the relevant threatened fauna species SIAs (refer Section 7).

5.2.2 Introduction and spread of invasive fauna and flora species

Non-native invasive species have the potential to impact on terrestrial and aquatic biodiversity as native species can become displaced through predation and competition or alter habitat capacity for native species.

Weeds may out-compete less disturbance-tolerant native species and/or smother native vegetation. This, in turn, may alter the species composition of the vegetation community they encroach upon. The most likely causes of weed dispersal and introduction associated with the Project include vegetation clearing, movement and disturbance of soil, and attachment of seed (and other propagules) to footwear, vehicles and machinery. Weed proliferation is exacerbated by clearing activities that disturb and expose the soil. Additionally, both terrestrial and aquatic weeds have the capacity to dominate localised environments (specifically riparian environments), resulting in a change to waterway form and function. The alteration of the localised floral assemblages has the capacity for significant cascading impacts of waterway resilience, potentially indirectly exacerbating other direct impacts.

Additionally, invasive fauna and pest animals, such as foxes (*Vulpes vulpes*) and domestic cats (*Felis catus*) may hunt native species and compete with them for food and shelter. Both species have been observed via database records within 1 to 2 km of the disturbance footprint. Other major consequences of competition from invasive species include displacement of native fauna by colonisation of necessary habitat, such as breeding habitat like hollows and waterways (i.e. Cane toads (*Rhinella marina*), Indian myna (*Acridotheres tristis*) and feral honeybees). The invasive fungus, *Phytophthora cinnamomi* and *Austropuccinia psidii*, also poses a significant threat to native vegetation, causing root-rot and tree dieback.

Sphagneticola trilobata, *Lantana camara*, and *Celtis sinensis* are all listed under the provisions of the Biosecurity Act and were recorded by Aurecon within the disturbance footprint during the ecological field surveys.

One species of restricted fauna was recorded in the disturbance footprint by Aurecon during the ecological field surveys, Cane toad (*Rhinella marina*). The Cane toad is a restricted invasive animal under the Biosecurity Act. The Project is unlikely to introduce new pest animals to the area due to the previous disturbance.

The disturbance footprint is within Biosecurity Zone 2 for Fire ants (*Solenopsis invicta*), which covers suburbs yet to receive eradication treatment. Biosecurity Zone 2 includes restrictions on the movement of organic materials (e.g. soil, mulch and potted plants) inside and outside the zones.

Project activities during the construction phase are considered likely to increase the potential for the introduction and movement of weed species or increase in invasive species.

Measures to avoid, minimise and mitigate potential Project weed and pest impacts are discussed in Section 6.

The introduction and spread of invasive fauna and flora species impacts and implementation of mitigation measures have been incorporated into the relevant threatened fauna species SIAs (refer Section 7).

5.2.3 Hydrology and water quality

Overview

The Project is not located within the Moreton Bay Ramsar Wetland and will therefore not result in direct potential impacts to the Ramsar wetland values.

The Project is however located upstream to the Moreton Bay Ramsar Wetland boundary, approximately 23 m from the southernmost extent of the disturbance footprint at the intersection of Bowman Road and Bulcock Street and along Omrah Avenue. The Project therefore has the potential to indirectly impact downstream environments (e.g. Pumicestone Passage) as a result of changes in water quality, increased sedimentation and change in hydraulics/hydrology. These potential impacts have been modelled and assessed in terms of their potential risk during the detailed design phase for each of the pre-construction (baseline), construction and operational phases.

Mitigation measures have been implemented as part of the Project detailed design, construction and operational phases, including for example the design, installation and maintenance of a combination of stormwater capture and treatment measures in accordance with TMR's Road Planning and Design Manual (TMR 2024b)). Further, construction mitigation measures (compliance with TMR technical specifications *MRTS04 General Earthworks* (with respect to ASS), *MRTS 51 Environmental Management* and *MRTS 52 Erosion and Sediment Control*) are proposed to be incorporated into the Project EMP(C) to further minimise potential indirect impacts.

The sections below discuss the potential Project indirect impacts to the Moreton Bay Ramsar Wetland, including with reference to the integrated water quality and hydraulic modelling and assessments undertaken during the Project detailed design phase.

Measures to avoid, minimise and mitigate potential direct and indirect impacts to Moreton Bay Ramsar Wetland are discussed in Section 6.

The potential Project indirect water quality and flooding impacts discussed in this section have been incorporated into the SIA for the Moreton Bay Ramsar Wetland which is provided in Section 7.2.

Water quality and sedimentation

The Project has the potential to indirectly impact downstream environments as a result of changes in water quality and the release of sedimentation runoff to downstream sensitive environments (e.g. Pumicestone Passage, Moreton Bay Ramsar Wetland) during both construction and operation, and are acknowledged as being a key threatening process for other MNES, including the listed Coastal Swamp Sclerophyll Forest TEC.

During Project construction, excavation activities and clearing of vegetation (e.g. installation of new road pavement works where none currently exists or the upgrading of existing pavements, as well as the

installation of retaining walls and noise walls) may result in surface sediment being exposed resulting in sediment laden runoff entering waterways and the introduction of a greater extent of impervious surfaces where none currently exists. This could in turn increase turbidity and suspended sediments and has the potential to increase nutrient and toxicant concentrations, including in the instance of disturbance of acid sulfate soils. There is also potential for excavation activities to require dewatering, which if left unmitigated, may result in transportation of contaminants and impacts to groundwater dependent ecosystems. Given the minor nature of the ground disturbance, and the implementation of measures in the Project EMP(C), the Project is not expected to result in impacts to surface water or groundwater and associated groundwater dependent ecosystems values.

Additionally, during both construction and operation, there is potential for surface water runoff to be generated from the disturbance footprint that contains pollutants (e.g. sediment, litter, metals and hydrocarbons), which if unmitigated, could discharge into downstream aquatic environments. Sedimentation in waterways associated with increases in turbidity/suspended solids also has the potential to harm aquatic flora and fauna both within the Moreton Bay Ramsar Wetland and more broadly within aquatic habitats in and around the proposed action.

Sedimentation can cause reduced light penetration and the infilling of slow-moving sections of waterways (e.g. deep pools), lowering habitat quality and affecting primary production processes. Further, an influx of liberated nutrients from inadequate sediment control may result in localised eutrophication, which may lead to an increased risk of algal blooms. These potential bloom events may subsequently lead to deficiencies in available dissolved oxygen contributing to fish kills.

Accidental spills and leaks during construction could impact the water quality in the area if left unmitigated. Potential spills include hydrocarbons and cleaning agents which are potentially harmful to aquatic biota, should they reach concentrations which trigger acute or chronic physiological responses. For the operational phase, this includes potential spills (hydrocarbons) from vehicle road accidents, as well as tyre wear and fuel emissions (heavy metals), particularly during rainfall events.

The construction and operational phase water quality modelling and associated risk assessment undertaken for the Project has however identified that the potential indirect impacts to Moreton Bay Ramsar Wetland values are low risk. To address the above mentioned potential indirect impacts, the Project proposes to implement key mitigation measures as detailed in Section 6, which will be incorporated for Project implementation into the Project EMP(C) (and associated subplans) in accordance with *MRTS 51 Environmental Management* and EMP(O).

Integrated water quality modelling results

Integrated MUSIC, SOURCE and TUFLOW modelling has been completed for the Project (pre-construction baseline, construction and operational phases) to assess potential impacts at the Project scale, wider catchment and to the downstream receiving environment of the Pumicestone Passage and the Moreton Bay Ramsar Wetland.

As part of design development, the Project has adopted a stormwater design approach that seeks to achieve the following, in order of priority:

1. Retention of natural bushland and sensitive environments, avoiding/minimising direct impact and clearing to the minimum extent practical
2. Maintain, wherever practicable, the existing stormwater regime in terms of flows, flood levels, depths and velocities
3. Use of natural, surface water quality solutions to treat both road and external catchment runoff, where applicable
4. Where Project constraints limit natural surface water quality treatment solutions (refer Section 4.3.4), employ end of line proprietary gross pollutant traps.

Construction phase scenarios

MUSIC modelling

At the Project scale, a reduction in annual runoff volume was observed during both construction scenarios for each of the east and west catchments. This decrease is likely attributable to a reduction in overall impervious area, as the MUSIC model assumed all construction areas as being fully pervious. Outputs of the MUSIC modelling identified decreases in the TN and TP loads during construction, following a similar trend to runoff volume, with annual loads comparable between the two construction scenarios.

The post-development scenario reflected the inclusion of the following key stormwater design measures:

- Median swales with slotted kerbs
- Table drain swales with slotted kerbs
- Bioretention street trees
- End of line bioretention basins
- Gross pollutant traps.

In contrast, total TSS loads were predicted to increase under both construction scenarios relative to the baseline, with differences between the east and west catchments. In particular, the high construction disturbance area scenario resulted in higher annual TSS loading in the west catchment which could be attributed to a modelled rainfall event in October 2022, which coincided with the highest monthly rainfall recorded during the simulation period.

A comparison of median pollutant concentrations (refer Table 5.3) shows that TSS concentrations increased by an order of magnitude during the construction phase compared to baseline conditions. TSS concentrations exceeding the allowable limit of 50 mg/L were observed in the MUSIC model results for the east catchment across both construction scenarios, noting no upper limiting concentrations were assigned and applying an 80% effectiveness assumption to erosion and sediment control measures. Further, areas outside the temporary footprint did not undergo any erosion and sediment control measures. In contrast to the trends observed for TN and TP loads, both TN and TP concentrations also increased during construction, however the magnitude of these increases was less pronounced than that observed for TSS.

These changes in pollutant generation are largely attributed to the increase in impervious areas (predominantly associated with Ben Bennett Bushland Park) and the development footprint constraints (refer Section 4.3.4).

Table 5.3 MUSIC model median construction phase pollutant concentrations summary (May 2022 – June 2023 simulation period)

Parameter	East catchment			West catchment		
	Baseline (2024)	Construction scenario 1	Construction scenario 2	Baseline (2024)	Construction scenario 1	Construction scenario 2
TSS (mg/L)	6.2	62.8	64.0	5.6	48.8	49.1
TP (mg/L)	0.04	0.18	0.19	0.03	0.12	0.11
TN (mg/L)	0.48	1.47	1.4	0.44	1.15	0.99

SOURCE modelling

SOURCE model results (including both Project and broader catchment-scale impacts) were consistent with the MUSIC model project-scale observations. As the Project accounts for only a small portion of the total catchment (approximately 4% of the east catchment and 1% of the west catchment), broad catchment flows and loads dominate the results. Annual runoff volumes decreased during construction for both catchments, however the proportional magnitude of change relative to the baseline was considerably smaller at the catchment scale.

Similarly, pollutant loads (TSS, TN and TP) followed the same general trend observed at the Project scale (refer Table 5.4). Given the limited influence of the small disturbance footprint in proportion to the overall

catchment pollution loads, the change relative to the baseline was small. Simulated catchment-wide pollutant concentrations showed little variation between baseline and construction scenarios, (within approximately 1% annual average change in most pollutants assessed). The slight reduction in SOURCE modelled median TSS concentrations during the construction phase was contrary to the increase observed at the Project scale (MUSIC modelling). This result was likely due to the lower runoff volumes during construction, combined with the diluting effect of background catchment loads. As a result, overall TSS concentrations at the catchment scale appeared to be similar to, or slightly lower than, baseline conditions.

Table 5.4 SOURCE model median construction phase pollutant concentrations summary (May 2022 – June 2023 simulation period)

Parameter	East catchment			West catchment		
	Baseline (2024)	Construction scenario 1	Construction scenario 2	Baseline (2024)	Construction scenario 1	Construction scenario 2
TSS (mg/L)	27.9	21.2	23.6	13.6	11.2	11.7
TP (mg/L)	0.08	0.08	0.08	0.06	0.05	0.05
TN (mg/L)	1.05	1.04	1.03	0.97	0.98	0.97

TUFLOW FV modelling

Whilst the MUSIC and SOURCE modelling focused on catchment loads and specific contributions from the Project, this section describes how these loads affect water quality within the Pumicestone Passage and Moreton Bay Ramsar Wetland.

Despite minor changes being observed at the Project scale, results from the TUFLOW FV modelling showed no discernible change during construction relative to the baseline across all baseline water quality sites. One exception was a minor reduction in organic phosphorus from construction when compared to the baseline at MP7. This was likely due to erosion and sediment control measures being implemented during the Project construction phase. Additionally, there were no obvious changes associated with the different construction sequences, indicating downstream indirect impacts to the Moreton Bay Ramsar Wetland will be minor and largely influenced by the magnitude of events themselves. Summary model plot outputs are provided in Appendix F.1.

For construction, dilution mapping results showed that risks from altered flow conditions are negligible, however risks during construction require monitoring due to the exposure of soils and potential exports of contaminants at larger concentrations in comparison to existing (baseline) conditions. Summary dilution mapping outputs are provided in Appendix F.3.

In addition to design mitigation measures implemented to date as part of detailed design, further mitigation measures are proposed to be incorporated into the Project EMP(C). Additionally, mitigation measures are proposed to be incorporated into the Project Erosion and Sediment Control Plan (ESCP) to minimise the potential impacts of sedimentation runoff into downstream sensitive environments. These mitigation measures are further discussed in Section 6.

Operational phase scenarios

MUSIC modelling

As expected, the increase in impervious area during the Project operational phase resulted in higher annual flow volumes in both the east and west catchments (refer Table 5.5).

Table 5.5 Annual flow volumes – operational phase (May 2022 - June 2023 equivalent simulation period only)

Parameter	Baseline (2024) (ML)	Operation (2024) (ML)	Change (ML)
East catchment	53	71	18
West catchment	15	17	1

Median pollutant concentrations (refer Table 5.6) increased in both catchments under operational conditions, with a greater rise in the east catchment, acknowledging the presence of the Project stormwater design measures (e.g. swales, bioretention street trees and basins, gross pollutant traps) and that the measures are heavily constrained by a range of factors as discussed in Section 4.3.4.

Table 5.6 MUSIC model median operational pollutant concentrations (May 2022 – June 2023 equivalent simulation period only)

Parameter	East catchment		West catchment	
	Baseline (2024)	Operation (2024)	Baseline (2024)	Operation (2024)
TSS (mg/L)	6.2	9.9	5.6	7.0
TP (mg/L)	0.04	0.09	0.03	0.07
TN (mg/L)	0.5	1.4	0.4	1.0

SOURCE modelling

Annual runoff volumes and pollutant loads for the SOURCE model catchments (east, west and south) (refer Figure 3.3) were assessed for baseline and operational phases. As shown in Table 5.7 to Table 5.10, increases in both flow and pollution loads are evident with predicted local catchment growth, even in the absence of the Project.

To isolate the impact of the Project, operational phase results can be compared against corresponding scenarios without the Project (e.g. '2024 no Project (Baseline)' vs '2024 with Project'). The difference in annual volume and pollutant loads reflects the direct effect of the Project (refer Table 5.7 (east and west), Table 5.8, and Table 5.9). As with the construction phase, the relative impact at the catchment scale remains minor due to the limited proportion of the total catchment affected by the Project. No change in flow or pollutant loads was observed in the south catchment across each of the three paired baseline and operational scenarios (refer Table 5.10) as this catchment does not receive runoff from the Project disturbance footprint.

Median pollutant concentrations also show slight increases due to background catchment development in the absence of the Project; however these changes are minimal. More insightful is the comparison between corresponding cases with and without Project scenarios at each time horizon. In summary, the modelling indicates:

- Stormwater treatment measures are at their most effective in the west catchment, resulting in a notable reduction in TSS concentrations
- TN and TP concentrations showed small changes, with slight increases in the east and slight decreases in the west. These changes are sufficiently low to be within the bounds of model uncertainty.

A preliminary comparison was also made between modelled concentrations and existing water quality monitoring data, focusing on the monitoring point MP#7 (refer Table 4.2) within the east catchment. As shown in Figure 5.1, modelled TN and TP concentrations are generally of the same order of magnitude as baseline water quality observed values, though the model tends to predict higher concentrations. Median modelled TN and TP concentrations were 1.05 mg/L and 0.08 mg/L, compared to observed medians of 0.5 mg/L and 0.05 mg/L, respectively.

Table 5.7 Annual flow volumes – operational phase (May 2022 – June 2023 equivalent simulation period only)

Catchment	2024		2027		2041	
	No Project	With Project	No Project	With Project	No Project	With Project
East	1,357	1,375 (1.32%)	1,367 (0.74%)	1,385 (1.32)	1,399 (3.12%)	1,420 (1.53%)
West	1,203	1,204 (0.11%)	1,208 (0.43%)	1,210 (0.11%)	1,224 (1.73%)	1,230 (0.54%)
South	304	304 (0%)	306 (0.91%)	306 (0.91%)	316 (3.94%)	316 (3.94%)

Table 5.8 SOURCE model – Summary of east catchment median outflow pollutant concentrations during operations (May 2022 – June 2023)

Parameter	2024		2027		2041	
	No Project	With Project	No Project	With Project	No Project	With Project
TSS (kg)	27.9	29.9	28.1	30.2	29.1	31.2
TP (kg)	0.09	0.09	0.08	0.09	0.08	0.10
TN (kg)	1.12	1.10	10.5	1.10	1.06	1.11

Table 5.9 SOURCE model – Summary of west catchment median outflow pollutant concentrations during operations (May 2022 – June 2023)

Parameter	2024		2027		2041	
	No Project	With Project	No Project	With Project	No Project	With Project
TSS (kg)	13.6	4.8	13.7	4.8	13.9	4.9
TP (kg)	0.06	0.04	0.06	0.04	0.06	0.04
TN (kg)	0.97	0.96	0.97	0.96	0.98	0.97

Table 5.10 SOURCE model – Summary of south catchment median outflow pollutant concentrations during operations (May 2022 – June 2023)

Parameter	2024		2027		2041	
	No Project	With Project	No Project	With Project	No Project	With Project
TSS (kg)	1.1	1.1	1.0	1.0	1.0	1.0
TP (kg)	0.02	0.02	0.02	0.02	0.02	0.02
TN (kg)	0.85	0.85	0.85	0.85	0.84	0.84

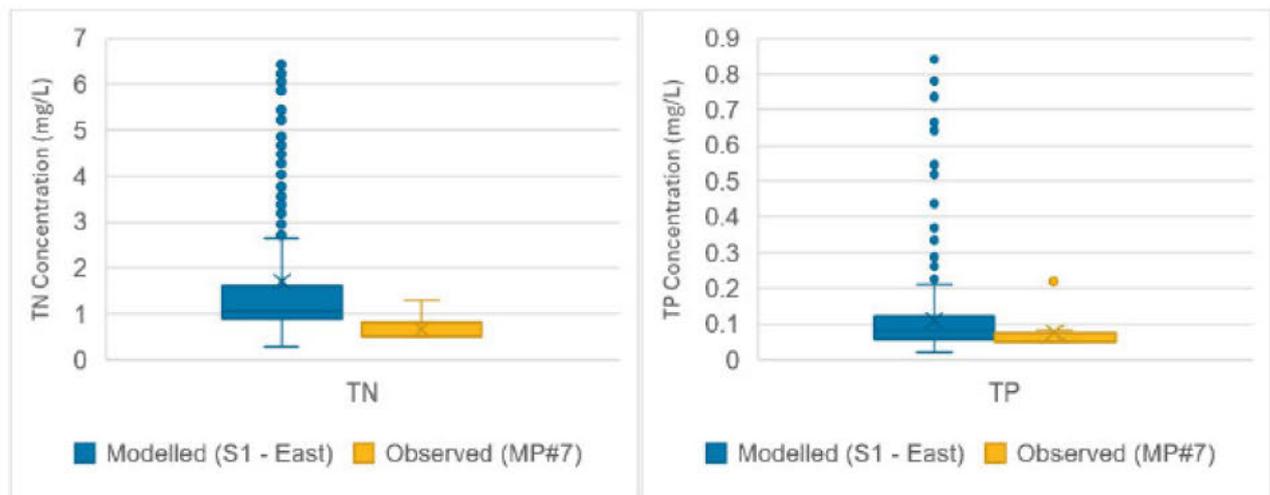


Figure 5.1 Modelled vs observed TN (left) and TP (right) concentrations

TUFLOW FV modelling

As detailed previously, TUFLOW FV modelling describes how the Project loads affect water quality within the Pumicestone Passage and Moreton Bay Ramsar Wetland. Consistent with the construction phase, the TUFLOW FV modelling for the operational phase showed no discernible change between the baseline and operational scenarios across each of the Project baseline monitoring sites. Summary model plot outputs are provided in Appendix F.2.

In terms of dilution, 1:10 and 1:50 dilution mapping for the 2024 baseline (pre-construction) and 2024 Project operational scenarios showed that limited dilution occurs in Pumicestone Creek, regardless of scenario, whereas a more significant degree of mixing can be observed once waters from the catchment reach the Pumicestone Passage. Consistent with previous results, minimal differences can also be seen between scenarios, with differences in areas under dilution contours confined to no more than a few model cells (refer summary dilution mapping outputs in Appendix F.3).

The areas associated with dilution below 1:10 and 1:50 for the baseline and operational scenarios are also summarised in Appendix F.3, presenting minimal differences between scenarios and the baseline (pre-construction).

Risk assessment

Outcomes of the risk assessment undertaken based on modelling results are summarised below and presented in Appendix F.4.

Emphasis in the analysis was to assess risks to water quality in the Pumicestone Passage. Modelling results indicated that provided concentrations from the Project discharges do not change considerably from existing outflows from the Project disturbance footprint, water quality outcomes in the Pumicestone Passage due to Project construction and operation will be negligible. This is largely due to the small project area in relation to the overall catchment area, combined with stormwater treatment measures, particularly during the operational phase of the Project. Even for the increase in TSS concentration in Project outfalls predicted for the construction phase, no significant changes resulted in the downstream waterways when comparing cases with and without the Project.

Although risks to the Pumicestone Passage were predicted to be low, there are still risks associated with limited knowledge of toxicant concentrations in the Pumicestone Passage and in Project discharges, particularly during construction, potential uncertainty on whether pollutant loads increase with increased traffic volumes and other risks not able to be accounted for in the modelling (i.e. heavy metals). However based on modelling results and dilution mapping, it follows that provided toxicant concentrations from the Project do not drastically change from baseline concentrations, the risk of increased toxicant concentrations in the Pumicestone Passage is minimal.

Noting the above, the highest identified risks for the Project are associated with the ground disturbance works (excavation and vegetation clearing) during the construction phase and potential spills from vehicles as well as tyre wear and fuel emissions during the operational phase (particularly in times of rainfall events). Project management measures within the EMP(C) and subplans, and EMP(O) are best equipped to address these risks and are discussed in Section 6.

Hydraulic and hydrology alterations

Moreton Bay Ramsar Wetland

The Project will result in a minor increase in hardstand which may result in a localised change to surface water flow to downstream environments. An increase in surface water flow may result in scouring and subsequent erosion downstream, and chemical imbalances in waterways. Water Sensitive Urban Design (e.g. basins and swales (TMR's Road Planning and Design Manual (TMR 2024b)) and construction measures (e.g. ESCP, *MRTS 51 Environmental Management* and *MRTS 52 Erosion and Sediment Control*) will be implemented to minimise potential hydraulic impacts and maintain the existing flow regime within the catchments.

The changes in peak water levels between the design and existing scenarios have been assessed for the 39% AEP, 10% (2100) AEP, 2% (2100) AEP, 1% (2100) AEP and 0.05% AEP events and are presented in the afflux mapping in Appendix F. The potential hydraulic impacts to the Moreton Bay Ramsar Wetland resulting from the proposed design, including changes to water levels, peak flows, timing and duration of flooding are discussed below.

The peak afflux within the Moreton Bay Ramsar Wetland is shown in Table 5.11.

Table 5.11 Peak changes in water levels within the Moreton Bay Ramsar Wetland

Design event	Maximum afflux (mm)
39% AEP	22
10% AEP (2100)	10
2% AEP (2100)	2
1% AEP (2100)	2
0.05% AEP	26

The peak afflux across the events assessed is no more than 26 mm and is localised within the upper reach of the Pumicestone Passage. The changes in peak flows, durations and timings have been assessed across the design events at the location “Y” in Figure 5.2.

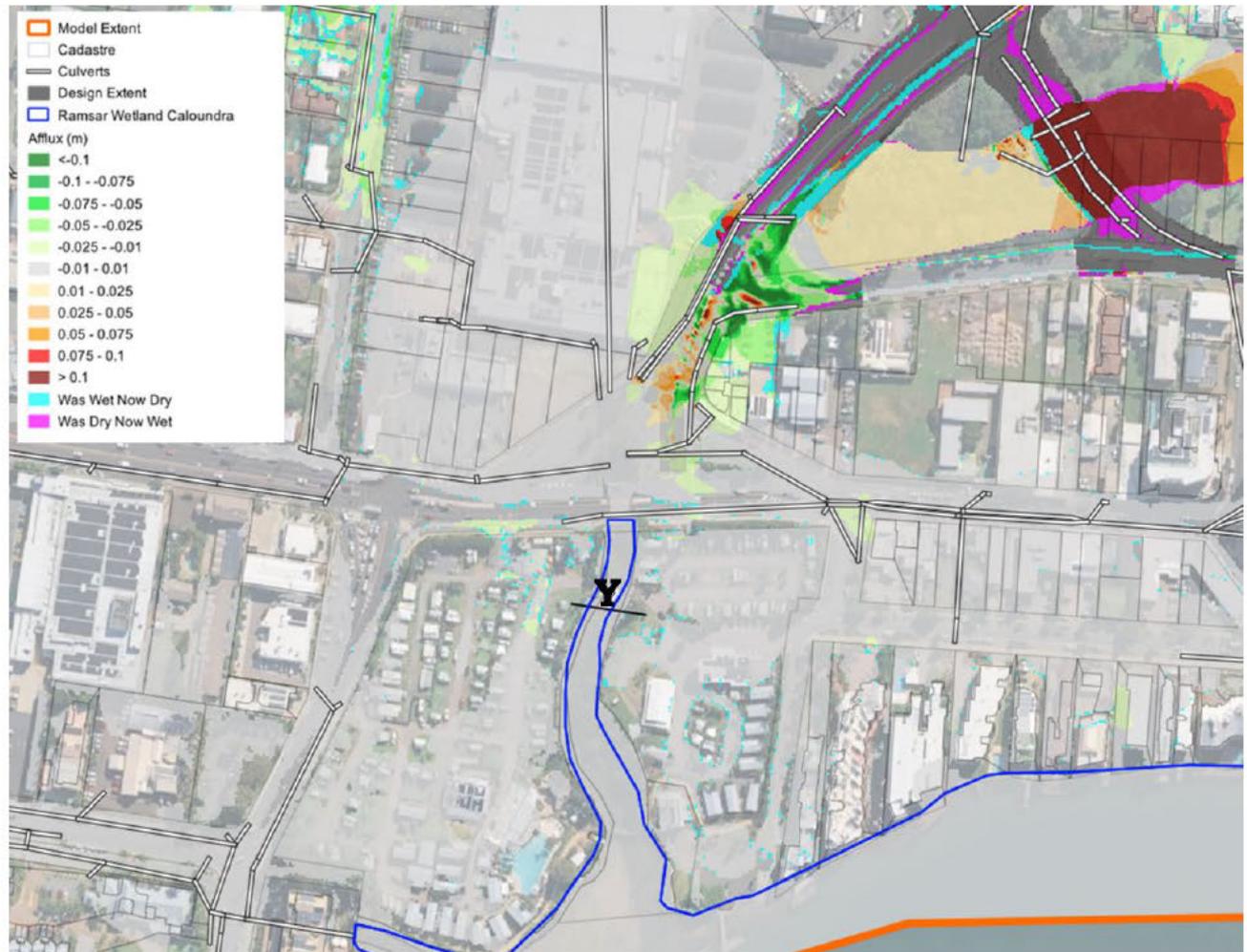


Figure 5.2 Location of flow comparison

The changes in peak flow between the existing and design scenario are shown in Table 5.12 with the corresponding flow hydrographs shown in the Figure 5.3.

Table 5.12 Change in peak flows into Pumicestone Passage

Design event	Existing peak flow (m ³ /s)	Design peak flow (m ³ /s)	Change in peak flow (m ³ /s)	Change in peak flow (%)
39% AEP	22.4	23.1	0.7	3.3
10% AEP (2100)	42.0	42.7	0.7	1.5
2% AEP (2100)	56.5	56.7	0.2	0.4
1% AEP (2100)	62.5	62.7	0.2	0.3
0.05% AEP	75.0	75.3	0.3	0.4

The results show that the design has increased the peak flows into Pumicestone Passage by no more than 3.3% across the events assessed. The design has also resulted in minimal changes to the timing and volume of flows into the Pumicestone Passage and Moreton Bay Ramsar Wetland, and therefore the potential hydraulic impacts to the Moreton Bay Ramsar Wetlands are considered to be negligible.

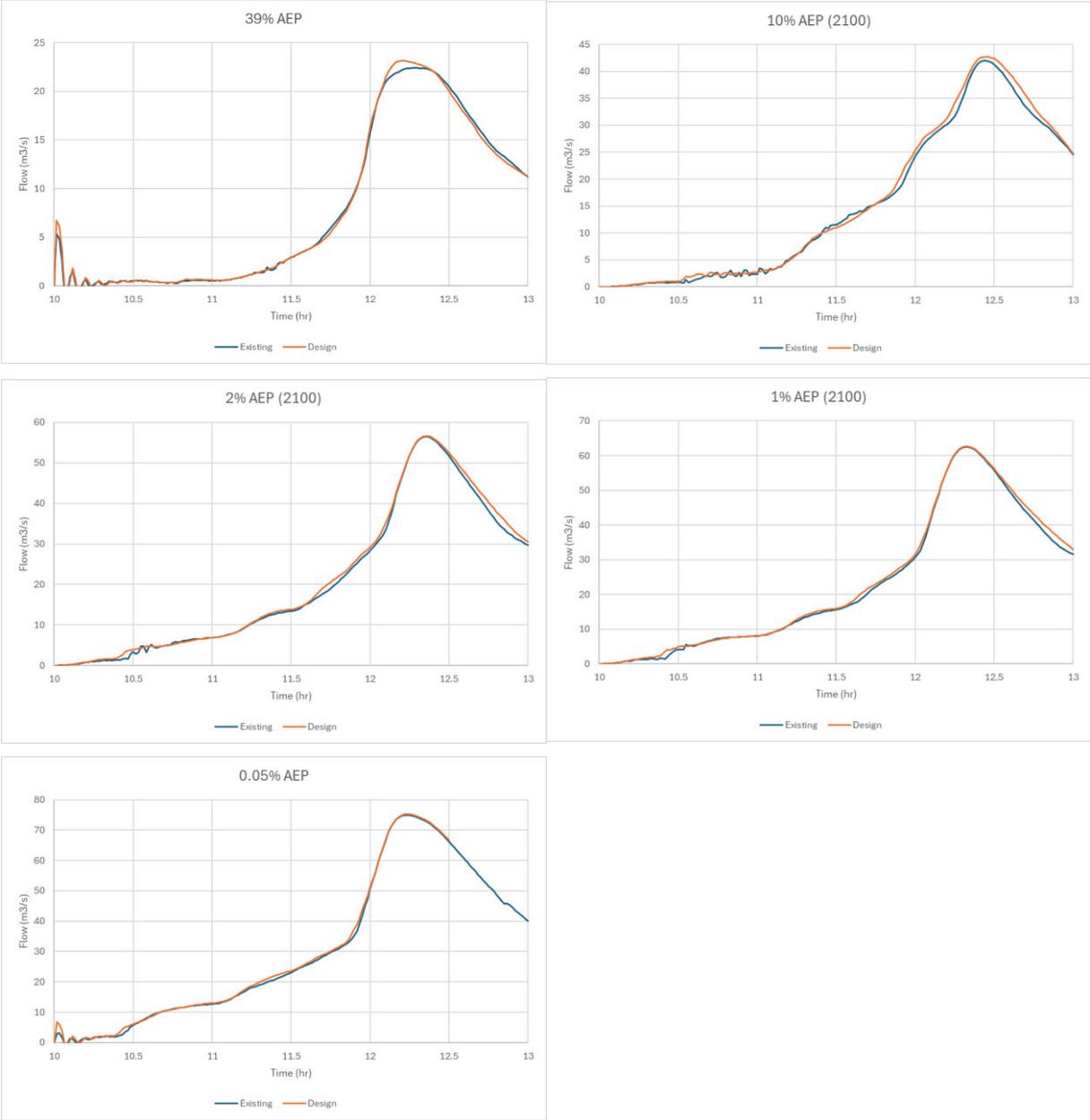


Figure 5.3 Comparison of existing and design flows into the Pumicestone Passage

Threatened ecological communities

The Coastal Swamp Sclerophyll Forest TEC is a wetland associated community. Since hydrology governs the vegetation in wetland systems, the areas most critical to the survival of the ecological community are those where the hydrological regime remains reasonably intact such that the vegetative diagnostic features are maintained. Changes to natural hydrological regimes is a major factor contributing to the loss of wetland features, biological diversity and ecological function in Coastal Swamp Sclerophyll Forests (DAWE 2021a).

A total of 1.43 ha of vegetation analogous to the Coastal Swamp Sclerophyll Forest TEC was observed directly within the disturbance footprint via ground-truthed vegetation surveys and was contiguous with a larger patch approximately 8.2 ha in size.

Within the disturbance footprint the design will result in an increase in water levels within a portion of the Ben Bennett Bushland Park by over 300 mm in the 1% (2100) AEP event when compared to existing baseline conditions as a result of water ponding against the proposed road embankment.

However, flood modelling outside of the disturbance footprint has shown minor flood depth change, velocity and regime flow change for 1% AEP in the two remaining TEC patches when comparing the baseline and design case. This minor change is unlikely to cause an adverse impact to the TEC due to the size of local catchment and temporary nature of the event. It is therefore considered that abiotic factors necessary for the two remaining TEC patches survival will remain unaltered by indirect impacts associated with the proposed action. No hydrological changes are anticipated to impact the TEC nor modify its extent as a result of the design.

Refer to Appendix G for the afflux mapping for the design case.

5.2.4 Potential acid sulfate soils

During the construction phase the Project has the potential to disturb PASS, generate acidity and mobilise/release metals within receiving surface and groundwater ecosystems (including impacts to water quality and flora and fauna).

PASS will be managed through MRTS04 and the implementation of a Project ASSMP and therefore this impact is considered to be low risk.

The potential Project ASS impacts and implementation of mitigation measures have been incorporated into the SIAs (refer Section 7).

5.2.5 Species population density

The loss of MNES habitat within the disturbance footprint may influence fauna densities and distributions, and potentially result in localised MNES species population declines. This may occur as a result of the following mechanisms:

- Impact on terrestrial biodiversity through vegetation clearing
- Impact on aquatic biodiversity through vegetation clearing and drainage alterations. There is potential to impact higher trophic organisms (e.g. reptiles and aquatic birds) through potential reduction in food web interactions.
- Reduction of naturally occurring microhabitats available within an area (instream structures, loss of riparian habitat)
- Vegetation clearing may increase the pressure and exposure from other processes, including erosion, pest species, and water quality degradation
- The risk of increased vehicle strike to native fauna is considered high without fauna sensitive design measures and post construction fauna exclusion fencing due to the increased movement of heavy machinery and vehicles during the construction works due to an increase in distance for fauna to travel. However mitigation measures will be implemented (i.e. temporary and permanent fauna exclusion fencing) during all design phases to complement existing provisions and reduce the potential for increased instances of fauna mortality associated with the Project.

Measures to minimise and mitigate potential Project impacts to threatened fauna species densities and distributions are discussed in Section 6. Mitigation measures will be incorporated into the Project EMP(C) and EMP(O) to minimise the potential impacts to fauna densities and distributions and therefore this impact is considered to be low risk.

The potential Project impacts to threatened fauna species densities and distributions and implementation of mitigation measures have been incorporated into the SIAs (refer Section 7).

5.2.6 Impact on plant-pollinator associations

Some wildlife, such as invertebrates and plants, coexist in symbiotic relationships that are mutually advantageous to the success of both species. For example, the ability of a vegetation community to successfully regenerate is often highly dependent upon these pollinators, and seed dispersers such as beetles, bees, bats and birds.

Many pollinators rely on the sequential flowering of vegetation, which, in turn, ensures food sources are available year-round (with the exception of other environmental conditions, for example drought), while seed dispersers may nest, roost and forage within the vegetation community itself.

However, local populations of pollinators and seed dispersers are often highly susceptible to habitat degradation and fragmentation, which is associated with vegetation clearing and the use of certain chemicals (e.g. pesticides and herbicides).

Specific impacts to these relationships and subsequent populations may include the elimination of key components in their food web, impairments to their reproductive ability, a reduction in genetic variation of a local community (flora), starvation due to lack of available food source and death via direct contact with a poison.

Mitigation measures such as dust suppression, noise restrictions and minimising pesticide use will aid in the reduction of impacts on plant-pollinator associations. Measures to minimise and mitigate potential Project impacts on plant-pollinator associations are discussed in Section 6. Mitigation measures will be incorporated into the Project EMP(C) to minimise the potential impacts to plant pollinators and therefore this impact is considered to be low risk.

The potential Project impacts on plant-pollinator associations and implementation of mitigation measures have been incorporated into the SIAs (refer Section 7).

5.2.7 Bushfire

Bushfires may be the result of natural and/or anthropogenic processes. The bushfire hazard differs throughout the disturbance footprint but is mapped as high potential within Ben Bennett Bushland Park, the rest of the disturbance footprint has low bushfire potential. Areas of contiguous forest and high fuel loads represent the most at-risk locations within the disturbance footprint.

The impact of bushfire on a given ecosystem will vary depending upon its intensity, the season, the time since the last fire, the vegetation structure as well as the species composition involved. Specific impacts that occur to these communities as a result of fire include a reduction in total area, a loss of biodiversity and a loss of soil nutrients through a reduction in available organic matter.

While bushfire is an important factor in shaping the dynamics on many Australian ecosystems, too frequent fire can alter the species composition of the communities and facilitate weed infestation and dieback.

Activities which may increase the risk and frequency of bushfires occurring within and adjoining the disturbance footprint include the careless discarding of matches and cigarette butts, littering and the operation of equipment (e.g. sparks associated from hot works).

Measures to minimise and mitigate potential Project bushfire impacts are discussed in Section 6. Mitigation measures will be incorporated into the Project EMP(C) to minimise the risk of bushfire and therefore this impact is considered to be low risk.

The potential Project bushfire impacts and implementation of mitigation measures have been incorporated into the SIAs (refer Section 7).

5.2.8 Noise, vibration and light pollution

Increased noise, vibration and/or light can alter individual species behaviours, and disrupt the balance of inter-species interactions. Typically, fauna will move away from noise and light sources as these may be perceived as a threat.

In general, construction activities generate noise and vibration which may impact on adjacent vegetation and fauna. The likelihood of potential impacts is anticipated to be greatest where Project activities take place near vegetated areas and known habitat.

During the construction phase, there will be an increase in noisy activity in the disturbance footprint as machinery undertakes clearing and other activities. Impacts of construction noise will be temporary and will not affect the entire disturbance footprint simultaneously. However, when activity and noise is occurring in areas adjoining retained habitat, potential impacts may include the following:

- Reduced foraging ability by auditory predators due to increased background noise
- Increased risk of predation by visual predators due to increased background noise
- Increased potential for collisions with vehicles/machinery.

During operation there is likely to be an increase in noise due to introduction of traffic into an area that previously did not have traffic before. Road traffic noise could disrupt fauna movement and behaviour impacting their foraging and predation avoidance. The Project design includes noise barriers, vegetation and a culvert underpass which could assist in minimising operational noise impacts to fauna using the area.

Artificial light used during Project construction can affect fauna by disrupting patterns, with quality of light (e.g. wavelength, colour), intensity and duration potentially evoking different responses. Impacts from increased light levels include disorientation from or attraction toward artificial sources of light; mortality from collisions with structures; and effects on light-sensitive cycles of species (e.g. breeding and migration for fauna and flowering in plants). Artificial light will be of greater impact during night works, however it is noted that the majority of the Project construction works will be undertaken during the daytime, with a minimal need for night works.

During operation the Project will include lighting on the new road and shared path. However the lighting design to be implemented includes directional road lighting and lower mounted share path lighting in order to reduce light spill towards sensitive receptors, including the Ben Bennett Bushland Park. There is also landscaping proposed between the shared path and Ben Bennett Bushland Park which will also reduce light spill towards sensitive receptors. As such the Project lighting is unlikely to impact on threatened fauna during operation.

The *'National Light Pollution Guidelines for Wildlife'* (DCCEEW 2023b) will be implemented as part of the Project and aims to recognise the potential conflicting requirements for human safety and wildlife conservation.

Measures to minimise and mitigate potential Project noise, vibration and light impacts are discussed in Section 6. Mitigation measures within the Project EMP(C) and EMP(O) will be implemented to reduce potential impacts of noise, vibration, and light and therefore this impact is considered to be low risk.

The potential Project noise, vibration and light impacts and implementation of mitigation measures have been incorporated into the SIAs (refer Section 7).

5.2.9 Dust deposition

In general, dust deposition from construction activities has the potential to impact upon vegetation if excessive quantities are sustained over extended periods of time. Excessive dust deposition on foliage reduces photosynthetic processes, which in turn stunts floral growth rates, and reduces the overall health of the remaining remnant communities within, and adjacent to, the disturbance footprint.

Measures to minimise and mitigate potential Project dust impacts are discussed in Section 6. Mitigation measures within the Project EMP(C) will be implemented to reduce potential impacts associated with dust deposition and therefore this impact is considered to be low risk.

The potential Project dust impacts and implementation of mitigation measures have been incorporated into the TECs and threatened fauna species SIAs (refer Section 7).

5.2.10 Impacts to root zones

The root zones of trees play a crucial role in maintaining their overall health and resilience. These zones are integral to nutrient uptake, water absorption, and the establishment of symbiotic relationships with soil microorganisms. Indirect impacts on these areas, due to impacts such as compaction, reduction in soil porosity, and root stress can lead to profound consequences for tree health and, consequently, the

surrounding vegetation community. Unmitigated, the degradation of root zones can lead to reduced biodiversity, increased soil erosion, and diminished habitat quality for dependent species. Changes in root zone dynamics may exacerbate the vulnerability of threatened ecological communities to invasive species, which often exploit disturbed natural systems. The loss of native plant species can alter the competitive dynamics within the ecosystem, enabling invaders to establish and proliferate at the expense of endemic flora.

Mitigation measures to avoid, minimise and mitigate impacts to root zones are outlined in Section 6. Mitigation measures within the Project EMP(C) will be implemented to reduce potential Project impacts to root zones and therefore this impact is considered to be low risk.

The potential Project impacts to root zones and implementation of mitigation measures have been incorporated into the TECs and threatened fauna species SIAs (refer Section 7).

5.2.11 Increasing edge effects

Edge effects refer to the differences in ecological conditions found between the boundary and the centre of a given vegetation patch. Edge effects can penetrate from 15 to 50 m into an area of remnant and non-remnant woody vegetation depending on the topography, physical processes and vegetation type involved (Murcia 1995). This reduces the interior (core) habitat through the migration of the community's 'edge' inwards (Lindenmayer & Fischer 2013). These variations can manifest in a range of environmental factors, such as weed presence, characteristics of vegetation (including structure, composition, and functioning), wildlife and their habitats, as well as soil attributes.

Edges and their effects can emerge from the clearing of vegetation and from the ongoing operation and maintenance of the road corridor. The key environmental impacts associated with the new edges established by the Project are likely to encompass:

- Greater temperature extremes: Edge areas typically experience more pronounced temperature variations and lower humidity compared to the interior of the vegetation, with these effects being more pronounced in densely vegetated regions.
- Physical disruption to edge vegetation: Ongoing disturbances, such as maintenance of operational road edges (e.g. maintenance vehicle access, vegetation trimming to ensure safety clearances, maintenance of fauna infrastructure) and pedestrian activity, can cause continual damage to boundary vegetation.
- Modification of microclimate: The introduction of new edges leads to increased light and wind exposure, thereby altering the local microclimate.
- Changes in soil properties: Edge areas may experience soil compaction, a decrease in organic matter, and heightened erosion risks.
- Introduction of invasive species: Weeds, pests, and pathogens can be brought in via mud and debris that clings to vehicles.
- Introduction of litter: Edge areas may experience an introduction/increase in litter discarded by motorists utilising the operational road.
- Alterations in vegetation: The impacts outlined above can lead to significant changes in the vegetation itself.

The Coastal Swamp Sclerophyll Forest TEC may be particularly sensitive to edge effects due to its characteristics of species composition and environmental conditions. A 100 m buffer zone, around direct TEC impact areas has been applied and is presented in Figure 4.8 as per conservation advice (DAWE 2021a).

Approximately 1.97 ha of Coastal Swamp Sclerophyll Forest TEC is located within 100 m of the disturbance footprint. Due to 100 m buffer distance between this TEC area and the disturbance footprint and the implementation of mitigation measures, the Project indirect impacts are unlikely to occur within this TEC area. As a precautionary measure, approximately 10 m of potential indirect impacts has been incorporated into the total boundary of the disturbance footprint beyond the actual design. Monitoring, management and rehabilitation measures will be applied to manage edge effects, hydrological changes and relevant threats listed in the conservation advice for the TEC (DAWE 2021a).

Conversely, the Lowland Rainforest of Subtropical Australia TEC may also be sensitive to edge effects for similar characteristics of species composition and environmental conditions. A 50 m buffer zone around the Lowland Rainforest of Subtropical Australia TEC has been applied and is presented in Figure 4.8 as per conservation advice (DSEWPC 2011a). Approximately 1.66 ha of Lowland Rainforest of Subtropical Australia TEC is located approximately 7.3 m to the north of the disturbance footprint, 0.13 ha of that patch is located within 50 m of the disturbance footprint. As a precautionary measure, approximately 10 m of potential indirect impacts has been incorporated into the total boundary of the disturbance footprint beyond the actual design. Due to the implementation of mitigation measures, the Project indirect impacts are unlikely to occur within the Lowland Rainforest of Subtropical Australia TEC. Monitoring, management and rehabilitation measures will be applied to manage edge effects and other relevant threats listed in the conservation advice for the TEC (DSEWPC 2011a).

To determine the risk of weed-related edge effects for the Coastal Swamp Sclerophyll TEC and Lowland Rainforest TEC, 100 m transects were placed perpendicular to the current edge of the TEC boundary measuring representative weed percentage cover every 10 m and extent of incursion along the transect (refer Figure 4.9). It was found that weed edge effects did not spread beyond 3 m into the current edge of these TECs. It is therefore anticipated that with the implementation of *MRTS 16 Landscape and Revegetation* (Clause 8.3) and *MRTS 51 Environmental Management* (Clauses 7.7.1 and 8.12) and the EMP(C) during construction and continuation of current weed maintenance during operation (refer Appendix L) weed edge effects resulting from construction and operation will be minimal. In addition, due to the distance between the Project footprint boundary and the Lowland Rainforest TEC being approximately 7.3 m, no weed-related edge effects are anticipated for this TEC.

The risk of Project works contributing significantly to edge effects is considered low as the disturbance footprint is already subject to fragmentation and disturbance (including from the existing Nicklin Way State-controlled road and HV transmission line). Many of these potential environmental impacts, including introduction of weeds, pest and pathogens, and vegetation impacts will be managed through best practice biosecurity practices and vehicle restrictions. Rehabilitation/revegetation of areas no longer used for construction activities will further reduce potential impacts. Measures to manage Project edge effects are further described in Section 6.

The potential Project edge effects impacts and implementation of mitigation measures have been incorporated into the TECs and threatened fauna species SIAs (refer Section 7).

6 Avoidance, minimisation and mitigation

6.1 Overview

This section details:

- The overall Project approach to avoiding, minimising and mitigating impacts to MNES and their habitat, including consideration of the 'S.M.A.R.T' principle
- The key avoidance measures that have been considered and implemented (or will be implemented)
- The SCC management framework (structure, processes and documentation requirements) (e.g. contract documents, management plans) to proactively manage potential impacts on MNES during each phase of the Project (i.e. design, construction and operational phases)
- The Project suite of proposed mitigation measures (summarised in Table 6.1) and the corresponding management plan/s that these measures will be captured within
- An assessment of the predicted effectiveness of the proposed avoidance and mitigation measures to achieve the relevant performance outcome
- A preliminary estimate of the cost to deliver the mitigation measures.

6.2 Approach

The Project has and will continue to adopt an 'avoid, minimise, mitigate and offset' approach to address the potential Project impacts on MNES and their habitat. This involves:

- **Avoid** – identifying and implementing reasonable and practicable options to avoid adverse impacts to the natural environment, including to MNES and their habitat. The key Project avoidance measures are discussed in Section 6.
- **Minimise and mitigate** – where avoidance of impacts cannot be fully achieved, identifying and implementing measures to reduce or lessen adverse impacts to the natural environment, including to MNES and their habitat. The proposed Project mitigation measures are detailed in Section 6 and have been developed with consideration to the 'S.M.A.R.T' principle. That is, they are:
 - S – Specific (what and how)
 - M – Measurable (baseline information, quantifiable (number/value), auditable)
 - A – Achievable (timeframe, financial and human resources)
 - R – Relevant (conservation advice, recovery plans, threat abatement plans)
 - T – Time-bound (set timeframes for implementation, performance and completion).
- **Offset** – following the identification and implementation of reasonable and practicable options to avoid adverse impacts, providing environmental offsets for remaining significant residual impacts. The proposed Project offset approach is detailed in Section 8.

6.3 Avoidance and minimisation measures

The majority of the proposed works have been collocated with existing infrastructure such as the HV transmission line, existing roads, residential development (demolition) and drainage infrastructure. The proposed action has been designed to firstly avoid impacts to flora and fauna species and their habitat. Where avoidance was not possible, the design and construction footprint has been minimised to the greatest extent possible, particularly in Ben Bennett Bushland Park.

The Project has undergone design refinements to avoid the identified potential impacts to MNES and has resulted in the following:

- Avoidance of direct and indirect impacts to the Lowland Rainforest of Subtropical Australia TEC, by micro-siting the design and construction footprint away from the extents of the TEC.

In addition to the above avoidance and as detailed in Section 2.5, the Project has incorporated minimisation measures to reduce impact to MNES. These measures include:

- Utilising existing cleared / disturbed areas where practicable, including existing powerline easements and road
- Designing the approach roads as close to the existing alignment as possible to minimise impact on the environment and ecological values
- The geometric design was considered in regard to minimising environmental and ecological impacts
- Incorporated retaining walls into the design instead of embankments to minimise the disturbance footprint and the extent of vegetation clearing
- Adopting a posted and design road speed of 50 km/hr to permit a reduced road design geometry and minimise the corridor footprint, as well as a reduction in the risk (likelihood and severity) of fauna mortality by vehicle strike.

6.4 Management framework

The Project has and will continue to be developed in accordance with the environmental management process set out in the TMR *Environmental Process Manual* (TMR 2023b and earlier versions). To date, this has included undertaking environmental assessments and reporting as summarised in Section 3.2 to support the various Project phases (options analysis, business case, preliminary design, detailed design). The key Project environmental management documents are:

- This preliminary documentation report together with any subsequent approval conditions issued by DCCEEW
- The REF report (Aurecon 2024e), prepared in accordance with the TMR *Environmental Processes Manual*
- The EMP(P) (Aurecon 2024d), prepared in accordance with the TMR *Environmental Processes Manual*. Prior to construction commencing, the EMP(P) will be updated by the Project Contractor to:
 - Reflect the revised disturbance footprint as detailed in this preliminary documentation (refer Section 2)
 - Provide any revisions to the scope of the proposed action, including additional information relating to MNES as contained in this preliminary documentation and any subsequent approval conditions
 - Provide details of the Project Contractor management responsibilities and timing for meeting Commonwealth, State and local statutory obligations and SCC contract requirements
 - Detail the processes for communicating with regulatory agencies, stakeholders and community during the construction phase.
- The EDR (Aurecon 2024c) prepared in accordance with the TMR *Environmental Processes Manual*.
- The TMR technical specifications and annexures (TMR 2025), including:
 - *MRTS04 General Earthworks*
 - *MRTS51 Environmental Management*
 - *MRTS52 Erosion and Sediment Control*
 - *MRTS16 Landscape and Revegetation Works*
 - *MRTS28 Contractor's Site Facilities and Camp*
 - *MRTS30 Asphalt Pavements*

- Copies of all TMR technical specifications are available online [here](#).
- TMR C7830 General Conditions of Contract – TMR Transport Infrastructure Contract-Construct Only (TIC-CO), which includes requirements for:
 - Development and implementation of a Project EMP(C) and associated management sub-plans, including ESCP and Pest and Weed Management Plan by the Project’s Contractor. The EMP(C) is to be approved by SCC and TMR prior to ground disturbance works commencing.
 - All relevant works to be undertaken in accordance with an agreement between TMR and the Kabi Kabi People
 - The Project Contractor to appoint an experienced Environmental Manager to manage the preparation and implementation of the Project EMP(C). The Environmental Manager is to be a Certified Professional in Erosion and Sediment Control (CPESC) with a minimum of ten years’ of transport infrastructure construction experience. The Environmental Manager position will be a full-time onsite role.
 - The Project Construction Brief and Tender Response Form outlining and referencing the Project’s environmental objectives, conditions, and commitments.

The Project EMP(C) to be developed by the Project Contractor will be required to comply with DCCEEW’s Environmental Management Plan Guidelines (DCCEEW 2024), TMR and SCC requirements and in doing so will:

- Define the environmental roles and responsibilities for the construction team/s
- Incorporate all Commonwealth, State and local legislative requirements and Project approval conditions and Project commitments (including compliance matrix)
- Detail specific subplans, including but not limited to air quality, biosecurity, fauna, vegetation, noise and vibration, and waste to address potential impacts during the construction phase. Each subplan will detail the relevant objectives, performance criteria, policies/standards/guidelines, mitigation measures and corrective actions, in accordance with S.M.A.R.T principles and incorporating those commitments and mitigation measures contained within this preliminary documentation report (refer Section 6.5)
- Reference the standalone Project WQMP and ASSMP
- Identify areas of high environmental risk and the management of those risks
- Address the environmental requirements and processes that will be followed during the construction phase
- Outline a schedule of monitoring, auditing, reviewing and reporting during the construction phase
- Be required to be reviewed and approved by SCC and TMR, and implemented by the Project Contractor prior to the relevant construction works/ground disturbance works commencing
- Be a ‘live’ document that will be updated as required based on new/additional knowledge as the construction phase progresses.

Indicative summary outlines for the Project EMP(C), WQMP and ASSMP describing the contents of each plan, have been prepared in accordance with DCCEEW’s Environmental Management Plan Guidelines (DCCEEW 2024) and are provided in Appendix N.

All Project packages will be delivered:

- During one Project construction period
- Fortnightly inspections by Project Environmental, formal quarterly audits (using TMR audit templates available at [Category 3 - Roadworks, Drainage, Culverts and Geotechnical \(Department of Transport and Main Roads\)](#))
- Independent ESC Audits by CPESC as per MRTS52.
- By a single construction Contractor suitably experienced and resourced in the delivery of road construction works having Federal, State and Local environmental conditions and constraints

- Under the control of an appointed construction Contract Administrator, suitably experienced and resourced in administration and control of road construction contracts delivered in accordance with environmental approval conditions
- Under the authority of SCC as the Principal,
- In partnership with the Queensland Government (TMR).

Following the completion of construction and prior to operations commencing, an EMP(O) will be prepared and implemented by SCC/TMR. The EMP(O) will:

- Define the environmental roles and responsibilities for the operations teams at SCC/TMR
- Include details of all relevant Project approval legislative requirements, conditions, commitments (compliance matrix)
- Describe the maintenance requirements and practices to be followed to avoid/minimise both natural and human potential environmental impacts
- Outline a schedule of monitoring, reviewing, reporting and auditing for the operational phase.

It is noted that SCC have a number of current operational plans in place such as *Sunshine Coast Biosecurity Plan 2024*, *Sunshine Coast Biosecurity Implementation Plan 2024* and *Regeneration Works Plan for Ben Bennett Bushland Park* which will also be applicable to the Project. These have been referenced throughout the operational phase mitigation measures section, where applicable (refer Table 6.1).

6.5 Mitigation measures

The SIAs (refer Section 7) completed for the proposed action concluded that the proposed action will have or is likely to have a significant residual impact on the following MNES and their habitat:

- Coastal Swamp Sclerophyll Forest TEC
- Koala
- Grey-headed flying-fox.

Table 6.1 details the mitigation measures that are to be implemented during each of the design/pre-construction, construction and operational phases of the Project, and in doing so details:

- Potential impacts: the potential impacts to MNES and their habitat as identified in Section 5
- Mitigation measures: the proposed measures to mitigate the potential impacts identified in Section 5. The Contractor will be required to incorporate these measures into each relevant EMP.
- Statutory or policy basis: the relevant Commonwealth, State or local statutory or policy basis for the proposed mitigation measure, and/or relevant TMR standard
- Environmental outcome: the aim of the mitigation measure
- Performance criteria: indicators to determine success
- Monitoring and evaluation program: activities to be undertaken to track implementation of the mitigation measure, including opportunities for improvement
- Responsible party: the party responsible for implementing the mitigation measure.

Table 6.1 Summary of potential impacts and proposed avoidance and mitigation measures

Potential impact	Avoidance/mitigation measure	Relevant statutory, policy or guideline document	Environmental outcome	Performance criteria	Monitoring and evaluation program	Responsible party
Design/pre-construction phase						
Water quality degradation	<ul style="list-style-type: none"> Ensure that the disturbance footprint defined during detailed design allows sufficient space for the provision of required temporary and permanent erosion and sediment control measures/pollution control measures. Develop stormwater quality management and water sensitive urban design by a suitably qualified person. Water quality improvement devices for the Project have been included within the Project detailed design (refer Appendix B). The proposed devices include: <ul style="list-style-type: none"> Grassed/vegetated swales Bioretention tree pits Bioretention basin Gross pollutant traps Landscaping/vegetation. 	<p><i>Road Planning and Design Manual (TMR 2024)</i></p> <p>International Erosion Control Association (2021) <i>Performance-Based Design and Installation Standard for Sediment Basins</i></p>	<p>Adverse effect on water quality is avoided or minimised through water quality assessment and implementation of MUSIC modelling.</p> <p>Environmental harm is avoided/minimised through the development of suitable drainage solutions and implementation of water quality improvement devices.</p>	<p>Stormwater quality management and water sensitive urban design will be developed by a suitably qualified person.</p> <p>There would be no greater increase than 3.3% across the events assessed.</p>	<p>Baseline water quality monitoring will confirm existing water quality in receiving waters and establish realistic and achievable water quality objectives for the proposed action through construction and operation.</p>	Designer
Changes to hydrology	<ul style="list-style-type: none"> Design effort to result in negligible changes to hydrology and associated potential flooding impacts in both the local and wider context of the hydrological regime of the Moreton Bay Ramsar Wetland. Project has been designed with the intent that the increase of impervious areas does not exceed the capacity of the local drainage network. 	<p><i>Road Planning and Design Manual (TMR 2024)</i></p> <p>International Erosion Control Association (2021) <i>Performance-Based Design and Installation Standard for Sediment Basins</i></p>	<p>Adverse effects to MNES, including the TECs are avoided or minimised.</p>	<p>There would be no greater increase than 3.3% across the events assessed.</p>	<p>Flooding modelling reviewed.</p>	Designer
Removal of threatened fauna habitat	<ul style="list-style-type: none"> Design must exhaust all opportunities to avoid and minimise the clearing footprint of MNES. Identify habitat exclusion zones prior to clearing to guide the placement of infrastructure and ancillary facilities outside of threatened fauna habitat areas, where possible. The limit of clearing (limit of work line) will be defined in Annexure <i>MRTS04.1 General Earthworks</i> and shown on the design drawings (refer Appendix B). The Contractor will be required to clearly delineate the limit of clearing in accordance with <i>Annexure MRTS04.1 General Earthworks</i> and design drawings and flag important features. Physical demarcation of disturbance footprint, to be completed by a qualified surveyor, with further verification/sign-off from SCC. Design should seek to retain areas of native vegetation that will provide a visual screen between the road and sensitive receptors and areas of native vegetation identified as important fauna habitat corridors. Planning for location of temporary works, including erosion and sediment controls, site offices, stockpile areas, and access tracks will seek to avoid clearing of native vegetation in accordance with <i>MRTS28 Contractor's Site Facilities and Camp Clause 4.2</i> and <i>MRTS51 Environmental Management Clause 8.1</i>. Landscaping and revegetation of the disturbance footprint will be undertaken in accordance with <i>MRTS16 Landscape and Revegetation</i> and landscape drawings. 	<p><i>MRTS04 General Earthworks</i></p> <p><i>MRTS51 Environmental Management</i></p> <p><i>MRTS16 Landscape and Revegetation</i></p> <p><i>MRTS28 Contractor's Site Facilities and Camp</i></p>	<p>Reduced impact to MNES during design consequently reducing fragmentation.</p>	<p>No authorised adverse impact to MNES and no incidents involving MNES habitat clearing and/or degradation outside the disturbance footprint.</p> <p>Disturbance boundary to be clearly delineated and demarcated.</p> <p>Full compliance with contract and approval requirements.</p> <p>Verified documentation of processes and reporting of compliance throughout all Project phases.</p>	<p>Construction contractor to review the design disturbance footprint and no-go zones prior to construction.</p>	Designer Contractor
Impacts to MNES Coastal Swamp Sclerophyll TEC	<ul style="list-style-type: none"> Design to exhaust all opportunities to avoid and minimise the clearing footprint of TEC. All temporary disturbances such as siting of laydown areas, site offices and access tracks are prohibited from within the TEC area. Design to have negligible hydrology impacts to the TEC. The limit of clearing (limit of work line) will be defined in Annexure <i>MRTS04.1 General Earthworks</i> and shown on the design drawings (refer Appendix B). Landscaping and revegetation of the disturbance footprint will be undertaken in accordance with <i>MRTS16 Landscape and Revegetation</i> and landscape drawings. 	<p><i>MRTS04 General Earthworks</i></p> <p><i>MRTS51 Environmental Management</i></p> <p><i>MRTS16 Landscape and Revegetation</i></p> <p><i>MRTS28 Contractor's Site Facilities and Camp</i></p>	<p>No adverse impact to the Coastal Swamp Sclerophyll TEC.</p> <p>Reduced impact to TEC during planning and construction phases.</p>	<p>No authorised adverse impact to MNES and no incidents involving MNES habitat clearing and/or degradation outside the disturbance footprint.</p> <p>Full compliance with contract and approval requirements.</p> <p>Verified documentation of processes and reporting of compliance throughout all Project phases.</p>	<p>Construction contractor to review the design disturbance footprint and no-go zones prior to construction.</p>	Designer Contractor

Potential impact	Avoidance/mitigation measure	Relevant statutory, policy or guideline document	Environmental outcome	Performance criteria	Monitoring and evaluation program	Responsible party
Impacts to MNES Lowland Rainforest of Subtropical Australia TEC	<ul style="list-style-type: none"> The limit of clearing (limit of work line) and requirement for flagging will be defined in Annexure <i>MRTS04.1 General Earthworks</i> and shown on the design drawings (refer Appendix B). No clearing is to occur within the mapped Lowland Rainforest of Subtropical Australia TEC. Flagging to be clearly visible and maintained for duration of construction. The Contractor to maintain a minimum 7.3 m buffer zone between the proposed action and Lowland Rainforest of Subtropical Australia TEC. Design to have negligible hydrology impacts to the TEC. Where structural root zones cannot be avoided (ie TPZs extend beyond the applied 7.3 m buffer zone), a suitably qualified and experienced arborist will be engaged to identify and implement a strategies to ensure that impacted trees can be retained (ie. selective trimming of canopy to ensure that the unimpacted roots can adequately support the retained canopy). This will ensure that impacts to trees on the edge of the TEC will be short term and not result in lasting impacts to the TEC. Exclusion of vehicles within the TEC and design measures to stop unauthorised vehicle access into the TEC during the operational phase of the Project 	<p><i>MRTS04 General Earthworks</i> <i>MRTS51 Environmental Management</i> <i>MRTS16 Landscape and Revegetation</i></p>	No adverse impact to the Lowland Rainforest of Subtropical Australia TEC.	<p>No authorised adverse impact to MNES and no incidents involving MNES habitat clearing and/or degradation outside the disturbance footprint.</p> <p>Full compliance with contract and approval requirements.</p> <p>Verified documentation of processes and reporting of compliance throughout all Project phases.</p>	Design review process of the disturbance footprint and no-go zones prior to construction.	Designer Contractor
Impacts to MNES Koala	<ul style="list-style-type: none"> Design to exhaust all opportunities to avoid and minimise the clearing footprint of Koala habitat. The limit of clearing (limit of work line) will be defined in Annexure <i>MRTS04.1 General Earthworks</i> and shown on the design drawings (refer Appendix B). Permanent fauna exclusion fencing has been designed for Koalas and other wildlife in accordance with <i>TMR Standard Drawing 1603</i> (refer Appendix B). Inclusion of 'WILD LIFE' road stencilling and pavement marking, and fauna (koala) roadside signage at entry/exit points within the section through Ben Bennett Bushland Park to alert drivers to the risk of wildlife vehicle collision. Refer to Photograph 6.1 and the design drawings in Appendix B. The Project detailed design has incorporated fauna furniture comprising interconnecting log rails with escape poles through and on either side of the 6,000(W) x 3,000(H) reinforced concrete box culvert to provide movement/threat abatement opportunities for Koalas (and other arboreal species) above ground away from the reach of predators and the operational road corridor. The design of fauna furniture: <ul style="list-style-type: none"> Is in accordance with <i>TMR Fauna Sensitive Transport Infrastructure Delivery Manual</i> (TMR 2024), <i>Koala Sensitive Design Guideline</i> (DES 2022), <i>TMR Standard Drawing 1603</i> (Koala fencing) and <i>Moreton Bay Regional Council (MBRC) Standard Drawing GI-0541</i> (fauna crossing underpass) and <i>GI-0510</i> (fauna refuge pole) Provides for dry passage Incorporates a stable, horizontal platform/rail a minimum of 1.5 m above the ground Requires horizontal platform/rail be a minimum of 300 mm wide comprising of either flat beams or round logs with the ends of each rail sloping to the ground with the outer cell wing walls to tie into natural terrestrial environments Incorporates refuge poles (new or salvaged timber) at each end of the culvert and complementary planting/revegetation and soft landscape treatments at culvert entrances to as part of a holistic approach to encourage fauna use Ensures provision of fauna exclusion fencing extends up and over culvert headwalls to direct fauna to the crossing and prevent entry to the operational road corridor. Refer Figure 6.1 for key details of the proposed culvert fauna furniture, and Appendix B for full drawings. Figure 6.2 provides a visual summary of all the design mitigation measures proposed for the Koala. 	<p><i>MRTS04 General Earthworks</i> <i>MRTS51 Environmental Management</i> <i>MRTS16 Landscape and Revegetation</i> <i>Fauna Sensitive Transport Infrastructure Delivery Manual (TMR 2024)</i> <i>Koala Sensitive Design Guideline (DES 2022)</i> <i>TMR Standard Drawing 1603</i> <i>MBRC Standard Drawings GI-0554</i> (fauna crossing underpass) and <i>GI-0510</i> (fauna refuge pole)</p>	Reduced impact to the Koala habitat during design and construction phases.	<p>No authorised adverse impact to MNES and no incidents involving MNES habitat clearing and/or degradation outside the disturbance footprint.</p> <p>Full compliance with contract and approval requirements.</p> <p>Verified documentation of processes and reporting of compliance throughout all Project phases.</p>	Design review process of the disturbance footprint and no-go zones prior to construction.	Designer Contractor

Potential impact	Avoidance/mitigation measure	Relevant statutory, policy or guideline document	Environmental outcome	Performance criteria	Monitoring and evaluation program	Responsible party
Impacts to MNES Grey-headed flying-fox	<ul style="list-style-type: none"> Design to exhaust all opportunities to avoid and minimise the clearing footprint of Grey-headed flying-fox habitat. The limit of clearing (limit of work line) will be defined in Annexure MRTS04.1 <i>General Earthworks</i> and shown on the design drawings (refer Appendix B). Design to account for Flying-fox friendly design principles, including removal of barbed/razor wire fencing in accordance with <i>National Recovery Plan for Grey-headed Flying-fox</i> (DAWE 2021b). 	<p><i>National Recovery Plan for Grey-headed Flying-fox</i> (DAWE 2021b) (specifically Recovery Objective 9)</p> <p><i>Fauna Sensitive Transport Infrastructure Delivery Manual</i> (TMR 2024)</p>	Reduced impact to the Grey-headed flying-fox habitat during planning and construction phases.	<p>No authorised adverse impact to MNES and no incidents involving MNES habitat clearing and/or degradation outside the disturbance footprint.</p> <p>Full compliance with contract and approval requirements.</p> <p>Verified documentation of processes and reporting of compliance throughout all Project phases.</p>	Design review process of the disturbance footprint and no-go zones prior to construction.	Designer Contractor
Loss of fauna movement and habitat fragmentation	<ul style="list-style-type: none"> Fauna mitigation structures such as fauna exclusion fencing, fauna refuge poles in accordance with TMR <i>Fauna Sensitive Transport Infrastructure Delivery Manual</i> (TMR 2024) and <i>Koala Sensitive Design Guideline</i> (DES 2022) have been incorporated during the Project detailed design (refer Appendix B). Landscaping and revegetation the disturbance footprint will be undertaken in accordance with <i>MRTS16 Landscape and Revegetation</i> and landscape drawings. 	<p><i>Fauna Sensitive Transport Infrastructure Delivery Manual</i> (TMR 2024)</p> <p><i>MRTS 16 Landscape and Revegetation</i></p>	Fauna movements not adversely impacted by the proposed action, especially for Koala and Grey-headed flying-fox.	<p>Adherence to <i>TMR Fauna Sensitive Transport Infrastructure Delivery Manual</i> (TMR 2024).</p> <p>Adequate fauna exclusion fencing provided around the perimeter of developed areas and key biodiversity areas to prevent fauna entrapment.</p>	Design review process of the disturbance footprint and no-go zones prior to construction.	Designer Contractor
Injury and/or mortality to fauna	<ul style="list-style-type: none"> Permanent fauna exclusion fencing has been designed and located for Koalas and other wildlife in accordance with TMR <i>Standard Drawing 1603</i>. Inclusion of 'WILD LIFE' road stencilling and pavement marking, and fauna (Koala) roadside signage at entry/exit points within the section through Ben Bennett Bushland Park to alert drivers to the risk of wildlife vehicle collision. Refer to Photograph 6.1 and the design drawings in Appendix B. A lighting audit/assessment has been conducted during detailed design to establish existing conditions. The Project temporary and permanent lighting will be designed in accordance with the principles of best practice lighting design. Lighting design measures to be implemented such as, lighting bulb type (i.e. LED), covering (e.g. dome versus flat) and heights in order to reduce light spill towards sensitive receptors, including the Ben Bennett Bushland Park. Consideration of soft lighting for shared use path. Consideration of dimming lighting of shared use path during peak hours. 	<p><i>Fauna Sensitive Transport Infrastructure Delivery Manual</i> (TMR 2024)</p> <p><i>TMR Standard Drawing 1603</i></p> <p><i>National Light Pollution Guidelines for Wildlife</i> (DCCEEW 2023b)</p>	No threatened fauna mortality during the construction or operational phases of the Project.	<p>Design and location of fauna exclusion fencing will maximise its effectiveness in preventing access to the road corridor.</p> <p>Inclusion of 'WILD LIFE' road stencilling and pavement marking will raise awareness and alert drivers.</p>	Design review process of the disturbance footprint and no-go zones prior to construction.	Designer Contractor
Construction phase						
Water quality degradation	<ul style="list-style-type: none"> Contractor to develop, implement and audit a ESCP (based on the concept ESCP) in accordance with the <i>Best Practice Erosion and Sediment Control Document</i> (ICEA 2008) and <i>MRTS 52 Erosion and Sediment Control</i> and outline measures for the prevention of erosion and sedimentation during construction. Prepare and implement a WQMP as a subplan to the EMP(C) based on the outline detailed in Appendix L. The WQMP must be prepared in accordance with DCCEEW's Environmental Management Plan Guidelines (DCCEEW 2024), and include: <ul style="list-style-type: none"> Objectives, targets and key performance indicators Compliance summary of the Project legislative and contractual obligations, approvals and commitments Detail roles and responsibilities, including competence, training and awareness Describe the existing environment, including environmental values and influences on water quality Summarise the baseline water quality monitoring program and data/results Set site specific water quality objectives and parameters developed with reference to water quality objectives defined in the <i>Queensland Water Quality Guidelines 2009</i>, <i>Environmental Protection (Water and Wetland Biodiversity) Policy 2019</i>; Pumicestone Passage Environmental Values and Water Quality Objectives (WQ1413) and in compliance with <i>MRTS51 Environmental Management</i> and <i>MRTS52 Erosion and Sediment Control</i> Detail the water quality monitoring program to monitor activities for the duration of construction and for three years after construction is complete to monitor and manage Project site activities and potential downstream impacts to Pumicestone Passage 	<p>Environmental Management Plan Guidelines (DCCEEW 2024)</p> <p><i>MRTS51 Environmental Management</i></p> <p><i>MRTS52 Erosion and Sediment Control</i></p> <p><i>MRTS30 Asphalt Pavements</i></p> <p>IECA Best Practice Guidelines</p> <p><i>Environmental Protection (Water and Wetland Biodiversity) Policy 2019</i> (EPP (Wetland and Water Biodiversity))</p> <p>TMR General Conditions of Contract Annex A Item 29A and 29C</p> <p><i>Work Health and Safety Act 2011</i> (Qld)</p>	<p>Water quality (pre and post construction) is maintained.</p> <p>No adverse impact to fauna/flora resulting from spills.</p> <p>Effective erosion and sediment control measures are implemented.</p>	<p>Construction cannot commence until the EMP(C) and ESPC have been reviewed and deemed suitable by TMR and SCC Environmental Officer.</p> <p>Strict adherence with the CPESC certified Construction ESCP.</p> <p>Offsite discharges do not cause pollution.</p> <p>No environmental harm recorded during construction.</p>	<p>Construction ESCP to be reviewed by a CPESC and signed off by SCC prior to construction commencing in accordance with requirements for a high erosion risk site as per Table 6.3 of <i>MRTS52 Erosion and Sediment Control</i></p> <p>Monthly independent erosion and sediment control audits by a third party CPESC or other Appropriately Qualified Person.</p> <p>Weekly surface water quality monitoring as per <i>MRTS51 Environmental Management</i> Clause 8.2.3 and <i>Annexure MRTS 51.1 Environmental Management</i> MRTS51.1 Item 2.3.</p> <p>Post rainfall event water quality monitoring as per</p>	Contractor CPESC

Potential impact	Avoidance/mitigation measure	Relevant statutory, policy or guideline document	Environmental outcome	Performance criteria	Monitoring and evaluation program	Responsible party
	<ul style="list-style-type: none"> – Describe the contingency and ameliorative measures/corrective actions to be implemented if adverse impact/s were to occur – Management, reporting, auditing and review requirements. ■ Location/risk relevant spill kits to be available. ■ Undertake weekly inspections and maintenance of machinery and infrastructure as per <i>MRTS51 Environmental Management</i>. ■ <i>Tack coat and/or asphalt shall not be placed when the pavement surface is wet or rain is imminent as per MRTS30 Asphalt Pavements.</i> ■ Prepare a Project EMP(C) in accordance with DCCEEW's Environmental Management Plan Guidelines (DCCEEW 2024), General Conditions of Contract Clause 15.7 Environmental Management, <i>MRTS51 Environmental Management</i> and <i>MRTS52 Erosion and Sediment Control</i> for SCC and TMR review and approval prior to construction commencing. Refer EMP(C) outline in Appendix L. The EMP(C) is to include measures such as: <ul style="list-style-type: none"> – Incorporate a WQMP (as detailed above) – Use of clean water diversion and onsite management of water – Emergency control plans for general spillages – Dust suppression measures – Requirement for fuel and chemicals to be stored in accordance with the applicable safety data sheets and Australian Standards including <i>AS 1940 – 2017 The storage and handling of flammable and combustible liquids</i> and the <i>Work Health and Safety Act 2011</i> (Qld) AS3833 – Spill response strategies. ■ Implement the Project EMP(C) for the duration of construction, with reviews and updates undertaken as required. 				<p><i>MRTS51 Environmental Management</i> Clause 8.2.3 and <i>Annexure MRTS51.1 Environmental Management</i> Item 2.3.</p> <p>Monitoring by visual inspection will be carried out by the Contractor, including following rainfall events during the construction phase.</p>	
Disturbance of ASS leading to runoff and leachate impacting land and water	<ul style="list-style-type: none"> ■ Contractor to engage a suitably qualified person with ASS experience to advise management and monitoring measures for ASS. ■ Contractor to prepare and implement an ASSMP in accordance with DCCEEW's Environmental Management Plan Guidelines (DCCEEW 2024) and <i>MRTS04 General Earthworks</i> for SCC and TMR review and approval prior to construction commencing. The ASSMP must detail the management and monitoring requirements for soils, surface waters and groundwaters to be implemented during the construction phase of the Project. Spoil treatment requirements (i.e. liming rates) and disposal/reuse opportunities will also be prescribed (refer ASSMP outline in Appendix L). 	<p>Environmental Management Plan Guidelines (DCCEEW 2024)</p> <p><i>MRTS51 Environmental Management</i></p> <p><i>MRTS04 General Earthworks</i></p> <p>Queensland ASS Technical Manual – Soil Management Guidelines (Queensland Government) ((QASSIT)) (DORDESI 2024)</p> <p>National ASS Sampling and Identification Methods Manual (Water Quality Australia 2018) or later current version</p>	Minimal loss or degradation of land attributable to the Project	<p>Water quality (pre and post construction) is maintained</p> <p>All ASS encountered during construction is investigated and managed in accordance with <i>MRTS04 General Earthworks</i> and QASSIT.</p> <p>All land disturbed during construction will be rehabilitated or otherwise stabilised at the completion of works.</p>	<p>ASSMP to be reviewed and signed off by SCC prior to construction commencing.</p> <p>Field and laboratory testing to be undertaken in accordance with <i>MRTS04 General Earthworks</i> Clause 10.1.</p> <p>Monitoring by visual inspection will be carried out by the Contractor, including following rainfall events during the construction phase.</p>	Contractor
Vegetation clearance and removal of threatened species habitat	<ul style="list-style-type: none"> ■ The limit of clearing (limit of work line) as detailed in <i>Annexure MRTS04.1 General Earthworks</i> and shown on the design drawings will be marked out by the Contractor and flagging of important features (e.g. TEC boundary) to prevent unnecessary vegetation clearing. Physical demarcation of disturbance footprint, to be completed by a qualified surveyor, with further verification/sign-off from SCC. ■ Minimise the clearing footprint, including avoiding/minimising clearing to mapped and ground-truthed threatened fauna and communities habitat. ■ No permanent clearing is to be conducted for temporary construction uses such as site compounds, car parks, laydown areas, etc. ■ A certified fauna spotter/catcher (i.e. holding a Rehabilitation Permit (Spotter Catcher) issued by DETSI is to be engaged prior to any vegetation clearing. The responsibilities of the fauna spotter catcher will be to ensure that: <ul style="list-style-type: none"> – Pre-clearance searches of habitat are undertaken, with habitat features/trees clearly identified and searched for fauna presence. – Displaced fauna are to be relocated to a suitable, previously identified recipient site, provided the animal did not sustain any injuries. Any injured animals (native or introduced) are to be taken to receive veterinary attention immediately. Once recovered, animals will be relocated to an area of similar habitat adjoining the Project, where practicable. – In the case of the presence of other fauna species, the spotter catcher will encourage the fauna to leave by reasonable means or capture and relocate it in 	<p>DCCEEW Environmental Management Guidelines (DCCEEW 2024)</p> <p><i>MRTS 04 General Earthworks</i></p> <p><i>Nature Conservation (Koala) Conservation Plan 2017</i></p> <p><i>MRTS16 Landscape and Revegetation</i></p> <p><i>MRTS51 Environmental Management</i></p> <p><i>MRTS28 Contractor's Site Facilities and Camp</i></p> <p><i>AS 4970-2009 Protection of trees on development sites</i></p> <p><i>PSSS01 General Supplementary Specification</i></p>	<p>No incidents involving MNES habitat clearing and/or degradation outside the approved disturbance footprint.</p> <p>No unauthorised adverse impacts to vegetation and habitats resulting from clearing operations.</p> <p>All ancillary and temporary works (construction laydowns, site offices, etc.) are located in previously cleared areas and do not result in the clearing of vegetation with MNES values.</p>	<p>Construction minimise impact to MNES disturbance footprint, where possible.</p> <p>No unauthorised clearing occurs</p> <p>Disturbance footprint to be clearly delineated and demarcated.</p> <p>Site temporary facilities to be reviewed and approved prior to commencing construction.</p>	<p>Design review process of the disturbance footprint and no-go zones prior to construction.</p> <p>Weekly environmental inspections and monthly environmental reporting as per <i>MRTS51 Environmental Management</i>.</p> <p>Monitoring of actual clearing areas and locations.</p>	Contractor

Potential impact	Avoidance/mitigation measure	Relevant statutory, policy or guideline document	Environmental outcome	Performance criteria	Monitoring and evaluation program	Responsible party
	<p>the local environment prior to felling and trimming. If the spotter/catcher determines that a fauna species is present in a tree he/she will remove the animal prior to the felling of that tree or any tree of which the crown overlaps that tree. All members of staff have an obligation to report any fauna species seen in areas to be cleared to the fauna spotter/catcher prior to clearing.</p> <ul style="list-style-type: none"> – Clearing only occurs once a spotter/catcher gives sign off that vegetation has been inspected and is clear of native fauna identified as present on the site. – Clearing commences in areas of least connectivity and directs fauna towards retained areas, in particular towards remnant vegetation with the Impact area. Clearing is sequenced to ensure adequate time for fauna to relocate towards retained areas. <ul style="list-style-type: none"> ■ Temporary fencing, including fauna fencing to be delineated on construction drawings and installed along physical clearing boundaries to clearly identify no-go zones. ■ Implement the relevant management measures from the Sunshine Coast Regional Council Koala Conservation Plan (Sunshine Coast 2022) and the recovery of the species as per the National Recovery Plan for the Koala (<i>Phascolarctos cinereus</i>) (combined populations of Queensland, New South Wales, and the Australian Capital Territory) (DAWE 2023). This will include sequential clearing practices and clearing works to be conducted in the presence of a suitably qualified Koala spotter which will be summarised in the Project EMP(C). ■ Strict control of ignition sources through hot works permit to minimise the risk of accidental fires. ■ Rehabilitation of disturbed habitat to be undertaken in suitable locations using native species in accordance with <i>MRTS16 Landscape and Revegetation</i> and landscape drawings included in Volume 2 of the TIC-CO. ■ Avoidance of key structural roots originating from the Inspection and identification of TPZ determined in accordance with <i>AS 4970-2009 Protection of trees on development sites</i> and the <i>PSSS01 General Supplementary Specification</i> assessed by a qualified arborist or relevant specialist for trees greater than 3 m. ■ In accordance with <i>PSSS01 General Supplementary Specification</i> the Contractor is to prepare a Vegetation Management Plan in accordance with the SCC Advanced Faunal Habitat Program information Sheet and Coarse Woody Debris Salvage Specifications. The Vegetation Management Plan is to be prepared, implemented and audited as part of the Project EMP(C). 					
Fauna injury/fatality due to collision with construction traffic/plant	<ul style="list-style-type: none"> ■ Site inductions and pre-start meetings to convey specific information to construction personnel and raise awareness/identification of species on site, as well as protocols relating to the protection of species and their habitat. For example, habitat tree inspection and management requirements; contact lists of nearby veterinary centres/wildlife hospitals and procedures for sick or injured fauna requiring rescue to be provided at induction. ■ A certified fauna spotter/catcher (i.e. holding a Rehabilitation Permit (Spotter Catcher) issued by the DETSI will be engaged prior to any vegetation clearing. The responsibilities of the fauna spotter catcher will ensure that: <ul style="list-style-type: none"> – Pre-clearance searches of habitat to be undertaken, with habitat features/trees clearly identified and searched for faun presence. – Displaced fauna will then be relocated to a suitable, previously identified recipient site, provided the animal did not sustain any injuries. Any injured animals (native or introduced) are to be taken to receive veterinary attention immediately. Once recovered, animals will be relocated to an area of similar habitat adjoining the Project, where practicable. – In the case of the presence of other fauna species, the spotter catcher will encourage the fauna to leave by reasonable means or capture and relocate it in the local environment prior to felling and trimming. If the spotter/catcher determines that a fauna species is present in a tree he/she will remove the animal prior to the felling of that tree or any tree of which the crown overlaps that tree. All members of staff have an obligation to report any fauna species seen in areas to be cleared to the fauna spotter/catcher prior to clearing. – Clearing only occurs once a spotter/catcher gives sign off that vegetation has been inspected and is clear of native fauna identified as present on the site. – Clearing commences in areas of least connectivity and directs fauna towards retained areas, in particular towards remnant vegetation with the Impact area. 	<p><i>MRTS51 Environmental Management</i> <i>MRTS16 Landscape and Revegetation</i> <i>TMR Standard Drawing SD1603</i></p>	<p>No threatened fauna mortality during the construction phase of the Project.</p> <p>Threatened fauna access and/or interaction with construction areas or activities is avoided through effective exclusion devices.</p>	<p>No recorded fauna species injured or killed during the construction works.</p> <p>No unauthorised clearing of habitat.</p>	<p>Weekly environmental inspections and monthly environmental reporting as per <i>MRTS 51 Environmental Management</i></p> <p>Monitoring of actual clearing areas and locations.</p>	Contractor

Potential impact	Avoidance/mitigation measure	Relevant statutory, policy or guideline document	Environmental outcome	Performance criteria	Monitoring and evaluation program	Responsible party
	<p>Clearing is sequenced to ensure adequate time for fauna to relocate towards retained areas.</p> <ul style="list-style-type: none"> Fauna Management Plan to be prepared, implemented and audited as a subplan to the Project EMP(C). Works to be undertaken in accordance with the Project High Risk SMP. Installation of temporary fauna exclusion fencing shall be installed to minimise Koalas or other fauna species entering the construction site. Domestic dogs are to be prohibited on the construction site at all times in accordance with MRTS 51 Environmental Management. Traffic Management Plan to be prepared, implemented and audited as a subplan to the Project EMP(C) to manage construction movement and access and will outline the current and expected flow of vehicle movements, identify potential collision points for terrestrial fauna Rehabilitation of temporary construction areas to be undertaken sequentially and as soon as practicable after clearing in accordance with <i>MRTS16 Landscape and Revegetation</i> and landscape drawings. 					
Impacts to MNES Coastal Swamp Sclerophyll TEC	<ul style="list-style-type: none"> Prior to construction verify the extent and condition of the Coastal Swamp Sclerophyll TEC to enable monitoring and reporting during construction and at the completion of the construction. Site-inductions and toolbox talks to convey specific information to construction personnel and raise awareness/identification of the TEC, as well as protocols relating to the protection of the TEC. Clearly delineate the limit of clearing in accordance with <i>MRTS04 General Earthworks</i> and flagging of TEC boundary to prevent unnecessary vegetation clearing. Clearly delineate a 100 m buffer zone from the boundary of clearing (that is direct impact area) as per the approved conservation advice (DAWE 2021a) with high visibility flagging to minimise indirect impacts and ensure vegetation removal is not undertaken outside of the disturbance footprint. Directly adjacent to remaining TEC, establish softscape general planting in particular endemic trees to reestablish canopy and soil permeability on the edge of the TEC. Within this buffer zone maintain current weed control provisions in Appendix L, particularly maintaining encroachment of edge effect weeds such as Signal grass. Within the 100 m TEC buffer particular actions to reduce changed hydrological regimes should include: <ul style="list-style-type: none"> Clean-water diversion to maintain hydrological regimes within the TEC in downslope areas where water can be diverted around construction site Ensure no permanent impoundment of drainage flows to maintain hydrological regimes Installation of stormwater inlet pit and drainage outflow to prevent concentration of concentrated erosive flow. Installation of Koala exclusion fencing will prevent movement of most species into high traffic regions of the proposed upgrade and will double to prevent recreational use of areas that are not designated walking tracks and minimise the disturbance from anticipated increase in active network use. Clear signage should delineate sensitive areas to avoid potential disturbance from recreational users. Temporary disturbances such as siting of laydown areas, site offices and access tracks are prohibited from within the TEC area. Strict control of ignition sources to minimise the risk of accidental fires. A Pest and Weed Management Plan will be prepared, implemented and audited as a subplan to the Project EMP(C). Obtain biosecurity certificates certifying all imported topsoils and mulches are weed free and regular weed hygiene inspections to be undertaken for all machinery entering the disturbance footprint to prevent introduction of new weed infestations within TEC. Machinery will be suitably cleaned prior to working within the TEC area to avoid introduction of any new weed species accordance with the <i>Vehicle and Machinery Checklists: Clean Down Procedures</i> (DAF 2019). Avoidance of key structural roots originating from the Inspection and identification of TPZ determined in accordance with AS4970 assessed by a qualified arborist or relevant specialist for trees greater than 3 m. Where structural root zones cannot be avoided, a suitably qualified and experienced arborist will be engaged to identify and implement a strategy to ensure that impacted 	<p><i>MRTS04 General Earthworks</i> <i>MRTS16 Landscape and Revegetation</i> <i>MRTS28 Contractor's Site Camp and Facilities</i> <i>MRTS51 Environmental Management</i> <i>Conservation Advice for the Coastal Swamp Sclerophyll Forest Of New South Wales And South East Queensland</i> (DAWE 2021a)</p>	No unauthorised clearing of Coastal Swamp Sclerophyll TEC.	<p>Disturbance footprint to be clearly delineated and demarcated. Buffer zones for MNES values applied to reduce indirect impacts.</p> <p>No fires in any vegetation, including the TEC.</p> <p>Full adherence to the ESCP within the Project EMP(C).</p> <p>Rehabilitation to include species that meet Key Diagnostic Characteristics and description of the TEC in the Conservation Advice.</p> <p>Full adherence to Project EMP(C), including early eradication of new weed incursions.</p>	<p>Prior to vegetation clearing and during entire construction phase.</p> <p>Weekly environmental inspections and monthly environmental reporting as per <i>MRTS51 Environmental Management</i>.</p>	Designer Contract

Potential impact	Avoidance/mitigation measure	Relevant statutory, policy or guideline document	Environmental outcome	Performance criteria	Monitoring and evaluation program	Responsible party
	<p>trees can be retained (i.e. selective trimming of canopy to ensure that the unimpacted roots can adequately support the retained canopy). This will ensure that impacts to trees will be short term.</p> <ul style="list-style-type: none"> Rehabilitation of disturbed habitat to be undertaken in suitable locations using native species that meet Key Diagnostic Characteristics and description of the TEC in accordance with <i>MRTS16 Landscape and Revegetation</i> and landscape drawings. The Project EMP(C) to be implemented to manage any indirect impacts such as dust, water quality, erosion and sediment controls, with their performance validated through monitoring, observations and reporting. Inclusion of myrtle rust management measures in the Pest and Weed Management Plan, including but not limited to regular cleaning of equipment, regular inspection of flora for signs of myrtle rust and thoroughly checking all external plants brought on site for rehabilitation for signs of myrtle rust. If myrtle rust is found adhering to the general biosecurity obligation of taking all practical and reasonable steps to minimise risks and limit spread and contacting Biosecurity Queensland on 13 25 23 to report sighting and trigger control actions. 					
Impacts to MNES Lowland Rainforest of Subtropical Australia TEC	<ul style="list-style-type: none"> Prior to construction complete a survey of the Lowland Rainforest of Subtropical Australia TEC to verify the extent and condition to enable monitoring during construction. Site-inductions and toolbox talks to convey specific information to construction personnel and raise awareness/identification of the TEC, as well as protocols relating to the protection of the TEC. Clearly delineate the limit of clearing in accordance with <i>MRTS04 General Earthworks</i> and no-go zone of the Lowland Rainforest of Subtropical Australia TEC to prevent unnecessary vegetation clearing. Construction footprint will be strictly limited to the smallest area possible required in order to facilitate the works. Clearing of the Lowland Rainforest of Subtropical Australia TEC is prohibited. Clean-water diversion to maintain hydrological regimes in downslope areas where water can be diverted around construction sites. EMP(C) to be implemented to manage any indirect impacts such as dust, water quality, erosion and sediment controls, with their performance validated through monitoring, observations and reporting. A Pest and Weed Management Plan will be prepared, implemented and audited as a sub-plan to the Project EMP(C). Ensure all imported topsoils and mulches are weed free and undertake regular weed hygiene inspections for all machinery entering from outside of the site to prevent introduction of new weed infestations in accordance with the <i>Vehicle and Machinery Checklists: Clean Down Procedures</i> (DAF 2019). Strict control of ignition sources to minimise the risk of accidental fires will be implemented. In the event of accidental clearing of the Lowland Rainforest of Subtropical Australia TEC, the area will be rehabilitated with species characteristic of the Lowland Rainforest of Subtropical Australia TEC as per the conservation advice (DSEWPC 2011). Where structural root zones cannot be avoided, a suitably qualified and experienced arborist will be engaged to identify and implement a strategy to ensure that impacted trees can be retained (i.e. selective trimming of canopy to ensure that the unimpacted roots can adequately support the retained canopy). This will ensure that impacts to trees will be short term. Ongoing weed, pest and restoration activities undertaken by SCC for the TEC within Ben Bennett Bushland Park in accordance with the Ben Bennett Bushland Park Regeneration Works Plan (refer Appendix L) and the exclusion of unauthorised vehicle access, noting that formed access track currently exist through the TEC which are used for educational activities. 	<p><i>MRTS04 General Earthworks</i> <i>MRTS16 Landscape and Revegetation</i> <i>MRTS51 Environmental Management</i> <i>Conservation Advice for the Lowland Rainforest of Subtropical Australia</i> (DSEWPC 2011)</p>	No unauthorised clearing of Lowland Rainforest of Subtropical Australia TEC.	<p>Disturbance footprint to be clearly delineated and demarcated. Buffer zones for MNES values applied to reduce indirect impacts.</p> <p>No fires in any vegetation, including the TEC.</p> <p>Full adherence to the ESCP.</p> <p>Full adherence to Project EMP(C), including early eradication of new weed incursions.</p>	<p>Prior to vegetation clearing and during entire construction phase.</p> <p>Weekly environmental inspections and monthly environmental reporting as per <i>MRTS51 Environmental Management</i>.</p>	Contractor
Impacts to MNES Koala	<ul style="list-style-type: none"> Site-inductions and toolbox talks to convey specific information to construction personnel and raise awareness/identification of Koalas. Clearly delineate the limit of clearing in accordance with <i>MRTS04 General Earthworks</i> and flagging of important feature (e.g. Koala habitat) to prevent unnecessary vegetation clearing. Conduct preclearance surveys by suitably qualified personnel and implement Koala spotters to locate Koalas within the disturbance footprint prior to clearing. 	<p><i>MRTS04 General Earthworks</i> <i>MRTS16 Landscape and Revegetation</i> <i>MRTS51 Environmental Management</i> <i>Nature Conservation (Koala) Conservation Plan 2017</i> <i>TMR Standard Drawing 1603</i></p>	No unauthorised clearing of Koala habitat.	<p>No records of Koala impacted by Project works.</p> <p>Disturbance boundary clearly delineated and demarcated.</p> <p>Installation of temporary Koala exclusion fencing as per <i>Annexure MRTS51.1 Environmental</i></p>	<p>Prior to vegetation clearing and during entire construction phase.</p> <p>Weekly environmental inspections and monthly environmental reporting as per <i>MRTS 51</i></p>	Designer Contractor

Potential impact	Avoidance/mitigation measure	Relevant statutory, policy or guideline document	Environmental outcome	Performance criteria	Monitoring and evaluation program	Responsible party
	<ul style="list-style-type: none"> Koala spotter catcher to be present on-site during clearing works and earthwork phases. Vegetation clearing is to comply with the sequential clearing requirements stated in the <i>Nature Conservation (Koala) Conservation Plan 2017</i>. Erect temporary Koala fencing in accordance with TMR Standard Drawing SD1603 around the construction works area. The fence is required to be installed around all areas of construction proposed within 150 m of remaining Koala habitat. Temporary Koala exclusion fencing will be inspected weekly to ensure fencing is in good condition and maintained so there are no points of egress for Koalas into the construction site. Domestic dogs are to be prohibited on the construction site at all times. Prior to vegetation clearing, trees (or areas) with Koalas present are clearly flagged (e.g. individual tree marked with a specific colour; signage/flagging tape for larger areas containing many trees), and an exclusion zone set in place by the Koala spotter catcher, and all personnel notified of location. In the event a Koala is identified within the construction areas, works are to stop within 50 m of the Koala or where the canopy of any other tree overlaps (whichever is greater). Works should not resume until the Koala(s) leave the area on its own accord. Rehabilitation of disturbed habitat to be undertaken in suitable locations (i.e. outside road corridor) using native species in accordance with the proposed actions <i>MRTS16 Landscape and Revegetation</i> and landscape drawings. 	<i>National Recovery Plan for the Koala (Phascolarctos cinereus) (combined populations of Queensland, New South Wales, and the Australian Capital Territory) (DAWE 2022c)</i>		<p><i>Management</i> will maximise its effectiveness in preventing access to the works and minimise impacts on native vegetation.</p> <p>Landscape and rehabilitation in accordance with <i>MRTS16 Landscape and Revegetation</i> and landscape drawings included in Volume 2 of the TIC-CO.</p>	<i>Environmental Management.</i>	
Impacts to MNES Grey-headed flying-fox	<ul style="list-style-type: none"> Clearly delineate the limit of clearing in accordance with <i>MRTS04 General Earthworks</i> and flagging of important feature (e.g. Grey-headed flying-fox habitat) to prevent unnecessary vegetation clearing Vegetation clearing across entire disturbance footprint to be supervised by a suitably qualified fauna spotter catcher with knowledge and experience relevant to management of flying-foxes and their habitat. For any clearing activities, a fauna spotter catcher will undertake a pre-clearing fauna inspection which will check for presence of new camps. Only a qualified and suitable fauna spotter catcher or wildlife carer with up-to-date Lyssavirus vaccines are to handle bats. Personnel must not attempt to touch or handle a flying-fox. If interaction with a flying-fox is required, a fauna spotter catcher must be contacted. This information will also be conveyed to all construction personnel during site inductions. If a new flying-fox camp is found within 300 m of the disturbance footprint a suitably qualified fauna spotter catcher will review the proposed construction activities and include timing and appropriate management measures in the Project EMP(C). Rehabilitation of disturbed habitat to be undertaken in suitable locations (i.e. outside road corridor) using native species in accordance with the proposed actions <i>MRTS16 Landscape and Revegetation</i> and landscape drawings. 	<p><i>Referral guideline for management actions in grey-headed and spectacled flying-fox camps (DotE 2015b)</i></p> <p><i>MRTS04 General Earthworks</i></p> <p><i>MRTS16 Landscape and Revegetation</i></p> <p><i>MRTS51 Environmental Management</i></p>	No unauthorised clearing of Grey-headed flying fox habitat.	<p>No records of Grey-headed flying-fox impacted by the Project.</p> <p>Disturbance boundary clearly delineated and demarcated.</p> <p>Landscape and rehabilitation in accordance with <i>MRTS16 Landscape and Revegetation</i> and landscape drawings included in Volume 2 of the TIC-CO.</p>	Weekly environmental inspections and monthly environmental reporting as per <i>MRTS51 Environmental Management.</i>	Contractor
Introduction or spread of pest or weed species	<ul style="list-style-type: none"> A Pest and Weed Management Plan will be prepared, implemented and audited as a sub-plan to the Project EMP(C). Undertake a pre-clearance weed survey with subsequent report outlining requirements for treatment (Australian Pesticides and Veterinary Medicines Authority registered (targeted) herbicides to be used by a licensed commercial operator (weed spraying) and management, which are to be implemented and reported on in accordance with the Project EMP(C). Treat weeds two weeks prior to clearing and grubbing activities as per <i>MRTS51 Environmental Management</i> and <i>MRTS16 Landscape and Revegetation Clause 7.3 Pesticides</i> for the treatment of weeds which may have been introduced during landscaping and revegetation. All imported fill or other construction materials to be certified weed free. Ensure all imported topsoils and mulches are weed free and undertake regular weed hygiene inspections for all machinery entering the site to prevent introduction of new weed infestations. Machinery will be suitably cleaned prior to working within the disturbance footprint to avoid introduction of any new weed species in accordance with the Department of Primary Industries Vehicle and Machinery Checklists: Clean Down Procedures, 2019. Based on pre-construction weed survey results, temporary washdowns will be required throughout high-risk activities (e.g. site establishment and clearing works). 	<p>Biosecurity Act</p> <p><i>Sunshine Coast Biosecurity Plan 2024</i></p> <p><i>Sunshine Coast Biosecurity Implementation Plan 2024</i></p> <p><i>MRTS04 General Earthworks</i></p> <p><i>MRTS16 Landscape and Revegetation</i></p> <p><i>MRTS51 Environmental Management</i></p>	<p>No pest or weeds brought into the disturbance footprint.</p> <p>No unauthorised adverse impact to MNES brought about by biosecurity hazards due to the Project works.</p>	<p>Full adherence to general biosecurity obligation under the Biosecurity Act.</p> <p>Full adherence to environmental management plans.</p>	<p>Pre-clearance weed survey.</p> <p>Weekly environmental inspections and monthly environmental reporting as per <i>MRTS51 Environmental Management.</i></p>	Contractor

Potential impact	Avoidance/mitigation measure	Relevant statutory, policy or guideline document	Environmental outcome	Performance criteria	Monitoring and evaluation program	Responsible party
	<ul style="list-style-type: none"> Vegetation waste from clearing and grubbing that is free from weeds, pest and pathogens will be used in conjunction with soil erosion and sediment control measures, including brush matting, mulch or fauna logs (Clause 7.2.5 of <i>MRTS04 General Earthworks</i>). Establish and comply with procedures for fire ant carrier material within zone 2, under Part 5, Division 2 of the <i>Biosecurity Regulation 2016</i>, or otherwise obtain a Biosecurity Instrument Permit. A Fire Ant Management Plan will be prepared, implemented and audited as a sub-plan to the Project EMP(C) and include details on steps that will be taken to reduce the risk of spreading fire ants, including complying with the movement and storage procedures. Ensure construction team undertake fire ant inspections of material that could carry fire ants. 					
Noise, dust and lighting impacts on MNES fauna	<ul style="list-style-type: none"> Dust will be controlled and monitored throughout the construction phase within direct and indirect impact areas through dust suppression (e.g. soil binders, watercarts), speed restrictions, appropriate erosion and sediment measures, and progressive stabilisation and revegetation of temporary disturbance areas, in accordance with the recommendations provided in the Air Quality Assessment and the requirements as set out in the EMP(P) and MRTS51.1. Air quality impacts from construction plant and equipment will be controlled and monitored throughout the construction phase in accordance with the recommendations provided in the Air Quality Assessment (SLR 2025) and the requirements as set out in the EMP(P) and MRTS51.1. Noise impacts associated with construction of the Project will be controlled and monitored throughout the construction phase in accordance with the recommendations provided in the Construction Noise Impact Assessment (Stantec Australia 2025) and the requirements as set out in the EMP(P) and MRTS51.1. Vibration impacts associated with construction of the Project will be controlled and monitored throughout the construction phase in accordance with the recommendations provided in the Vibration Impact Assessment (SLR 2025) and the requirements as set out in the EMP(P) and MRTS51.1. Project EMP(C) will include measures to mitigate the air quality, noise, vibration and light spill risk associated with the proposed action in accordance with <i>Queensland Environmental Protection Regulation 2019, Environmental Protection (Air) Policy 2019 and Environmental Protection (Noise) Policy 2019, National Light Pollution Guidelines for Wildlife (DCCEEW 2023b) and the Project specific environmental management documentation</i>. Stage construction works to minimise the area of disturbed soil at any one time. Clearing activities will be restricted to daylight hours to reduce impacts from construction light and noise on threatened species. Project working times outlined within the construction contract documents prohibits night works on the following sections of the Project: <ul style="list-style-type: none"> Third Avenue Extension between Arthur Street and Nicklin Way Gosling Street Extension between Omrah Ave and Bowman Road. Where night works are required elsewhere on the Project, lights will be directed to minimise light spill into areas adjacent to the Project site, including areas of natural habitat to reduce impacts on nocturnal fauna species. Where required, hoarding or shielding will also be used to ensure light spill is not affecting nocturnal fauna in sensitive locations. 	<p><i>MRTS02 Provision for Traffic GT&C Schedule 1 Item 1 (Working Days and Working Hours)</i></p> <p><i>MRTS51 Environmental Management Environmental Protection Regulation 2019 Environmental Protection (Air) Policy 2019 Environmental Protection (Noise) Policy 2019 Transport Noise Management Code of Practice: Volume 2 - Construction Noise and Vibration Road Traffic Air Quality Management Manual National Light Pollution Guidelines for Wildlife (DCCEEW 2023b) Construction Noise Impact Assessment (Stantec Australia 2025) Air Quality Assessment (SLR 2025) Vibration Impact Assessment (SLR 2025)</i></p>	No impact from construction affecting MNES fauna survival.	<p>The Project EMP(C) measures to minimise dust, noise, vibration and lighting impacts will be implemented successfully and measured against criteria nominated in <i>MRTS 51 Environmental Management</i>.</p> <p>No records of injured MNES fauna due to construction, noise, vibration, dust and lighting impacts.</p> <p>Night works to be approved by the Contract Administrator at least 7 days prior to commencement of night works.</p>	Weekly environmental inspections and monthly environmental reporting as per <i>MRTS 51 Environmental Management</i> .	Designer Contractor
Operational phase						
Water quality degradation	<ul style="list-style-type: none"> Prepare and implement an operational phase WQMP as a subplan to the EMP(O). The WQMP must be prepared in accordance with DCCEEW's Environmental Management Plan Guidelines (DCCEEW 2024), and include: <ul style="list-style-type: none"> Objectives, targets and key performance indicators Compliance summary of the Project legislative and contractual obligations, approvals and commitments Detail roles and responsibilities, including competence, training and awareness 	<p>Environmental Management Plan Guidelines (DCCEEW 2024)</p> <p><i>Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP (Wetland and Water Biodiversity))</i></p> <p><i>Work Health and Safety Act 2011 (Qld) Structures Inspection Manual Part 1: Structures Inspection Policy (TMR 2016)</i></p>	<p>Water quality post construction is maintained.</p> <p>No adverse impact to fauna/flora resulting from spills.</p> <p>Water quality treatment devices are routinely inspected, maintained and defects rectified in a timely manner.</p>	<p>The Project EMP(O) measures to avoid water quality degradation will be implemented successfully.</p> <p>No environmental harm recorded during the operational phase.</p>	Implementation of operational phase water quality monitoring program for a period of one year following the completion of construction.	SCC and TMR for each of their respective operational road assets.

Potential impact	Avoidance/mitigation measure	Relevant statutory, policy or guideline document	Environmental outcome	Performance criteria	Monitoring and evaluation program	Responsible party
	<ul style="list-style-type: none"> – Describe the existing environment including environmental values and influences on water quality – Summarise the baseline and construction phase water quality monitoring program and data/results – Set site specific operational water quality objectives and parameters developed with reference to water quality objectives defined in the Queensland Water Quality <i>Guidelines 2009, Environmental Protection (Water and Wetland Biodiversity) Policy 2019</i>; Pumicestone Passage Environmental Values and Water Quality Objectives (WQ1413) – Inspection and maintenance program for water quality treatment infrastructure – Detail the water quality monitoring program to monitor operational phase after activities and potential downstream impacts to Pumicestone Passage – Describe the contingency and ameliorative measures/corrective actions to be implemented if adverse impact/s were to occur – Management, reporting, auditing and review requirements. <ul style="list-style-type: none"> ■ Undertake inspections of all culverts in accordance with the <i>Structures Inspection Manual Part 1: Structures Inspection Policy</i> (TMR 2016) 					
Fauna injury/fatality due to collision with operational traffic	<ul style="list-style-type: none"> ■ Adopting a restrictive road design geometry and a posted (and design) road speed of 50km/hr to reduction in the risk (likelihood and severity) of fauna mortality or injury by vehicle strike. ■ Incorporate into the EMP(O) the requirement to: ■ Maintain posted vehicle speed along the section through Ben Bennett Bushland Park of 50 km/hour ■ Maintain fauna exclusion fencing as part of routine road corridor maintenance to remove debris and replace damaged/worn sections to ensure proper functioning and minimise wildlife strike. This includes routine trimming of overhanging branches to prevent wildlife entry. ■ Maintain 'WILDLIFE' road stencilling and pavement marking, and fauna signage at entry/exit points within the section through Ben Bennett Bushland Park to alert drivers of the risk of wildlife vehicle collision ■ Maintain fauna furniture as part of routine road corridor maintenance to remove debris (including within culverts) and replace damaged/worn elements to ensure proper functioning and enable target fauna usage. 	<i>TMR Fauna Sensitive Transport Infrastructure Delivery Manual</i> <i>TMR Standard Drawing 1603</i>	No threatened fauna mortality during the operational phase of the Project. Threatened fauna access and/or interaction with the operational road corridor is minimised through effective exclusion devices in key areas.	The Project EMP(O) measures to avoid fauna injury or fatality will be implemented successfully. Operational phase vegetation management is limited to only those works necessary to maintain operational safety and efficiency of the operational road corridor.	Undertake regular inspections as part of SCC local road and TMR State-controlled road maintenance programs. Inspect fauna furniture at least annually targeting fauna underpass structures prior to start of Koala breeding season (July). A maintenance check is to be performed within five days of any reported road kill incident.	SCC and TMR for each of their respective operational road assets.
Impacts to MNES Coastal Swamp Sclerophyll TEC	<ul style="list-style-type: none"> ■ Incorporate into the EMP(O) the requirement to: ■ Minimise operational phase clearing to only those works necessary to maintain operational safety and efficiency of the operational road corridor. 	<i>TMR Fauna Sensitive Transport Infrastructure Delivery Manual</i>	No clearing of Coastal Swamp Sclerophyll TEC during the operational phase.	Operational phase vegetation management is limited to only those works necessary to maintain operational safety and efficiency of the operational road corridor.	Undertake regular inspections as part of SCC local road and TMR State-controlled road maintenance programs.	SCC and TMR for each of their respective operational road assets.
Impacts to MNES Lowland Rainforest of Subtropical Australia TEC	<ul style="list-style-type: none"> ■ Incorporate into the EMP(O) the requirement to: ■ Minimise operational phase clearing to only those works necessary to maintain operational safety and efficiency of the operational road corridor. ■ In addition to the EMP(O), ongoing weed, pest and restoration activities during the operational phase will be undertaken by SCC for the TEC within Ben Bennett Bushland Park in accordance with the Ben Bennett Bushland Park Regeneration Works Plan (refer Appendix L) and the exclusion of unauthorised vehicle access, noting that formed access track currently exist through the TEC which are used for educational activities. 	<i>Conservation Advice for the Lowland Rainforest of Subtropical Australia</i> (DSEWPC 2011)	No clearing of Lowland Rainforest of Subtropical Australia TEC during the operational phase.	Operational phase vegetation management is limited to only those works necessary to maintain operational safety and efficiency of the operational road corridor.	Undertake regular inspections as part of SCC local road and TMR State-controlled road maintenance programs.	SCC and TMR for each of their respective operational road assets.

Potential impact	Avoidance/mitigation measure	Relevant statutory, policy or guideline document	Environmental outcome	Performance criteria	Monitoring and evaluation program	Responsible party
Impacts to MNES Koala	<ul style="list-style-type: none"> Incorporate into the EMP(O) the requirement to: <ul style="list-style-type: none"> Maintain fauna exclusion fencing as part of routine road corridor maintenance to remove debris and replace damaged/worn sections to ensure proper functioning and minimise wildlife strike in accordance with <i>Structures Inspection Manual Part 1: Structures Inspection Policy</i> (TMR 2016) Maintain fauna furniture as part of routine road corridor maintenance to remove debris (including within culverts) and replace damaged/worn elements to ensure proper functioning and enable target fauna usage Maintain 'WILDLIFE' road stencilling and pavement marking, and fauna signage at entry/exit points within the section through Ben Bennett Bushland Park to alert drivers of the risk of wildlife vehicle collision Minimise operational phase clearing to only those works necessary to maintain operational safety and efficiency of the operational road corridor. 	<p><i>TMR Fauna Sensitive Transport Infrastructure Delivery Manual</i> <i>Nature Conservation (Koala) Conservation Plan 2017</i> <i>TMR Standard Drawing 1603</i> <i>National Recovery Plan for the Koala (Phascolarctos cinereus) (combined populations of Queensland, New South Wales, and the Australian Capital Territory)</i> (DAWE 2022c) <i>Structures Inspection Manual Part 1: Structures Inspection Policy</i> (TMR 2016)</p>	<p>No Koala mortality during the operational phase of the Project. Koala access and/or interaction with the operational road corridor is minimised through effective exclusion devices in key areas</p>	<p>No recorded Koalas injured or killed during the operational phase. Any operational phase clearing is limited to only those works necessary to maintain operational safety and efficiency of the operational road corridor.</p>	<p>Undertake regular inspections as part of SCC local road and TMR State-controlled road maintenance programs. Inspect fauna furniture at least annually targeting fauna underpass structures prior to start of Koala breeding season (July). A maintenance check is to be performed within five days of any reported road kill incident.</p>	<p>SCC and TMR for each of their respective operational road assets.</p>
Impacts to MNES Grey-headed flying-fox	<ul style="list-style-type: none"> Incorporate into the EMP(O) the requirement to: Minimise operational phase clearing to only those works necessary to maintain operational safety and efficiency of the operational road corridor. 	<p><i>TMR Fauna Sensitive Transport Infrastructure Delivery Manual</i></p>	<p>No clearing of Grey-headed flying fox habitat.</p>	<p>Operational phase vegetation management is limited to only those works necessary to maintain operational safety and efficiency of the operational road corridor.</p>	<p>Undertake regular inspections as part of SCC local road and TMR State-controlled road maintenance programs.</p>	<p>SCC and TMR for each of their respective operational road assets.</p>
Impacts from pest animals on threatened fauna and their usage of crossing structures	<ul style="list-style-type: none"> Incorporate into the EMP(O) the requirement to: Consult with SCC Biosecurity Working Group regarding current initiatives (SCC Prevention and Control Program for Invasive Animals) and regional pest control agencies (i.e. Biosecurity Queensland) as applicable Implement a Project Pest Control Management Plan, focused on crossing structures, where deemed appropriate. 	<p><i>Sunshine Coast Biosecurity Plan 2024</i> <i>Sunshine Coast Biosecurity Implementation Plan 2024</i> <i>Biosecurity Act 2014 (Qld)</i> <i>TMR Fauna Sensitive Transport Infrastructure Delivery Manual</i></p>	<p>No adverse impact to MNES fauna resulting from pest</p>	<p>The Project EMP(O) measures to reduce pest animal predation will be implemented successfully. SCC and TMR meet their General Biosecurity Obligation under the <i>Biosecurity Act 2014 (Qld)</i>.</p>	<p>Monitoring for presence of pest animals at crossing structures as part of fauna connectivity monitoring.</p>	<p>SCC and TMR for each of their respective operational road assets.</p>
Introduction or spread of pest or weed species	<ul style="list-style-type: none"> Incorporate into the EMP(O) the requirement to: Monitor and manage pest and weeds within the corridor, in coordination with SCC's existing Regeneration Works Plan for the Ben Bennett Bushland Park (refer Appendix L), such as: <ul style="list-style-type: none"> Woody weed management Boundary management to minimise and manage seed movement and edge effects. 	<p><i>Sunshine Coast Biosecurity Plan 2024</i> <i>Sunshine Coast Biosecurity Implementation Plan 2024</i> <i>Biosecurity Act 2014 (Qld)</i> <i>SCC Regeneration Works Plan for Ben Bennett Bushland Park</i></p>	<p>No adverse impact to MNES flora and MNES fauna habitat resulting from pest and weeds.</p>	<p>The Project EMP(O) measures to minimise and manage introduction and/or spread of pest and weed species will be implemented successfully. SCC and TMR meet their General Biosecurity Obligation under the <i>Biosecurity Act 2014 (Qld)</i>.</p>	<p>Undertake regular pest and weed inspections as part of SCC local road and TMR State-controlled road maintenance programs</p>	<p>SCC and TMR for each of their respective operational road assets</p>
Noise impacts on MNES fauna	<ul style="list-style-type: none"> Incorporate into the EMP(O) the requirement to: Maintain noise barriers as part of routine road corridor maintenance to ensure proper functioning. 	<p><i>TMR Fauna Sensitive Transport Infrastructure Delivery Manual</i> <i>Environmental Protection Act 1994 (Qld)</i></p>	<p>No adverse impact to MNES fauna resulting from operational noise.</p>	<p>The Project EMP(O) measures to minimise and manage operational noise impacts will be implemented successfully.</p>	<p>Undertake regular noise wall inspections as part of SCC local road and TMR State-controlled road maintenance programs</p>	<p>SCC and TMR for each of their respective operational road assets</p>
Dust impacts on MNES fauna	<ul style="list-style-type: none"> Incorporate into the EMP(O) the requirement to: Maintain sealed road surface as part of routine road corridor maintenance to ensure proper functioning Maintain posted vehicle speed along the section through Ben Bennett Bushland Park of 50 km/hour Maintain noise barriers and retaining walls as part of routine road corridor maintenance. 	<p><i>Fauna Sensitive Transport Infrastructure Delivery Manual</i> (TMR 2024) <i>Environmental Protection Act 1994 (Qld)</i></p>	<p>No adverse impact to MNES fauna resulting from operational corridor air quality.</p>	<p>The Project EMP(O) measures to minimise and manage operational dust impacts will be implemented successfully.</p>	<p>Undertake regular inspections as part of SCC local road and TMR State-controlled road maintenance programs</p>	<p>SCC and TMR for each of their respective operational road assets</p>
Lighting impacts on MNES fauna	<ul style="list-style-type: none"> Incorporate into the EMP(O) the requirement to: Inspect, maintain and repair permanent lighting as part of routine road corridor maintenance to ensure proper functioning, including to reduce light spill towards sensitive receptors, including the Ben Bennett Bushland Park Consider using soft lighting along the shared use path during operations Consider employing dimming of lighting along shared used path during off-peak usage hours. 	<p><i>Fauna Sensitive Transport Infrastructure Delivery Manual</i> (TMR 2024) <i>National Light Pollution Guidelines for Wildlife</i> (DCCEEW 2023b) CTCU Environmental Lighting Assessment (Aurecon 2024)</p>	<p>No adverse impact to MNES fauna resulting from operational lighting</p>	<p>Operational lighting is contained to within the operational corridor and reduces light spill towards sensitive receptors including the Ben Bennett Bushland Park</p>	<p>Undertake regular lighting inspections as part of SCC local road and TMR State-controlled road maintenance programs</p>	<p>SCC and TMR for each of their respective operational road assets</p>

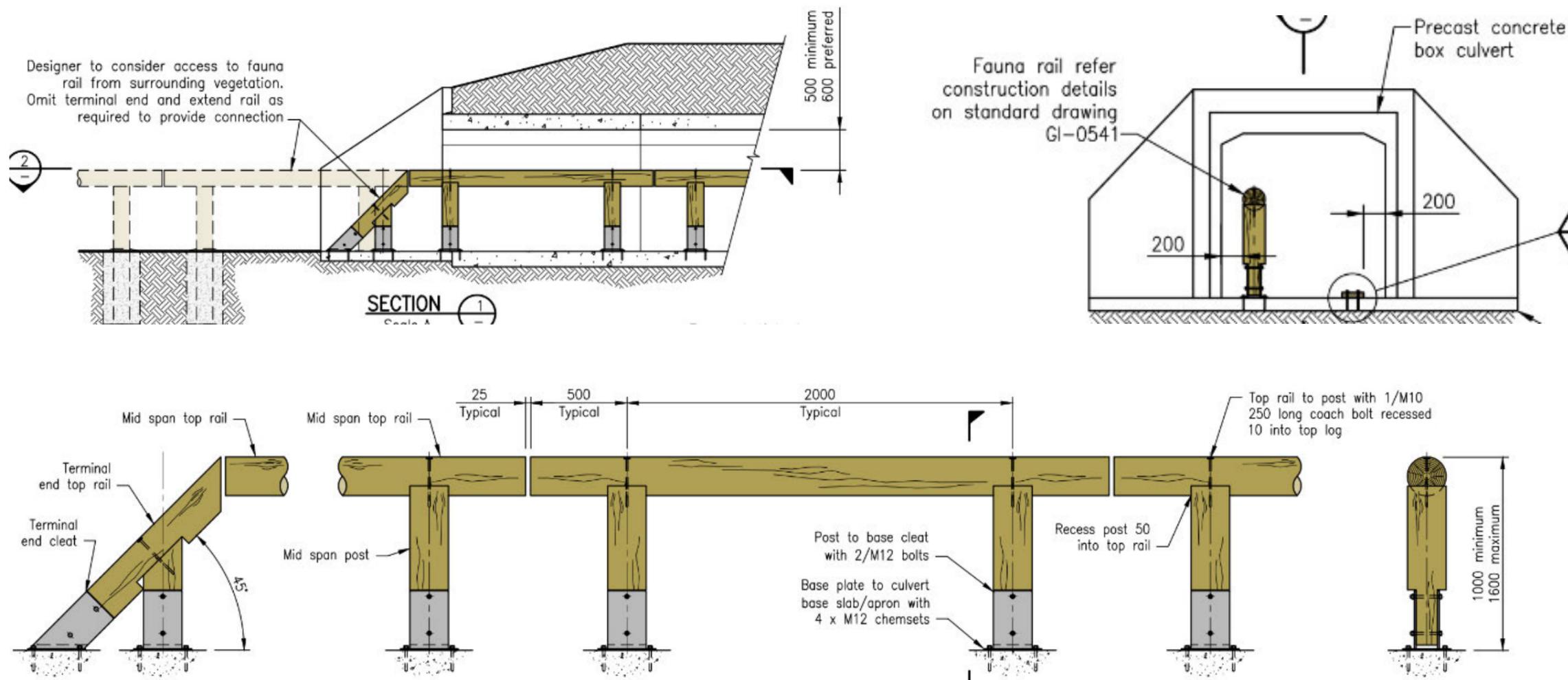
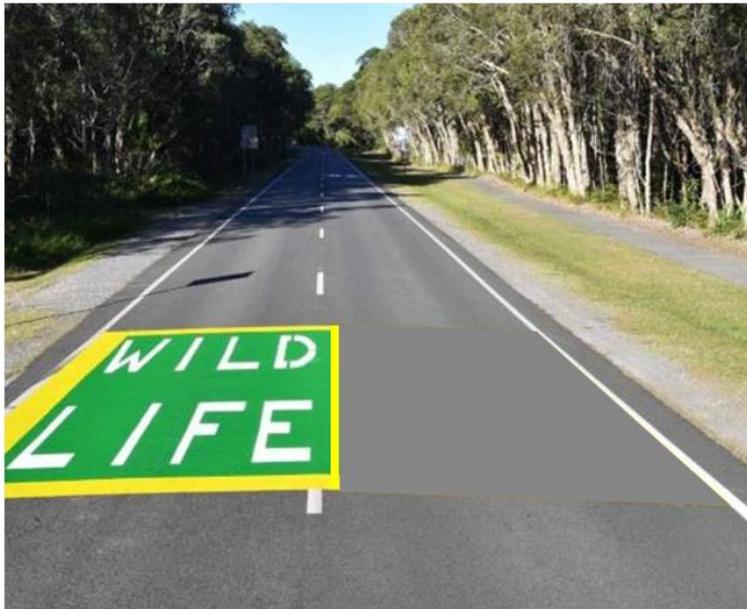
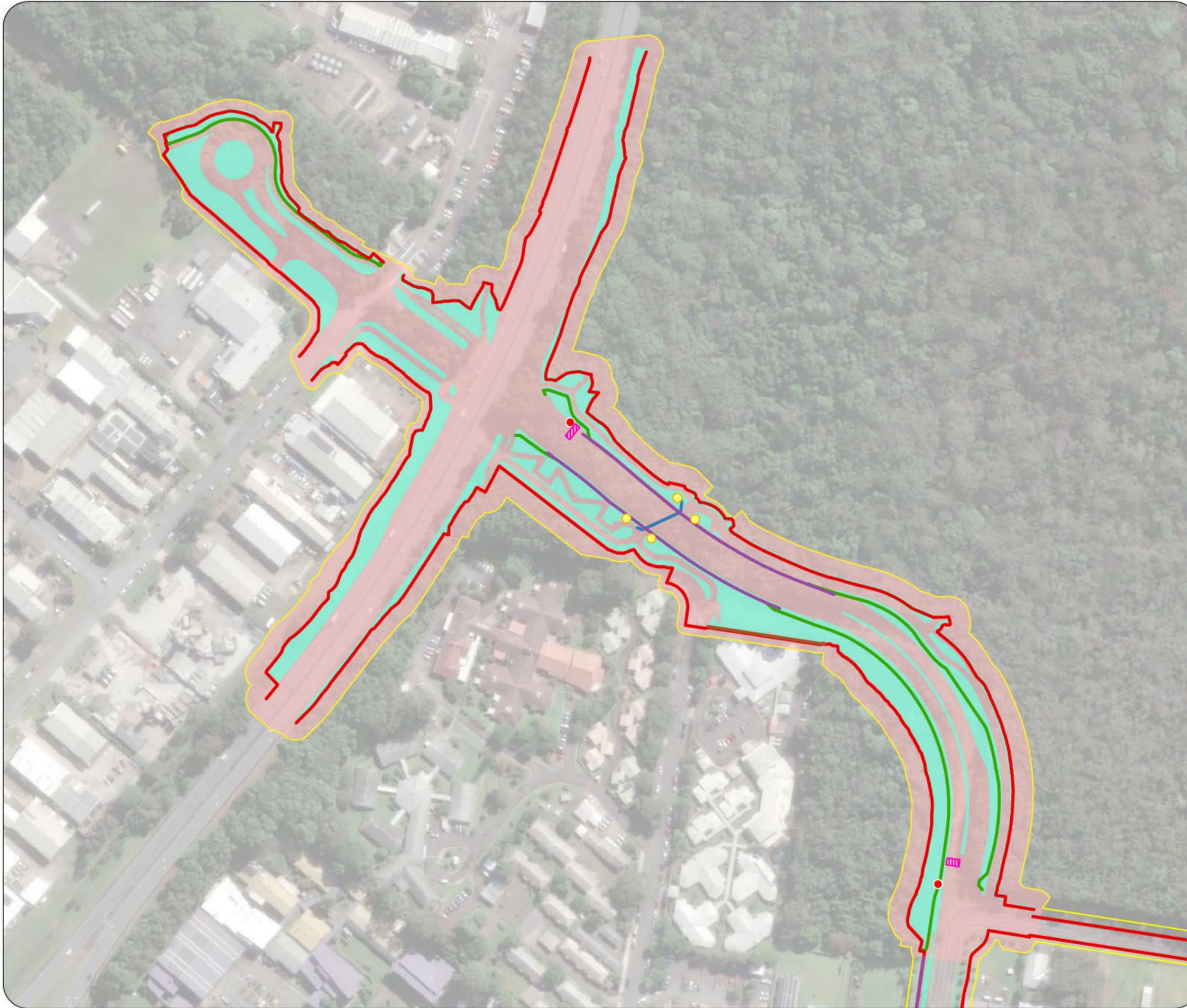


Figure 6.1 Schematic (top and middle) and photographic examples (bottom) of installed log rails with freestanding escape poles installed through a culvert beneath linear infrastructure



Photograph 6.1 'WILD LIFE' stencilling and pavement marking, and koala signage

Source: TMR (2024)



Service layers: Sources: Esri, TomTom, Garmin, FAO, NOAA, UDSG, © OpenStreetMap contributors, and the GIS User Community, City of Moreton Bay, Data sources: Queensland Spatial Catalogue - 2023



Legend

- Wildlife signage pole
- Refuge poles
- Koala fence
- Fauna log and rail
- Limit of work line
- Retaining walls
- Noise barrier
- ▨ Wildlife stencilling
- ▭ Landscaping
- ▭ Work Package B
- ▭ Disturbance Footprint

Revision: A

Date: 2/12/2025

A3 scale: 1:2,500



Caloundra Transport Corridor Upgrade

Figure 6.2 Summary of design mitigation measures for the Koala



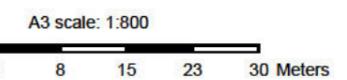
- Legend**
- Wildlife signage pole
 - Refuge poles
 - Koala fence
 - Fauna log and rail
 - Limit of work line
 - Retaining walls
 - Noise barrier
 - Landscaping
 - Disturbance Footprint
 - Wildlife stenciling



Service layers: Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, City of Moreton Bay, MBRC; Data sources: Queensland Spatial Catalogue - 2023

Revision: A

Date: 2/12/2025



Caloundra Transport Corridor Upgrade

Figure 6.2 Summary of design mitigation measures for the Koala

6.6 Effectiveness

Each of the proposed avoidance and mitigation measures presented in Section 6 has been assessed for predicted effectiveness; that is, a reflection of the confidence in the ability of the measure to achieve the performance outcome. The mitigation measures prescribed for the Project have been drawn on proven effectiveness of the measures outlined within the *Fauna Sensitive Transport Infrastructure Delivery Manual* (TMR 2024).

In undertaking this assessment, each avoidance and mitigation measure has been assigned one of the following effectiveness criteria based on the hierarchy of mitigation:

- High effectiveness – no direct or indirect impact to species and/or their habitats predicted to occur as a result of avoidance
- Moderate effectiveness – direct or indirect impacts to species and/or their habitats predicted to occur, however these impacts have been reduced/minimised, with no substantial recurring impact predicted
- Low effectiveness – direct or indirect impacts to species and/or their habitats predicted to occur, with limited reduction/minimising through control, survey and observation measures.

Overall, the measures proposed for the proposed action are considered to have a moderate to high effectiveness based on the Proponent's demonstrated experience in managing environmental impacts.

Table 6.2 details the outcomes of the assessment for each avoidance and mitigation measure, supported by references to SCC and TMR project examples, guidelines and other evidence that demonstrates effectiveness and success to achieve the desired performance outcome. Where similarities apply mitigation measure have been grouped together for this assessment.

Table 6.2 Evaluation of proposed avoidance and mitigation measures

Mitigation measure	Environmental outcome	Predicted effectiveness	Evidence and examples of success to achieve environmental outcome
Design phase			
Water quality, erosion and hydrology			
<ul style="list-style-type: none"> ■ Develop stormwater quality management and water sensitive urban design by a suitably qualified person ■ Water quality improvement devices for the Project have been included within the Projects detailed design. The proposed devices include: <ul style="list-style-type: none"> – Grassed/vegetated swales – Bioretention tree pits – Bioretention basin – Gross pollutant traps – Landscaping and vegetation. ■ Design effort to result in negligible changes to hydrology and associated flooding impacts in both the local and wider context of the hydrological regime of the Moreton Bay Ramsar Wetland 	<p>Adverse effect on water quality is avoided or minimised through water quality assessment and implementation of MUSIC modelling.</p> <p>Environmental harm is avoided/minimised through the development of suitable drainage solutions and implementation of water quality improvement devices.</p>	High	<p>The Project has incorporated water quality improvement devices.</p> <p>The Rockhampton Ring Road (EPBC 2020/8268) provides evidence on where successful implementation of capturing runoff and no discharge offsite occurred. The EMP(C) was audited during weekly inspections and no non-compliances were reported. Compliance reporting is publicly available in the project webpage: https://www.tmr.qld.gov.au/projects/rockhampton-ring-road</p> <p>The Coomera Connector (Stage 1) (EPBC 2020/8646) project is directly adjacent to Ramsar wetland and incorporated a number of treatment and capture devices to manage water quality to ensure no substantial or measurable change to Ramsar wetland. A WQMP was prepared and submitted to DCCEEW prior to clearing occurring within 50 m of Ramsar wetland. The Project is within the early stages of the construction, public information is available at the following webpage: https://www.tmr.qld.gov.au/projects/coomera-connector-stage-1</p>
Impacts to MNES			
<ul style="list-style-type: none"> ■ Design must exhaust all opportunities to avoid and minimise the clearing footprint of MNES ■ The limit of clearing (limit of work line) will be defined in Annexure MRTS04.1 <i>General Earthworks</i> and shown on the design drawings. The Contractor will be required to clearly delineate the limit of clearing in accordance with <i>Annexure MRTS 04.1 General Earthworks</i> and design drawings and flag important features. Physical demarcation of disturbance footprint, to be completed by a qualified surveyor, with further verification/sign-off from SCC. 	<p>Reduced impact to MNES during design and consequently reducing fragmentation</p>	High	<p>Through the design process of the proposed action direct impacts to MNES have been avoided and/or minimised wherever possible especially within Ben Bennett Bushland Park. Through the implementation of Project management framework and TMR MRTS specifications site specific clearing requirements have been established.</p> <p>This is demonstrated on the Bruce Highway upgrade from Caloundra Road to Sunshine Motorway (known as the CR2SM project), approved under EPBC 2015/7464, whereby the project implemented project management frameworks and the TMR MRTS specifications. Four annual compliance reports from this project are publicly available to demonstrate effectiveness, link to the public webpage: https://www.publications.qld.gov.au/dataset/tmr-bruce-highway-upgrade-caloundra-road-to-sunshine-motorway-annual-compliance-report</p>

Mitigation measure	Environmental outcome	Predicted effectiveness	Evidence and examples of success to achieve environmental outcome
<ul style="list-style-type: none"> ■ Implementation of fauna mitigation solutions consistent with the <i>Fauna Sensitive Transport Infrastructure Delivery Manual</i> (TMR 2024) and <i>Koala Sensitive Design Guideline</i> (DES 2022), including: <ul style="list-style-type: none"> – Permanent fauna exclusion fencing has been designed for Koalas and other wildlife in accordance with the TMR Standard Drawing 1603 – 'WILD LIFE' road stencilling and pavement marking has been designed at entry/exit points within the section through Ben Bennett Bushland Park to alert drivers of the risk of wildlife vehicle collision – Design to account for flying-fox friendly design principles – Lighting design measures to be implemented such as, lighting bulb type (i.e. LED), covering (e.g. dome verses flat) and heights in order to reduce light spill – Landscaping and revegetation the disturbance footprint will be undertaken in accordance with <i>MRTS16 Landscape and Revegetation</i> and landscape drawings included in Volume 2 of the TIC-CO. 	<p>Reduced impact to the Koala and Grey-headed flying-fox habitat during planning and construction phases.</p> <p>Enhanced wildlife awareness and alerting of drivers to risks of wildlife vehicle collision,</p> <p>Fauna movements not adversely impacted by the proposed action, especially for Koala and Grey-headed flying-fox,</p>	<p>High</p>	<p>SCC and TMR have delivered and continues to deliver fauna sensitive infrastructure throughout the Sunshine Coast region. The <i>Fauna Sensitive Transport Infrastructure Delivery Manual</i> (TMR 2024) is used to design, construct and maintain roads that better accommodate the needs of fauna, by reducing habitat or population fragmentation and the impact of road traffic.</p> <p>The Eton Range Realignment Project approved under EPBC 2015/7552 demonstrates successful example of fauna sensitive road design, particularly for Koalas, including fauna proof fencing, fauna underpass, wildlife road signage and a follow-up monitoring program to demonstrate effectiveness has occurred. Details can be reviewed online: https://www.tmr.qld.gov.au/projects/eton-range-realignment-project</p> <p>The Cresswell Road Bridge Project demonstrates the use of fauna structures through providing habitat pods for shelter and upgrade to wildlife bridge for arboreal species. SCC have been monitoring uses through cameras. Details can be reviewed online: https://www.sunshinecoast.qld.gov.au/news/the-amazing-unknown-wildlife-passage-we-zoom-past</p> <p>SCC constructed a new wildlife crossing under Mountain View Road in Maleny, which now provides a safe link for local fauna between the Mary Cairncross Reserve and nearby state forest. Details can be reviewed online: https://www.sunshinecoast.qld.gov.au/news/crossing-new-paths-for-wildlife-welfare</p> <p>SCC has successfully installed 'WILDLIFE' stencilling and pavement marking across roadways on Noojoor Road and Ocean Drive, Twin Waters to enhance driver awareness and prompt motorists to be more alert for wildlife (in this case, water dragons). Details can be reviewed online: https://www.sunshinecoast.qld.gov.au/news/how-we-are-helping-protect-an-ancient-wonder. No provision has been made for the inclusion of standard wildlife signage (i.e. stylised black animal on a yellow background) as there is overwhelming research evidence that concludes that most standard signage is largely ineffective in influencing vehicle speed, changing motorist behaviour or reducing rates of wildlife vehicle collision. Whilst stencilling is a form of signage, its location on the road is designed to alert motorists with a novel approach (TMR, 2024).</p>

Mitigation measure	Environmental outcome	Predicted effectiveness	Evidence and examples of success to achieve environmental outcome
Construction phase			
Water quality, erosion and hydrology			
Develop, implement and audit an ESCP (based on the concept ESCP) in accordance with 'Best Practice Erosion and Sediment Control Document' (ICEA, 2008) and MRTS52 Erosion and Sediment Control and outline measures for the prevention of erosion and sedimentation during construction	Water quality (pre and post construction) is maintained No adverse impact to fauna/flora resulting from spills. Effective erosion and sediment control measures are implemented	High	Monitoring of compliance with MRTS requirements and its effectiveness over the years has demonstrated construction measures to be highly effective in avoiding/mitigating erosion and sedimentation impacts. The CR2SM Project, approved under EPBC 2015/7464 demonstrates previous success in the implementation of best practice erosion and sediment control and compliance with legal and MRTS52 requirements and is evidenced in the commendation letter from DETSI to the Contractor at the CR2SM project. Publications located here: https://www.publications.qld.gov.au/dataset/tmr-bruce-highway-upgrade-caloundra-road-to-sunshine-motorway-annual-compliance-report
Contractor to prepare and implement a Water Quality Monitoring Plan	Water quality (pre and post construction) is maintained. No adverse impact to fauna/flora resulting from spills. Effective erosion and sediment control measures are implemented	High	Monitoring of compliance with MRTS requirements and its effectiveness over the years has demonstrated construction measures to be highly effective in avoiding and mitigating water quality impacts. The TMR Coomera Connector (Stage 1) (EPBC 2020/8646) project is directly adjacent to Ramsar wetland and incorporated a number of treatment and capture devices to manage water quality and ensure no substantial or measurable change to Ramsar wetland. WQMPs were prepared and submitted to DCCEE prior to clearing occurring within 50 m of Ramsar wetland. Details can be reviewed online: https://www.tmr.qld.gov.au/projects/coomera-connector-stage-1

Mitigation measure	Environmental outcome	Predicted effectiveness	Evidence and examples of success to achieve environmental outcome
Contractor requirement to prepare and implement an ASSMP, that has been endorsed by TMR prior to construction commencing	Minimal loss or degradation of land attributable to the Project. Water quality (pre and post construction) is maintained.	Moderate	As per the Queensland ASS Technical Manual – Soil Management Guidelines the offsite environmental impacts associated with disturbing ASS can often be mitigated when appropriate environmental management measures are implemented, this is done through a standalone ASSMP. The plan will be developed in accordance with the Queensland ASS Technical Manual – Soil Management Guidelines, webpage location: https://www.publications.qld.gov.au/ckan-publications-attachments-prod/resources/6d880993-4b80-45e3-9110-5c24fa7a7e75/soil-management-guidelines-version-5.1_1nov-2024_final.pdf?ETag=4174c06c44ba197679d49cf58cbb8f88
Impacts to MNES			
<ul style="list-style-type: none"> Construction mitigation measures associated with potential impacts to fauna, flora and their habitats and the general environment addressed by the successful implementation of a Project EMP(C) covering the suite of environmental values (i.e. fauna, flora, pest and weed, air, noise, vibration) and that has been endorsed by SCC prior to construction commencing Site-inductions and toolbox talks to convey specific information to construction personnel and raise awareness/identification of MNES 	No impact from construction affecting MNES fauna and flora survival.	High	The CR2SM Project, approved under EPBC 2015/7464 demonstrates previous success in the implementation of EMP(C) which underwent a document revision process by TMR. The Contractor provided monthly environmental reports demonstrating compliance with the EMP(C). Management measures of the EMP(C) sub-plans were monitored through daily inspections, supervision during vegetation clearing and accompanying fauna spotter-catcher reports, monitoring of water quality, erosion and sediment control performance, weeds/pests, etc. Internal and external audit checks are undertaken to ensure compliance, and a compliance tracking register is maintained by the Principal Contractor. Publications located here: https://www.publications.qld.gov.au/dataset/tmr-bruce-highway-upgrade-caloundra-road-to-sunshine-motorway-annual-compliance-report

Mitigation measure	Environmental outcome	Predicted effectiveness	Evidence and examples of success to achieve environmental outcome
<ul style="list-style-type: none"> A certified fauna spotter/catcher (i.e. holding a Rehabilitation Permit (Spotter Catcher) issued by the DETSI) will be engaged prior to any vegetation clearing. pre-clearance surveys to be undertaken by the certified fauna spotter/catcher Erect temporary fauna fencing in accordance with Annexure MRTS 51.1 <i>Environmental Management</i> around the construction works area, where required and delineate the clearing impact area with clear physical markers to ensure the clearing footprint is minimised as much as possible The limit of clearing (limit of work line) as detailed in Annexure MRTS04.1 <i>General Earthworks</i> and shown on the design drawings will be marked out by the Contractor and flagging of important features (e.g. TEC boundary) to prevent unnecessary vegetation clearing. Physical demarcation of disturbance footprint, to be completed by a qualified surveyor, with further verification/sign-off from SCC Vegetation clearing is to comply with the sequential clearing requirements stated in the <i>Nature Conservation (Koala) Conservation Plan 2017</i>. 	<p>No incidents involving MNES habitat clearing and/or degradation outside the approved disturbance footprint.</p> <p>No unauthorised adverse impacts to vegetation and habitats resulting from clearing operations.</p> <p>All ancillary and temporary works (construction laydowns, site offices, etc.) are located in previously cleared areas and do not result in the clearing of vegetation with MNES values.</p>		<p>Pre-clearance and clearance surveys have been successfully implemented and resulted in reduced impact to Koala habitat on the CR2SM project, approved under EPBC 2015/7464.</p> <p>Annual reporting on compliance with condition 3 (For the protection of the EPBC Act listed vulnerable Koala (<i>Phascolarctos cinereus</i>) the approval holder must: (a) Not disturb more than 35.3ha of Koala habitat within the Project site) of EPBC 2015/7464 demonstrated that the successful implementation of construction measures, in accordance with MRTS requirements, have resulted in 18.76 ha of Koala habitat being cleared by the project (well under the allowable limit of 35.3 ha).</p> <p>Compliance reporting is ongoing and publications located here: https://www.publications.qld.gov.au/dataset/tmr-bruce-highway-upgrade-caloundra-road-to-sunshine-motorway-annual-compliance-report</p>
<ul style="list-style-type: none"> Prior to construction, verify the extent and condition of the TECs to enable monitoring and reporting during construction and at the completion of the construction. 	<p>No unauthorised clearing of TECs.</p>	High	<p>Baseline surveys of TEC to verify extent and condition have been successfully implemented as part of the TMR Cooroy to Curra Section D Project (EPBC 2017/7941). Through employing this measure, the project was able to successfully reduce overall impacts to the TECs. Compliance reporting for the project is ongoing and publicly available in the project webpage: https://www.tmr.qld.gov.au/projects/bruce-highway-cooroy-to-curra/bruce-highway-cooroy-to-curra-section-d</p>
<ul style="list-style-type: none"> The Contractor will fulfil their General Biosecurity Obligation to mitigate biosecurity risks during construction through the preparation, implementation and auditing of a Pest and Weed Management Plan as a sub-plan to the Project EMP(C) Undertake a pre-clearance weed survey with subsequent report outlining requirements for treatment and management, which are to be implemented and reported on in accordance with the Project EMP(C) Treat weeds two weeks prior to clearing and grubbing activities as per MRTS 51 <i>Environmental Management</i> Ensure all imported topsoils and mulches are weed free and undertake regular weed hygiene inspections for all machinery entering the disturbance footprint to prevent introduction of new weed infestations within disturbance footprint 	<p>No pest or weeds brought into the disturbance footprint</p> <p>No unauthorised adverse impact to MNES brought about by biosecurity hazards due to the Project works.</p>	Moderate	<p>Monitoring of compliance with MRTS requirements, specifically MRTS 51, clause 8.12 Biosecurity and MRTS16 clause 8.3 Weed control and its effectiveness over the years has demonstrated construction measures to be highly effective in avoiding/mitigating impact.</p> <p>Further, general biosecurity obligation under the Biosecurity Act to be implemented as part of the Project EMP(C) and include:</p> <ul style="list-style-type: none"> Weeds, pest and pathogen monitoring and management measures and control Inspections/monitoring.

Mitigation measure	Environmental outcome	Predicted effectiveness	Evidence and examples of success to achieve environmental outcome
Operational phase			
Water quality, erosion and hydrology			
Water quality degradation	<p>Water quality post construction is maintained</p> <p>No adverse impact to fauna/flora resulting from spills.</p> <p>Water quality treatment devices are routinely inspected, maintained and defects rectified in a timely manner</p>	Moderate	<p>The Austroads Guide to Road Design sets out best practices for maintenance, including the need for regular inspection and cleaning of the drainage system to ensure it functions effectively and is clear of debris during operation. SCC will be responsible for the operational maintenance of the bio-basins, gross pollutant traps and bio-swales for the life cycle of the asset. On going maintenance to upkeep the stormwater treatment assets will include activities such as, weeding, supplementary planting as required, sediment removal from basins, swales and gross pollutant traps and ongoing general upkeep to ensure they are functioning as designed.</p>
Impacts to MNES			
<p>Fauna injury/fatality due to collision with operational traffic</p> <p>Impacts to MNES Koala</p>	<p>No threatened fauna mortality during the operational phase of the Project.</p> <p>Threatened fauna access and/or interaction with the operational road corridor is minimised through effective exclusion devices in key areas</p> <p>No Koala mortality during the operational phase of the Project.</p> <p>Koala access and/or interaction with the operational road corridor is minimised through effective exclusion devices in key areas</p>	High	<p>The Department of Environment and Science Koala-sensitive Design Guideline: A guide to koala-sensitive design measures for planning and development activities, highlights speed control as an effective measure to reduce impacts from traffic on koalas. The guideline further highlights that fauna exclusion fencing is suitable where it guides fauna to suitable crossing points and prevents them from interacting with high speed/volume roads.</p> <p>Given that there is no known current Koala population, speed reduction, fauna exclusion fencing, fauna underpass with appropriate furniture and wildlife signs through the operational area, is anticipated to have high effectiveness in reducing risk of traffic collision with koalas and other native fauna.</p>

Mitigation measure	Environmental outcome	Predicted effectiveness	Evidence and examples of success to achieve environmental outcome
<p>Impacts to MNES Coastal Swamp Sclerophyll TEC</p> <p>Impacts to MNES Lowland Rainforest of Subtropical Australia TEC</p> <p>Introduction or spread of pest or weed species</p>	<p>No clearing of Coastal Swamp Sclerophyll TEC during the operational phase</p> <p>No clearing of Lowland Rainforest of Subtropical Australia TEC during the operational phase</p> <p>No adverse impact to MNES fauna/flora resulting from pest and weeds</p>	<p>High</p>	<p>Current maintenance regimes of Ben Bennett Bushland Park is set out in the Regeneration Works Plan (refer Appendix L). This has effectively managed edge effects such as weeds (as evidenced from weed surveys of coverage and incursion) and as such post-construction this plan will continue to be applied during the operational phase of the Project.</p>

6.7 Indicative budget estimate

An indicative budget estimate has been prepared for the implementation of the avoidance, mitigation and offset measures for the Project and is presented in Table 6.3. It should be noted that these estimates are indicative only and are subject to a range of factors, including appointment of a Contractor and final Project timing.

Table 6.3 Indicative budget estimate for avoidance, minimisation and mitigation measures

Item	Estimated cost
Design and pre-construction phase, including: <ul style="list-style-type: none"> ■ Preliminary investigations, preparation and submission of environmental documents ■ Offsets (delivery and 20-year management) 	\$3,365,000.00
Construction phase, including: <ul style="list-style-type: none"> ■ Preparation and implementation of management plans (Project EMP(C)) and sub-plans, including submission and approvals; monitoring, review and auditing) ■ Fauna connectivity infrastructure ■ Corridor fencing (including fauna fencing and noise barriers) ■ Landscaping and revegetation ■ Sedimentation and spill basins (ESCP measures, temporary and permanent devices) 	\$5,232,000.00
Operational phase: <ul style="list-style-type: none"> ■ Ongoing monitoring, maintenance and compliance reporting for the disturbance footprint/operational road asset 	\$135,000.00
Total	\$8,732,000.00

7 Significant impact assessment

7.1 Overview

Under the MNES Significant Impact Guidelines 1.1, 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 upon the sensitivity, value, and quality of the environment, which is impacted, and upon the intensity, duration, magnitude, and geographic extent of the impacts. Each of these factors must be considered when determining whether an action is likely to have a significant impact on MNES (DotE 2013a).

The likelihood of occurrence assessment for MNES (refer Appendix E), was used to refine the scope of TECs and threatened species assessed under the SIAs. The SIAs have been undertaken in accordance with the MNES Significant Impact Guidelines 1.1 for MNES which are known to occur, considered likely to occur, or have potential to occur within or adjacent to the disturbance footprint. These MNES are:

- Moreton Bay Ramsar Wetland (wetland of international importance), located downstream of the disturbance footprint (refer Section 7.2)
- Two TECs, including Coastal Swamp Sclerophyll Forest TEC and Lowland Rainforest of Subtropical Australia TEC, present within and/or adjacent to the disturbance footprint (refer Sections 7.3.1 and 7.3.2, respectively)
- Listed threatened species with habitat values present, including six species which were considered likely or have potential to occur within the disturbance footprint (refer Appendix E), being:
 - Swift parrot (*Lathamus discolor*)
 - Koala (*Phascolarctos cinereus*)
 - South-eastern glossy black-cockatoo (*Calyptorhynchus lathami lathami*)
 - Three-toed snake-tooth skink (*Coeranoscincus reticulatus*)
 - Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)
 - Grey-headed flying-fox (*Pteropus poliocephalus*).

SIAs have also been undertaken in accordance with the MNES Significant Impact Guidelines 1.1 for MNES that were identified by the DCCEE RFI, including:

- Sand yabby (*Cherax robustus*)
- Wallum sedge frog (*Litoria olongburensis*).

SIAs have not be completed for listed migratory species as they are not a controlling provision and are unlikely to be impacted by the Project.

The SIAs were based on the potential direct impacts within the disturbance footprint, as well as the potential indirect Project impacts in the local and regional context. The conservation status of MNES listed under the EPBC Act at the time of the DCCEE referral decision (30 October 2024) are considered within the SIAs detailed within this document.

Based on the findings of the SIAs provided in Sections 7.2 to 7.5, the CIA provided in Section 7.6, and the implementation of mitigation measures (refer Section 6), the proposed action has the potential to have significant impacts to the Coastal Swamp Sclerophyll Forest TEC, Koala and Grey-headed flying-fox. The summary of the outcomes of the SIAs are included in Table 7.1.

Table 7.1 Summary of the SIA results

MNES	Significant residual impact area	SIA result
Wetlands of International importance		
Moreton Bay Ramsar Wetland	0 ha	Unlikely
Threatened ecological community		
Coastal Swamp Sclerophyll Forest	2.09 ha*	Likely
Lowland Rainforest of Subtropical Australia	0 ha	Unlikely
Threatened species		
Swift parrot (<i>Lathamus discolor</i>)	1.41 ha	Unlikely
Koala (<i>Phascolarctos cinereus</i>)	4.65 ha	Likely
South-eastern glossy black-cockatoo (<i>Calyptorhynchus lathami lathami</i>)	1.43 ha	Unlikely
Three-toed snake-tooth skink (<i>Coeranoscincus reticulatus</i>)	3.13 ha	Unlikely
Long-nosed potoroo (northern) (<i>Potorous tridactylus tridactylus</i>)	1.43 ha	Unlikely
Grey-headed flying-fox (<i>Pteropus poliocephalus</i>)	5.20 ha	Likely
Sand yabby (<i>Cherax robustus</i>)	0 ha	Unlikely
Wallum sedge frog (<i>Litoria olongburensis</i>)	0 ha	Unlikely

7.2 Wetland of international importance

As identified in Section 4, the proposed action is located in close proximity to, but wholly outside the Moreton Bay Ramsar Wetland.

The MNES Significant Impact Guidelines 1.1 provide criteria for assessing the potential for significant impacts to wetlands of international importance, including the Moreton Bay Ramsar Wetland, these being where there is a real chance or possibility that an action will result in:

- Areas of the wetland being destroyed or substantially modified
- A substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of groundwater and surface water flows to and within the wetland
- The habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected
- A substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or
- An invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.

7.2.1 Description

A review of the EPBC Act PMST has identified that at its closest point, the Moreton Bay Ramsar Wetland is located approximately 23 m downstream of the disturbance footprint.

The Moreton Bay Ramsar Wetland values, catchment hydrology, water quality objectives, water quality monitoring results and groundwater characteristics are provided in Sections 4.2 and 4.3.

7.2.2 Nature and extent of likely impact

The disturbance footprint is not located within the Moreton Bay Ramsar Wetland and will not cause direct impacts to the wetland values and hydrological regime of downstream environs.

The Project's stormwater design and environmental management regime, includes the combination of stormwater capture and treatment design measures in accordance with TMR's *Road Planning and Design Manual* (TMR 2024b) and erosion and sediment control as per *TMR technical specifications MRTS 52 Erosion and Sediment Control*. These measures which will be implemented across the construction and operational phases Project will ensure no indirect impacts occur to the Moreton Bay Ramsar Wetland.

Overall, no direct or indirect impacts on the Ramsar wetland will occur as a result of the Project given:

- The Project site is not directly within the Ramsar wetland
- There is no direct flow discharge to the Ramsar wetland
- Despite larger TSS and nutrient concentrations, the scale of the Project is small compared to the total catchment size and surrounding (and predominantly urban) catchment. As such, resulting post treatment TSS and nutrient loads from the Project are not predicted to be significantly higher than existing conditions, both during the Project construction and operational phases.
- Predicted TSS and nutrient concentration downstream effects in the Pumicestone Passage as shown within the TUFLOW FV modelling are negligible for the Project's construction and operational phases. Water quality impacts for other water quality constituents (i.e. hydrocarbons, heavy metals) are also expected to be negligible, provided the concentrations in the Project's outflow do not drastically change from background conditions in the receiving waters.
- Most identified surface water quality risks are therefore associated with effects at the Project scale and discharge conditions, including excavation and vegetation clearing works during construction, as well as risks of hydrocarbon leaks, tyre wear and vehicle fuel emissions during operations, particularly during rainfall events.
- Implementation of construction (e.g. *TMR technical specifications MRTS 51 Environmental Management* and *MRTS 52 Erosion and Sediment Control*, ESCP) and operational (e.g. combination of capture and treatment measures in accordance with TMR's *Road Planning and Design Manual* (TMR 2024b)) mitigation measures will avoid any Project indirect impacts on the downstream Ramsar wetland.

Whilst the Project will not result in any direct impacts to the Moreton Bay Ramsar Wetland, potential indirect Project impacts have been considered in the SIA presented in Table 7.2.

Table 7.2 Significant impact assessment – MNES Moreton Bay Ramsar Wetland

MNES significant impact assessment criteria – Moreton Bay Ramsar Wetland	The likelihood of the action resulting in a significant residual impact
An action is likely to have a significant impact on the ecological character of a declared Ramsar wetland if there is a real chance or possibility that it will result in:	
Areas of the wetland being destroyed or artificially modified	<p>Unlikely to have a significant impact</p> <p>The Project is located wholly outside the Moreton Bay Ramsar Wetland, being approximately 23 m upstream from the Moreton Bay Ramsar Wetland boundary at its closest point. The Project will not cause direct impacts to the wetland values, including destruction or substantial modification.</p> <p>The disturbance footprint and immediate surrounding area is a highly urban environment comprising a range of existing residential, commercial and industrial land uses and supporting infrastructure. The southern most portion of the disturbance footprint (and closest point to the Moreton Bay Ramsar Wetland) is already subject to artificial modifications to the existing catchment and drainage paths which currently flow via open drainage and underground drainage infrastructure before discharging to Pumicestone Passage and to the Moreton Bay Ramsar Wetland.</p> <p>Project construction and operational activities in this area (which are associated with Works Package A) predominantly comprise upgrades to the existing road infrastructure, being pavement, intersection, lighting and landscaping works. These works are minor in nature and any impacts are expected to be avoided, minimise and controlled through the Project EMP(C).</p>

MNES significant impact assessment criteria – Moreton Bay Ramsar Wetland	The likelihood of the action resulting in a significant residual impact
	<p>The road drainage design incorporates natural surface water quality treatment solutions and end of line proprietary gross pollutant traps for stormwater capture and treatment to reduce indirect impact to receiving environments through operation.</p> <p>Through the implementation of mitigation measures (e.g. Project EMP(C), ESCP, EMP(O)), the Project is considered unlikely to destroy or substantially modify areas of the Moreton Bay Ramsar Wetland.</p>
<p>A substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland</p>	<p>Unlikely to have a significant impact</p> <p>The Project involves construction and operation of additional road pavement and associated infrastructure and will subsequently involve an increase in hardstand areas and associated runoff inputs. As detailed in Section 4.3, the Project has, as part of its detailed design, undertaken hydraulic modelling to assess the existing flood regime with the disturbance footprint and surrounds, along with the flood immunity of the Project design during varying AEP flooding events (including severe storm), including with consideration for climate change.</p> <p>A discussion of the findings of the hydraulic assessment for the detailed design is presented in Section 5.2.3. The results of the hydraulic assessment show that the design has increased the peak flows into Pumicestone Passage by no more than 3.3% across the events assessed. The design has also resulted in minimal changes to the timing and volume of flows into the Pumicestone Passage and Moreton Bay Ramsar Wetland, and therefore the potential hydraulic impacts are considered to be negligible in both the local and wider context of the hydrological regime of the Moreton Bay Ramsar Wetland.</p> <p>The Project will implement water sensitive urban design elements (e.g. natural treatment solutions and end of line proprietary products) as well as construction management measures to minimise hydraulic impacts and maintain the existing flow regime within the catchment. With the implementation of these measures, the Project is unlikely to result in a substantial and measurable change in hydrological regime of Moreton Bay Ramsar Wetland.</p>
<p>The habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected</p>	<p>Unlikely to have a significant impact</p> <p>No direct encroachment on the Moreton Bay Ramsar Wetland is proposed, nor any alteration of hydrological regimes are considered likely to occur from the Project.</p> <p>The integrated surface water quality modelling undertaken for both the construction and operational phases (refer Section 5.2.3) showed that whilst minor changes in surface water flows and water quality are anticipated at the Project scale, results from the TUFLOW FV modelling showed no discernible change relative to the baseline (pre-construction) across all baseline water quality sites. Additionally there were no obvious changes associated with the different construction scenario sequences, indicating downstream indirect impacts to the Moreton Bay Ramsar Wetland.</p> <p>Dilution mapping for construction and operational phase scenarios also showed that (comparative to the baseline) limited dilution occurs in Pumicestone Creek, regardless of scenario, whereas a significant degree of mixing is observed once waters from the catchment reach the Pumicestone Passage (refer Section 5.2.3).</p> <p>Outcomes of the water quality risk assessment undertaken based on modelled results (refer Appendix F.4) has identified that provided concentrations from the Project discharges do not change considerably from existing outflows from the Project disturbance footprint, water quality outcomes, including in relation to fauna species (invertebrates and fish) in the Pumicestone Passage due to Project construction and operation will be negligible. This is largely due to the small project area in relation to the overall catchment area, combined with stormwater treatment measures, particularly during the operational phase of the Project. Even for the increase in TSS concentration in Project outfalls predicted for the construction phase, no significant changes resulted in the downstream waterways and habitats when comparing cases with and without the Project.</p> <p>With the implementation of mitigation measures (refer Section 6) during the design, construction and operational phases, the Project's low risk to water quality is considered unlikely to significantly affect the habitat or lifecycle of native species dependent on the Moreton Bay Ramsar Wetland.</p>

MNES significant impact assessment criteria – Moreton Bay Ramsar Wetland	The likelihood of the action resulting in a significant residual impact
<p>A substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health</p>	<p>Unlikely to have a significant impact</p> <p>The Project has the potential to result in sedimentation and nutrient impacts associated with construction and operation that are largely contained to the Project scale, but that may flow towards the Moreton Bay Ramsar Wetland. However, these impacts are expected to be minor and are anticipated to be mitigated through the Project EMP(C), WQMP and EMP(O), as detailed in Section , including:</p> <ul style="list-style-type: none"> ■ ESCP developed in accordance with best practice erosion and sediment control methods ■ Development of site-specific water quality objectives based on baseline water quality monitoring completed to date ■ Ongoing water quality monitoring and management of discharges to receiving environments for the duration of construction and for a period of one (1) year of operations ■ Management of construction activities (e.g. storage of chemicals, refuelling buffer zones) ■ Use of clean water diversion and onsite management of water ■ Landscape and rehabilitation works to be undertaken in accordance <i>MRTS 16 Landscaping and Revegetation</i>. <p>If encountered during construction, ASS/PASS will be managed in accordance with <i>MRTS 04 General Earthworks</i> and the QASSIT Manual.</p> <p>Integrated surface water quality modelling (MUSIC, SOURCE and TUFLOW FV) has been completed for the Project to assess potential Project impacts at the Project, catchment and downstream receiving environment (Pumicestone Passage) scales (refer Section 5.2.3 and Appendix F).</p> <p>The modelling identified an increase in untreated pollutants (TSS and nutrients) due to the increases in impervious areas at the Project scale. Despite the increase in TSS and nutrient concentrations, the scale of the Project is small compared to the total catchment size and surrounding (and predominantly urban) catchment. As such, resulting post treatment TSS and nutrient loads from the Project at the local and catchment scales are not predicted to be substantially higher than existing conditions, both during the Project construction and operational phases. Predicted TSS and nutrient concentration downstream effects in the Pumicestone Passage as shown within the TUFLOW FV modelling are negligible for the Project construction and operational phases. Water quality impacts for other water quality constituents (i.e. hydrocarbons and heavy metals) are also expected to be negligible, provided the concentrations in the Project's outflow do not drastically change from background conditions in the receiving waters.</p> <p>Outcomes of the water quality risk assessment undertaken based on modelled results (refer Appendix F.4) has identified potential impacts at the Project and catchment scale to be adequately managed through Project specific measures during the design, construction and operational phases. This includes the provision and maintenance of water quality improvement devices such as bioretention basins, grassed/vegetated swales to minimise operational impacts of the Project.</p> <p>With the implementation of mitigation measures (refer Section 6) as part of the Project detailed design (e.g. combination of capture and treatment measures in accordance with the <i>TMR Road Planning and Design Manual (TMR 2024b)</i>, as well as measures during construction and operation (maintenance), the Project is considered unlikely to cause a substantial or measurable change in the water quality of the Moreton Bay Ramsar Wetland.</p>
<p>An invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.</p>	<p>Unlikely to have a significant impact</p> <p>The likelihood of the Project introducing or spreading invasive species across the local landscape and impacting the Moreton Bay Ramsar Wetland is considered to be reduced and effectively managed via the implementation of mitigation measures included in the Pest and Weed Management Plan as a sub-plan to the Project EMP(C) in accordance with <i>MRTS 51 Environmental Management</i> (refer Section 6).</p> <p>The Project is considered unlikely to result in invasive species becoming established in the Moreton Bay Ramsar Wetland.</p>

MNES significant impact assessment criteria – Moreton Bay Ramsar Wetland	The likelihood of the action resulting in a significant residual impact
Assessment of potential for significant impacts	Under the significant impact test detailed above, it is considered unlikely that the proposed action will have a 'significant impact' on the Moreton Bay Ramsar Wetland.

7.3 Threatened ecological communities

The MNES Significant Impact Guidelines 1.1 provide criteria for assessing the potential for significant impacts to TECs, these being where there is a real chance or possibility that an action will:

- Reduce the extent of an ecological community
- Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines
- Adversely affect habitat critical to the survival of an ecological community
- 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
- 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
- Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
 - Assisting invasive species, that are harmful to the listed ecological community, to become established, or
 - Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or
- Interfere with the recovery of an ecological community.

A SIA has been completed and presented in Section 7.3.1 for the Coastal Swamp Sclerophyll Forest TEC which is known to occur within the disturbance footprint. Although not present within the disturbance footprint, a SIA has also been completed for the Lowland Rainforest of Subtropical Australia TEC (refer Section 7.3.2), due to its close proximity to the disturbance footprint to ensure potential Project indirect impacts are considered in the SIA for this TEC.

7.3.1 Coastal Swamp Sclerophyll Forest

Description

A total of 1.43 ha of vegetation analogous to the Coastal Swamp Sclerophyll Forest TEC was observed directly within the disturbance footprint via ground-truthed vegetation surveys and was contiguous with a larger patch approximately 8.2 ha in size. The patch is currently a Class B1 patch, a large patch (>5 ha) with non-native vegetation cover between 20% and 50%. The conservation advice for the TEC (DAWE 2021a) states that contiguous patches can include small scale (<30 m) variations and disturbances, such as the pathway (up to 21 m in width) that currently traverses through the patch within the disturbance footprint. It is anticipated that the proposed action will fragment the TEC with a gap up to 60 m between the two fragmented patches. The proposed remaining patch to the north-east would be 6.12 ha in size, and the proposed remaining patch to the south-west would be 0.66 ha in size.

It is anticipated that in terms of the condition threshold listed in the conservation advice for the Coastal Swamp Sclerophyll Forest TEC (DAWE 2021a), the north-eastern patch would remain a Class B1 patch (>5 ha and between 20% and 50% non-native cover), whilst the south-western patch would reduce from a Class B1 to a class C2 patch (non-native vegetation cover between 20% and 50%, and 0.5 to <2 ha). It is important to note that the reduction in either patches would not be reduced to the extent where they no longer meet minimum thresholds for the TEC, however as the south-western patch has been reduced in quality, the 0.66 ha of indirect impacts to this patch has been included in the total quantum of impacts for the TEC.

The extent of ground-truthed Coastal Swamp Sclerophyll Forest TEC, and where it intersects the disturbance footprint, is illustrated in Figure 7.1. A representative site photo is displayed in Photograph 7.1.



Photograph 7.1 Coastal Swamp Sclerophyll Forest TEC within the disturbance footprint

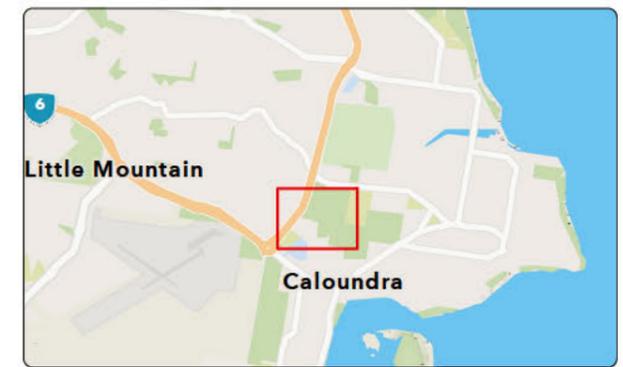
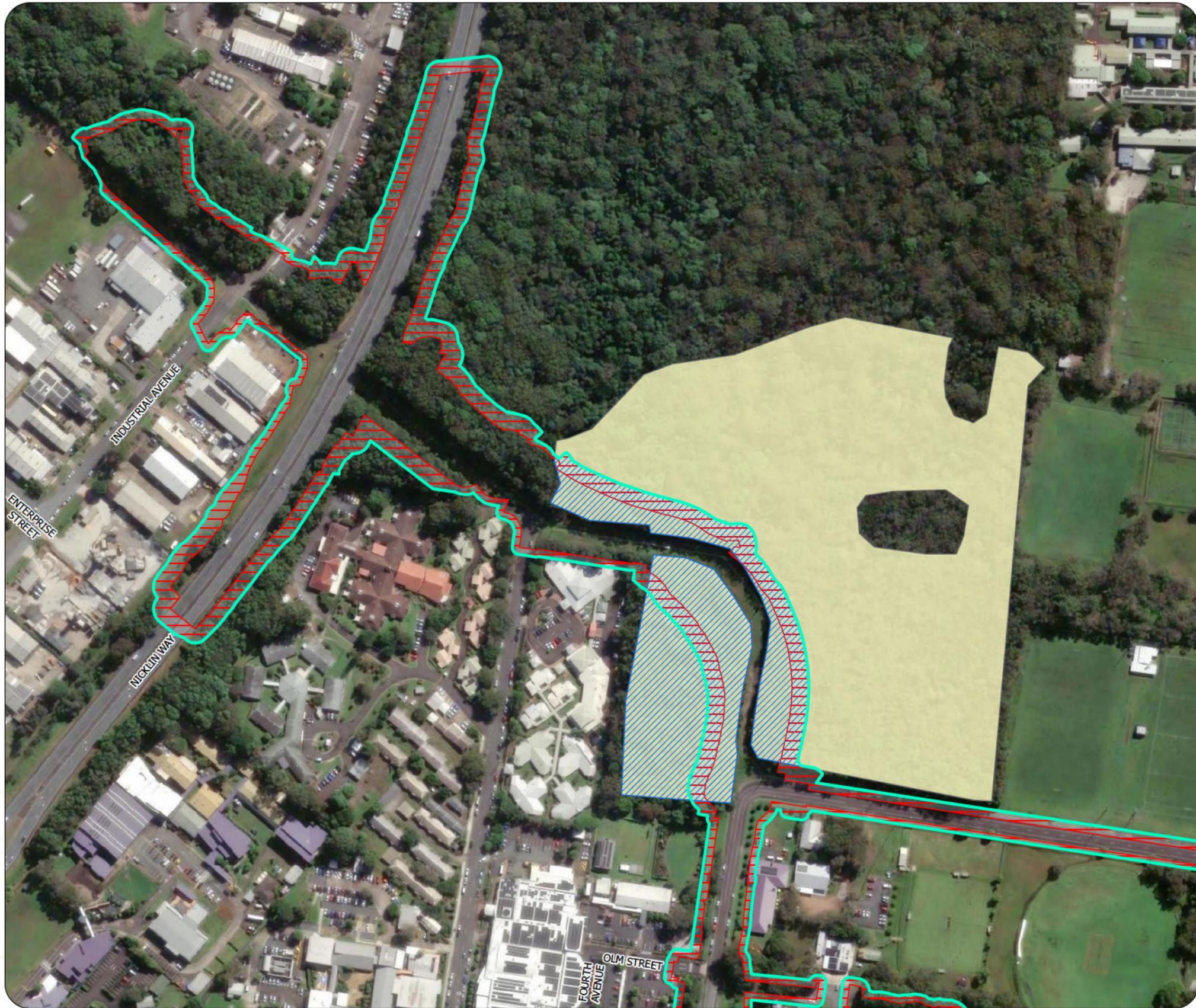
Threats

The main ongoing threats to this TEC include changed hydrological regimes, vegetation clearance, invasive fauna, impacts associated with fragmentation of remnants, disturbance from urbanisation and recreational activity, diseases and pathogens (such as myrtle rust), altered fire regimes and weeds (DAWE 2021a).

The Coastal Swamp Sclerophyll Forest TEC has been extensively cleared for development purposes because it primarily occurs on flat and relatively fertile soils. Clearing has dramatically decreased its extent, and the resulting fragmentation has made the TEC more vulnerable to threats such as weed invasion. Historical clearing is evident in the disturbance footprint around the 20 m wide HV powerline easement, directly to the south of Coastal Swamp Sclerophyll Forest TEC. Other historical disturbances include a 6 m wide walking track directly to the north of the TEC, that makes up part of the walking track infrastructure of Ben Bennett Bushland Park. The TEC has also experienced historical artificial drainage surrounding the south-western edges of the HV powerline easement as well as between the Ben Bennett Bushland Park and the Caloundra Rugby Union Club to the east.

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Project No: P522936 Map by: AT Export date: 17/12/2025

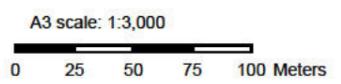


- Legend**
- Disturbance Footprint
 - Extent of Coastal Swamp Sclerophyll Forest TEC
 - Significant residual impact area for the CSSF TEC (includes direct and indirect impacts)
 - Indirect impact/edge effect areas

Service layers: City of Moreton Bay, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community; Data sources: Queensland Spatial Catalogue - 2023

Revision: A

Date: 17/12/2025



Caloundra Transport Corridor Upgrade

Figure 7.1 Extent of Coastal Swamp Sclerophyll Forest TEC

Weeds compete with native species for space, light, water and nutrients. They also suppress and out-compete mid-storey and canopy trees. Transformer weeds are highly invasive plants with the potential to seriously alter the structure and function of the TEC they invade, thereby 'transforming' them into a different system. In this TEC they include *Megathyrus maximus* (Green panic), a weed that can increase the risk of bushfire, and *Ochna serrata* (Ochna) a weed that can form dense thickets.

Urbanisation results in impacts such as the invasion of bushland by domestic dogs and cats, rubbish dumping, trampling, garden escapes, firewood collection, impacts from vehicles, the creation of informal trails, and arson. Urbanisation also increases pressure to reduce bushfire fuel loads that may be detrimental to the ecological community. Urbanisation in the form of residential development has long been established to the south of Ben Bennett Bushland Park. With the planned mitigation measures which include monitoring and action plans for removing weeds and pest species it is unlikely that the Project will increase the prevalence of weed or pest species.

Within the disturbance footprint the design will result in an increase in water levels within a portion of the Ben Bennett Bushland Park by over 300 mm in the 1% (2100) AEP event when compared to existing baseline conditions as a result of water ponding against the proposed road embankment.

Flood modelling conducted outside of the disturbance footprint has shown minor flood depth change, velocity and regime flow change for 1% 2100 AEP event when comparing the baseline and design case (refer Section 5.2.3). This minor change is unlikely to cause an adverse impact to the TEC due to the size of local catchment and temporary nature of the event. It is therefore considered that abiotic factors necessary for the two remaining TEC patches survival will remain unaltered by indirect impacts associated with the proposed action.

Significant impact assessment

A SIA of the potential Project impacts upon the Coastal Swamp Sclerophyll Forest TEC is provided in Table 7.3.

Table 7.3 Significant impact assessment for Coastal Swamp Sclerophyll Forest TEC

Significant impact criteria	Predicted direct impacts to the TEC	Predicted indirect impacts to the TEC
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:		
<p>Reduce the extent of an ecological community</p>	<p>Likely to have a significant impact Commonwealth conservation listing advice for this TEC does not provide minimum or maximum thresholds related to allowable direct removal of this community (DAWE 2021a). In addition, the direct removal of vegetation is identified as one of the key threatening processes for this TEC. area of 1.43 ha of vegetation analogous to the Coastal Swamp Sclerophyll Forest TEC was observed directly within the disturbance footprint. Therefore, the 1.43 ha of this TEC will be reduced as a result of the proposed action.</p>	<p>Likely to have a significant impact Approximately 1.97 ha of Coastal Swamp Sclerophyll Forest TEC is located within 100 m of the disturbance footprint. As a precautionary measure, approximately 10 m of potential indirect impacts has been incorporated into the total boundary of the disturbance footprint beyond the actual design.</p> <p>The 0.66 ha Coastal Swamp Sclerophyll Forest TEC patch to the south-west of the disturbance footprint is likely to be fragmented from the larger remaining 6.12 ha TEC patch to the north-east of the disturbance footprint. Therefore the 0.66 ha TEC patch has been included in the Project total significant residual impact area (i.e. 2.09 ha). The indirect impact associated with edge effects has been calculated as part of the total disturbance footprint and is displayed in Figure 7.1.</p> <p>Otherwise, the proposed action is unlikely to reduce to the extent of the TEC due to the following:</p> <ul style="list-style-type: none"> ■ No hydrological changes are anticipated to impact the TEC nor modify its extent as a result of the design ■ Construction footprint will be strictly limited to the smallest area possible required in order to facilitate the works ■ Strict control of ignition sources to minimise the risk of accidental fires will be implemented. ■ Dust will be controlled throughout the construction phase within direct TEC areas and buffer zones through dust suppression ■ Implement effective sediment and erosion control methods prior to and during vegetation clearing and civil works to control runoff and prevent movement of weeds and pathogens entering waterways and into adjoining TEC and other native vegetation outside of the disturbance footprint.
<p>Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines</p>	<p>Likely to have a significant impact As defined in the conservation advice for this TEC, small scale clearing through patches may not result in area being considered fragmented as already fragmented, contiguous patches can include small scale (<30 m) variations and disturbances, and the proposed action is likely to further fragment the community by increasing the distance between the two patches by clearing up to 50 m (DAWE 2021a).</p> <p>The TEC within and adjacent to the Project is approximately 8.2 ha, which comprises the Project direct impact area of 1.43 ha and two patches either side of the disturbance footprint (i.e. 0.66 ha to the south-west and 6.12 ha to the north-east). The TEC patches remaining each meet the minimum size for small non-continuous patch (with good condition).</p> <p>The 0.66 ha Coastal Swamp Sclerophyll Forest TEC patch to the south-east of the disturbance footprint is likely to be fragmented from the larger remaining 6.12 ha TEC patch to the north-east of the disturbance footprint. Therefore the 0.66 ha TEC patch has been included in the Project total significant residual impact area (i.e. 2.09 ha).</p>	
<p>Adversely affect habitat critical to the survival of an ecological community</p>	<p>Likely to have a significant impact A total of 1.43 ha of vegetation analogous to the Coastal Swamp Sclerophyll Forest TEC was observed directly within the disturbance footprint. The loss of vegetation is likely to constitute an adverse impact on habitat critical to the survival for this ecological community.</p>	<p>Unlikely to have a significant impact No hydrological changes are anticipated to significantly impact the two remaining TEC patches adjacent to the disturbance footprint nor modify their extent as a result of the Project.</p> <p>Project indirect impacts on the two remaining TEC patches will be temporary (i.e. approximately 2 years) and will be avoided and minimised by implementing the following:</p>

Significant impact criteria	Predicted direct impacts to the TEC	Predicted indirect impacts to the TEC
		<ul style="list-style-type: none"> ■ Construction footprints will be strictly limited to the smallest area possible required in order to facilitate the works ■ Regular weed hygiene inspections required for all machinery entering from outside to prevent introduction of new weed infestations within the TEC ■ Based on pre-construction weed survey results, temporary washdowns may be required throughout high-risk activities (e.g. site establishment and clearing works) ■ Strict control of ignition sources to minimise the risk of accidental fires will be implemented. ■ Rehabilitation of disturbed habitat to be undertaken in suitable locations (i.e. outside road corridor) using established native species in accordance with <i>MRTS16 Landscape and Revegetation</i> and landscape drawings included in Volume 2 of the TIC-CO ■ Implementation of effective erosion and sediment control methods prior to and during vegetation clearing and civil works to control runoff and prevent movement of weeds and pathogens entering waterways and into the adjoining TEC and other native vegetation outside of the disturbance footprint ■ Dust suppression measures to be implemented such as soil binders, watercarts, speed restrictions, appropriate erosion and sediment measures, and progressive stabilisation and revegetation of temporary disturbance areas ■ Avoidance of key structural roots originating from the Inspection and Identification of Tree Protection Zones (TPZ) determined in accordance with AS4970-2009 – <i>Protection of trees on development sites</i> assessed by a qualified arborist or relevant specialist for trees greater than 3 m. Inspections will be limited to within 100 m buffer of the disturbance footprint intersecting the Coastal Swamp Sclerophyll Forest TEC area. Areas where the excavation or fill associated with the disturbance footprint overlap with identified TPZs more than 10%, or encroach with the Structural Root Zone (SRZ), the whole TPZ area of each tree impacted will be added to the total quantum of the impact area. ■ Where structural root zones cannot be avoided, a suitably qualified and experienced arborist will be engaged to identify and implement a strategy to ensure that impacted trees can be retained (i.e. selective trimming of canopy to ensure that the unimpacted roots can adequately support the retained canopy). This will ensure that impacts to trees will be short term. <p>After construction is completed, disturbance and threats of the Project will return to current levels commensurate with surrounding land use.</p> <p>Approximately 1.97 ha of Coastal Swamp Sclerophyll Forest TEC is located within 100 m of the disturbance footprint. Due to 100 m buffer distance between this TEC area and the disturbance footprint and the implementation of mitigation measures, the Project indirect impacts are unlikely to occur within this TEC area. Further as a precautionary measure, approximately 10 m of potential indirect impacts has been incorporated into the total boundary of the disturbance footprint beyond the actual design.</p>

Significant impact criteria	Predicted direct impacts to the TEC	Predicted indirect impacts to the TEC
<p>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</p>	<p>Likely to have a significant impact</p> <p>The Project will directly remove 1.43 ha of Coastal Swamp Sclerophyll Forest TEC within the disturbance footprint which will result in destroying abiotic (non-living) factors (such as water, nutrients, or soil) within the disturbance footprint.</p>	<p>Unlikely to have a significant impact</p> <p>Flood modelling conducted outside of the disturbance footprint has shown minor flood depth change, velocity and regime flow change for 1% 2100 AEP event when comparing the baseline and design case (refer Section 5.2.3). This minor change is unlikely to cause an adverse impact to the TEC due to the size of local catchment and temporary nature of the event. It is therefore considered that abiotic factors necessary for the two remaining TEC patches survival will remain unaltered by indirect impacts associated with the proposed action.</p> <p>As part of the Project, mitigation measures (outlined in the Project EMP(C), an ESCP, Water Quality Monitoring Plan and ASSMP) will be implemented to ensure that the existing hydrological regimes, water quality, nutrient cycles and abiotic factors remain substantially unchanged (e.g. culverts installed to mitigate any long-term impacts to hydrology and nutrient cycles).</p>

Significant impact criteria	Predicted direct impacts to the TEC	Predicted indirect impacts to the TEC
<p>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</p>	<p>Likely to have a significant impact</p> <p>The Project will directly remove 1.43 ha of Coastal Swamp Sclerophyll Forest TEC within the disturbance footprint which will result in a substantial change to the TEC within the disturbance footprint.</p>	<p>Unlikely to have a significant impact</p> <p>Mitigation measures will be implemented to ensure that there is no substantial change in the species composition or loss of ecological functionality for the two remaining TEC patches. Potential indirect impacts are avoided and minimised through the following:</p> <ul style="list-style-type: none"> ■ Mitigation measures will be implemented to reduce potential risks of weed incursion, including the requirement for regular inspections of all machinery entering the site, significantly reducing the likelihood of introducing new weed infestations into the environmentally sensitive areas ■ Based on pre-construction weed survey findings, washdowns will be required during high-risk activities, such as site establishment and clearing works, to ensure that existing species are protected ■ Controls on ignition sources will also be enforced to minimise the risk of accidental fires ■ The rehabilitation of disturbed habitats is planned in suitable locations outside of road corridors, employing established native species as outlined in the <i>MRTS16 Landscape and Revegetation</i> and landscape drawings included in Volume 2 of the TIC-CO ■ Avoidance of key structural roots originating from the Inspection and identification of TPZ determined in accordance with AS4970-2009 – <i>Protection of trees on development sites</i> assessed by a qualified arborist or relevant specialist for trees greater than 3 m. Inspections will be limited to within 100 m buffer of the disturbance footprint intersecting the Coastal Swamp Sclerophyll Forest TEC area. ■ Where structural root zones cannot be avoided, a suitably qualified and experienced arborist will be engaged to identify and implement a strategy to ensure that impacted trees can be retained (ie. selective trimming of canopy to ensure that the unimpacted roots can adequately support the retained canopy). This will ensure that impacts to trees will be short term. ■ Ongoing weed, pest and restoration activities undertaken by SCC for the TEC within Ben Bennett Bushland Park in accordance with the Ben Bennett Bushland Park Regeneration Works Plan (refer Appendix L) and the exclusion of unauthorised vehicle access, noting that formed access track currently exist through the TEC which are used for educational activities <p>Approximately 1.97 ha of Coastal Swamp Sclerophyll Forest TEC is located within 100 m of the disturbance footprint. Due to 100 m buffer distance between this TEC area and the disturbance footprint and the implementation of mitigation measures, the Project indirect impacts are unlikely to occur within this TEC area.</p>

Significant impact criteria	Predicted direct impacts to the TEC	Predicted indirect impacts to the TEC
<p>Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:</p> <ul style="list-style-type: none"> ■ 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 	<p>Likely to have a significant impact</p> <p>The Project will directly remove 1.43 ha of Coastal Swamp Sclerophyll Forest TEC within the disturbance footprint which will result in a reduction of the TEC within the disturbance footprint.</p>	<p>Unlikely to have a significant impact</p> <p>The Project will not cause a substantial change in the quality or integrity of the occurrence of the two remaining TEC patches. Mitigation measures will be implemented to ensure that invasive species and the use of fertilisers, herbicides or other chemicals or pollutants do not cause a substantial reduction in the quality or integrity of an occurrence of an ecological community. Weed transect surveys determined that weed edge effects are unlikely to spread beyond 5 m into the current edge of the TEC (refer Section 3.7.2 and 4.5.3) and therefore with the implementation of the of <i>MRTS51 Environmental Management</i> and continuation of current weed maintenance (refer Appendix L) weed edge effects resulting from construction and operation will be minimal.</p> <p>Potential indirect impacts are avoided and minimised through the following:</p> <ul style="list-style-type: none"> ■ Regular weed hygiene inspections will be required for all machinery entering from outside will be implemented to prevent introduction of new weed infestations within the two remaining TEC patches ■ Based on pre-construction weed survey results, temporary washdowns may be required throughout high-risk activities (e.g. site establishment and clearing works) ■ Rehabilitation of disturbed habitat to be undertaken in suitable locations (i.e. outside road corridor) using established native species in accordance with the <i>MRTS16 Landscape and Revegetation</i> and landscape drawings included in Volume 2 of TIC-CO. These specifications control the use of fertilisers to provide safe and appropriate application to native species and to manage impacts outside of applied planting areas. ■ Inclusion of myrtle rust management measures in the Project EMP(C), including but not limited to regular cleaning of equipment, regular inspection of flora for signs of myrtle rust and thoroughly checking all external plants brought on site for rehabilitation for signs of myrtle rust. If myrtle rust is found adhering to the general biosecurity obligation of taking all practical and reasonable steps to minimise risks and limit spread and contacting Biosecurity Queensland on 13 25 23 to report sighting and trigger control actions.

Significant impact criteria	Predicted direct impacts to the TEC	Predicted indirect impacts to the TEC
Interfere with the recovery of an ecological community	<p>Likely to have a significant impact</p> <p>The Project will directly remove 1.43 ha of Coastal Swamp Sclerophyll Forest TEC within the disturbance footprint which will result in reducing the extent of the community and removing habitat critical to the survival of the community.</p>	<p>Likely to have a significant impact for fragmentation</p> <p>A national recovery plan is not currently available for the Coastal Swamp Sclerophyll Forest TEC. However, it is considered that recovery should focus on the following threats as identified in the TEC conservation advice (DAWE 2021a):</p> <ul style="list-style-type: none"> ■ Invasive fauna ■ Disturbance from urbanisation and recreational activity ■ Altered fire regimes ■ Changed hydrological regimes ■ Vegetation clearance ■ Impacts associated with fragmentation of remnants and weeds. <p>Measures will be implemented to reduce potential risks of weed incursion, including the requirement for plant (vehicle) weed and seed certificates alongside regular inspections of all machinery entering the site, significantly reducing the likelihood of introducing new weed infestations into the environmentally sensitive areas.</p> <p>Based on pre-construction weed survey findings, washdowns will be required during high-risk activities, such as site establishment and clearing works, to ensure that existing species are protected.</p> <p>Controls on ignition sources will also be enforced to minimise the risk of accidental fires.</p> <p>Flood modelling conducted outside of the disturbance footprint has shown minor flood depth change, velocity and regime flow change for 1% 2100 AEP event when comparing the baseline and design case (refer Section 5.2.3). This minor change is unlikely to cause an adverse impact to the TEC due to the size of local catchment and temporary nature of the event. It is therefore considered that abiotic factors necessary for the two remaining TEC patches survival will remain unaltered by indirect impacts associated with the proposed action.</p> <p>The Project will result in the fragmentation of the remaining 0.66 ha TEC patch to the south-west of the disturbance footprint which is likely to interfere with the recovery of this TEC patch. While this remaining TEC patch will still meet the condition thresholds of the TEC, it is likely that this TEC patch will be more vulnerable to impacts from surrounding urbanisation, and as such the remaining 0.66 ha TEC patch has been added to the total Project significant residual impact to the Coastal Swamp Sclerophyll Forest TEC.</p>
Assessment of potential for significant residual impacts	The Coastal Swamp Sclerophyll Forest TEC within and adjoining the disturbance footprint has been assessed against the criteria above and it has been determined that the Project is likely to constitute a significant residual impact on 2.09 ha of the Coastal Swamp Sclerophyll Forest TEC.	

7.3.2 Lowland Rainforest of Subtropical Australia

Description

Vegetation analogous to the Lowland Rainforest of Subtropical Australia TEC is mapped approximately 7.3 m to the north of the disturbance footprint within Ben Bennett Bushland Park (refer Section 4.5.2). However, whilst proximate to the disturbance footprint, direct disturbance/clearing of this ecological community is not proposed based on ground-truthed assessment. Vegetation surrounding the TEC is dominated by Myrtaceous plants (e.g. *Eucalyptus* spp. and *Melaleuca* spp.). These species are not considered to be part of the Lowland Rainforest of Subtropical Australia TEC as they are distinct communities in their own right which were confirmed during site-based field investigations.

The extent of ground-truthed Lowland Rainforest of Subtropical Australia TEC and its proximity to the proposed action is shown in Figure 7.2. A representative site photo is displayed in Photograph 7.2.

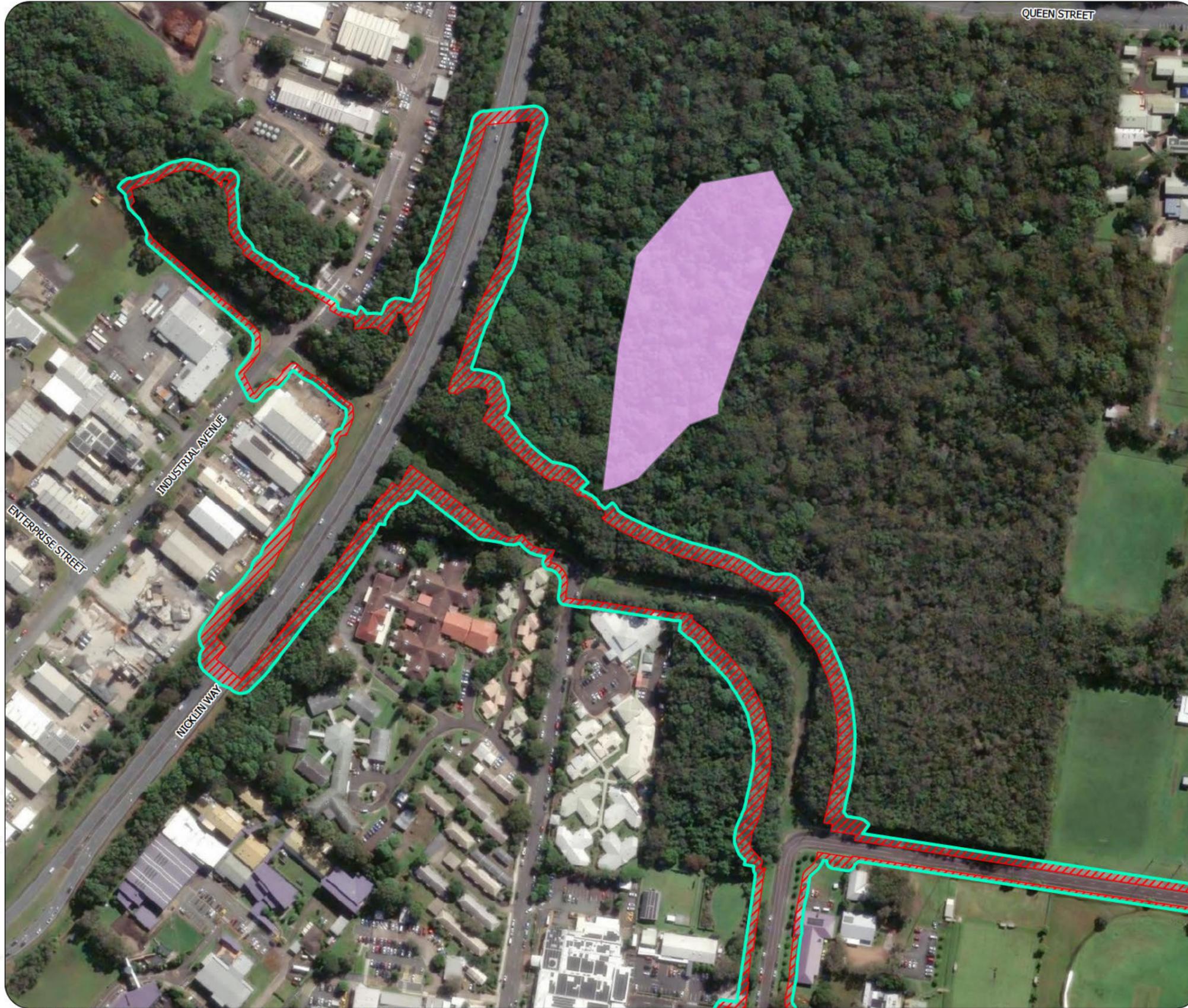


Photograph 7.2 Lowland Rainforest of Subtropical Australia TEC within approximately 7.3 m of the disturbance footprint

Threats

The main ongoing threats to the ecological community include vegetation clearance, impacts associated with fragmentation of remnants, weed invasion and urbanisation.

The Lowland Rainforest of Subtropical Australia TEC has been extensively cleared for agricultural purposes as it primarily occurs on flat and relatively fertile soils. Clearing has dramatically decreased its extent and the resulting fragmentation has made the TEC more vulnerable to threats such as weed invasion. Historical clearing is evident in the disturbance footprint around the 20 m wide HV powerline easement, with a buffer of 40 m between the easement and the TEC. Other historical disturbances include a 6 m wide walking track directly to the south of the TEC (refer Photograph 2.2), that makes up part of the walking track infrastructure of Ben Bennett Bushland Park. The TEC has also experienced historical logging, with species like *Gmelina leichhardtii* (White beech) heavily harvested.



Service layers: City of Moreton Bay, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community; Data sources: Queensland Spatial Catalogue - 2023



Legend

-  Disturbance Footprint
-  Extent of Lowland Rainforest of Subtropical Australia TEC
-  Indirect impact/edge effect areas

Revision: A

Date: 17/12/2025

A3 scale: 1:3,000



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Figure 7.2 Extent of Lowland Rainforest of Subtropical Australia TEC

Weeds compete with native species for space, light, water and nutrients. They also suppress and out-compete mid-storey and canopy trees. Transformer weeds are highly invasive plants with the potential to seriously alter the structure and function of the TEC they invade, thereby 'transforming' them into a different system.

Urbanisation results in impacts such as the invasion of bushland by domestic dogs and cats, rubbish dumping, trampling, garden escapes, firewood collection, impacts from vehicles, the creation of informal trails, and arson. Urbanisation also increases pressure to reduce bushfire fuel loads that may be detrimental to the ecological community. Urbanisation in the form of residential development has long been established to the south of Ben Bennett Bushland Park.

Hydrological threats have not been identified by the listing advice or Conservation Advice for this community (DSEWPC, 2011a).

Significant impact assessment

A SIA of the Project potential impact upon the Lowland Rainforest of Subtropical Australia TEC is provided in Table 7.4.

Given the Project commitment to TEC mitigation measures (refer Section 6) the proposed action is unlikely to significantly increase or amplify the abovementioned relevant TEC threats to the extent that a reduction in the quality and condition class of the TEC and/or long-term viability of TEC patches would occur. The SIA presented in Table 7.4 outlines this in further detail.

Table 7.4 Significant impact assessment of Lowland Rainforest of Subtropical Australia TEC

Significant impact criteria	Predicted direct impacts to TEC	Predicted indirect impacts to TEC
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:		
Reduce the extent of an ecological community	<p>Unlikely to have a significant impact</p> <p>No areas containing the Lowland Rainforest of Subtropical Australia TEC are proposed to be cleared (refer Figure 7.2). Clearing will be located south of the current extent of TEC. Therefore, the current extent of this TEC will not be reduced as a result of the Project.</p>	<p>Unlikely to have a significant impact</p> <p>Approximately 0.13 ha of Lowland Rainforest of Subtropical Australia TEC is located within 50 m of the disturbance footprint.</p> <p>The proposed action is unlikely to reduce to the extent of the TEC due to the following:</p> <ul style="list-style-type: none"> ■ Construction footprint will be strictly limited to the smallest area possible required in order to facilitate the works ■ Strict control of ignition sources to minimise the risk of accidental fires will be implemented ■ Dust will be controlled throughout the construction phase within direct TEC areas and buffer zones through dust suppression ■ Regular weed hygiene inspections required for all machinery entering from outside to prevent introduction of new weed infestations within the TEC ■ Implement effective sediment and erosion control methods prior to and during vegetation clearing and civil works to control runoff and prevent movement of weeds and pathogens entering waterways and into adjoining TEC and other native vegetation outside of the disturbance footprint ■ No hydrological changes are anticipated to impact the TEC nor modify its extent as a result of the design.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	<p>Unlikely to have a significant impact</p> <p>No areas containing the Lowland Rainforest of Subtropical Australia TEC are proposed to be cleared (refer Figure 7.2). Clearing will be located south of the current extent of the TEC. Therefore, the proposed action will not contribute to an increase in fragmentation of this TEC.</p>	<p>Unlikely to have a significant impact</p> <p>No areas containing the Lowland Rainforest of Subtropical Australia TEC are proposed to be cleared. Clearing will be located south of the current extent of the TEC. Therefore, the Project will not indirectly contribute to an increase in fragmentation of this TEC.</p>
Adversely affect habitat critical to the survival of an ecological community	<p>Unlikely to have a significant impact</p> <p>No areas containing the Lowland Rainforest of Subtropical Australia TEC are proposed to be cleared (refer Figure 7.2). Vegetation surrounding the TEC is dominated by Myrtaceous species (e.g. <i>Eucalyptus</i> spp. and <i>Melaleuca</i> spp.). These species are not considered to be part of the Lowland Rainforest of Subtropical Australia TEC as they are distinct communities in their own right.</p>	<p>Unlikely to have a significant impact</p> <p>Approximately 0.13 ha of Lowland Rainforest of Subtropical Australia TEC is located within 50 m of the disturbance footprint.</p> <p>Based on current survey effort into edge effects currently existing and as per the existing Ben Bennett Bushland Park Regeneration Works Plan (refer Appendix L), continued management will ensure that indirect impacts from edge are unlikely to occur within the extent of the Lowland Rainforest of Subtropical Australia TEC. The following mitigation measures will be applied to the Project:</p> <ul style="list-style-type: none"> ■ Construction footprints will be strictly limited to the smallest area possible required in order to facilitate the works ■ Regular weed hygiene inspections required for all machinery entering from outside to prevent introduction of new weed infestations within the TEC

Significant impact criteria	Predicted direct impacts to TEC	Predicted indirect impacts to TEC
	Therefore, the Project will not adversely affect habitat critical to the survival of the TEC.	<ul style="list-style-type: none"> ■ Based on pre-construction weed survey results, temporary washdowns may be required throughout high-risk activities (e.g. site establishment and clearing works) and biosecurity control measures in accordance with <i>MRTS 51 Environmental Management</i>. ■ Strict control of ignition sources to minimise the risk of accidental fires will be implemented ■ Rehabilitation of disturbed habitat to be undertaken in suitable locations (i.e. outside road corridor) using established native species in accordance with <i>MRTS16 Landscape and Revegetation</i> and landscape drawings included in Volume 2 of TMR's TIC-CO ■ Implementation of effective erosion and sediment control methods prior to and during vegetation clearing and civil works to control runoff and prevent movement of weeds and pathogens entering waterways and into the adjoining TEC and other native vegetation outside of the disturbance footprint ■ Dust suppression measures to be implemented such as soil binders, watercarts, speed restrictions, appropriate erosion and sediment measures, and progressive stabilisation and revegetation of temporary disturbance areas. <p>After construction is completed, disturbance and threats of the proposed action will return to current levels commensurate with surrounding land use.</p>
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	<p>Unlikely to have a significant impact</p> <p>No areas containing the Lowland Rainforest of Subtropical Australia TEC are proposed to be cleared (refer Figure 7.2). Clearing will be located south of the current extent of the TEC.</p>	<p>Unlikely to have a significant impact</p> <p>Clearing will be located south of the current extent of the TEC (refer Figure 7.2). Field investigations indicate that the proposed action is located 'downstream' of the Lowland Rainforest of Subtropical Australia TEC.</p> <p>Flood modelling conducted for the Project have shown no discernible flood depth change, velocity or regime flow change for 1% AEP for the TEC comparing the baseline and design case. It is therefore considered that abiotic factors necessary for the TEC survival will remain unaltered by indirect impacts associated with the Project.</p> <p>In addition, Project design includes stormwater infrastructure to ensure that current hydrological processes are maintained. It is therefore considered that abiotic factors necessary for the TEC survival will remain unaltered by the Project.</p>
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	<p>Unlikely to have a significant impact</p> <p>No areas containing the Lowland Rainforest of Subtropical Australia TEC are proposed to be cleared. Clearing will be located south of the current extent of the TEC (refer Figure 7.2).</p>	<p>Unlikely to have a significant impact</p> <p>Approximately 0.13 ha of Lowland Rainforest of Subtropical Australia TEC is located within 50 m of the disturbance footprint.</p> <p>Based on current survey effort into edge effects currently existing and as per the existing Ben Bennett Bushland Park Regeneration Works Plan (refer Appendix L), continued management will ensure that indirect impacts from edge are unlikely to occur within the extent of the Lowland Rainforest of Subtropical Australia TEC. The following mitigation measures will be applied to the Project:</p> <ul style="list-style-type: none"> ■ All construction material and laydown areas will be detailed in accordance with <i>MRTS 28 Contractor's Site Facilities and Camp</i> kept out of TEC extent and where possible, a buffer of existing vegetation between the proposed action and TEC will be retained (refer Figure 7.2). In addition, exclusion fencing will reduce the risk of illegal dumping of green waste that may result in increased weed prevalence.

Significant impact criteria	Predicted direct impacts to TEC	Predicted indirect impacts to TEC
		<ul style="list-style-type: none"> ■ Further rehabilitation against the disturbance footprint boundary is proposed for the Project in accordance with <i>MRTS16 Landscape and Revegetation</i> and annexure, and landscape drawings in Volume 2 of TMR's TIC-CO. ■ Avoidance of key structural roots originating from the inspection and identification of TPZ determined in accordance with AS4970-2009 – <i>Protection of trees on development sites</i> assessed by a qualified arborist or relevant specialist for trees greater than 3 m. Inspections will be limited to within 50 m buffer of the disturbance footprint intersecting the Lowland Rainforest of Subtropical Australia TEC. Preliminary surveys have been undertaken to identify any potential encroachment into the TPZ or SRZ of the trees within the LRSA and no potential encroachment was identified as per AS4970 (refer Figure 7.3). ■ Where SRZs cannot be avoided, a suitably qualified and experienced arborist will be engaged to identify and implement a strategy to ensure that impacted trees can be retained (i.e. selective trimming of canopy to ensure that the unimpacted roots can adequately support the retained canopy). This will ensure that impacts to trees will be short term. ■ Ongoing weed, pest and restoration activities undertaken by SCC for the TEC within Ben Bennett Bushland Park in accordance with the Ben Bennett Bushland Park Regeneration Works Plan (refer Appendix L) and the exclusion of unauthorised vehicle access, noting that formed access track currently exist through the TEC which are used for educational activities ■ Regular weed hygiene inspections required for all machinery entering from outside to prevent introduction of new weed infestations within the TEC ■ Based on pre-construction weed survey results, temporary washdowns may be required throughout high-risk activities (e.g. site establishment and clearing works) ■ Strict control of ignition sources to minimise the risk of accidental fires will be implemented ■ Rehabilitation of disturbed habitat to be undertaken in suitable locations (i.e. outside road corridor) using established native species in accordance with <i>MRTS16 Landscape and Revegetation</i> and landscape drawings included in Volume 2 of TMR's TIC-CO ■ Implementation of effective erosion and sediment control methods prior to and during vegetation clearing and civil works to control runoff and prevent movement of weeds and pathogens entering waterways and into the adjoining TEC and other native vegetation outside of the disturbance footprint ■ Dust suppression measures to be implemented such as soil binders, watercarts, speed restrictions, appropriate erosion and sediment measures, and progressive stabilisation and revegetation of temporary disturbance areas. <p>It is not considered that edge related impacts will cause a substantial change in the species composition or ecological functionality of the Lowland Rainforest of Subtropical Australia TEC at this location given the community's mature nature.</p> <p>After construction is completed, disturbance and threats of the proposed action will return to current levels commensurate with surrounding land use.</p>

Significant impact criteria	Predicted direct impacts to TEC	Predicted indirect impacts to TEC
<p>Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:</p> <ul style="list-style-type: none"> ■ 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 	<p>Unlikely to have a significant impact</p> <p>No areas containing the Lowland Rainforest of Subtropical Australia TEC are proposed to be cleared (refer Figure 7.2).</p>	<p>Unlikely to have a significant impact</p> <p>Approximately 0.13 ha of Lowland Rainforest of Subtropical Australia TEC are located within 50 m of the disturbance footprint.</p> <p>Clearing will occur proximate to the Lowland Rainforest of Subtropical Australia TEC, and it is expected that there may be edge related impacts to the south-western tip of Lowland Rainforest of Subtropical Australia TEC.</p> <p>Weed species present along the periphery of the TEC include non-native grasses such as Signal grass (<i>Urochloa muricata</i>) and small shrubs spread primarily by birds (e.g. <i>Ochna</i> [<i>Ochna serrulata</i>]). Whilst clearing may facilitate the establishment of these species at the edge of the clearing front, they are not likely to be able to encroach significantly into the undisturbed Lowland Rainforest of Subtropical Australia TEC as the area already contains a mature canopy and ecological community. This has been confirmed with weed transect surveys in which 100 m transects measuring weed percentage cover every 5 m were placed perpendicular to the current edge of the TEC boundary (refer Figure 4.9). It was found that weed edge effects did not spread beyond 3 m into the current edge of the TEC. For the condition class of the TEC to be impacted the non-native cover would need to increase from its current 0% cover to more than 30% non-native cover. It is therefore anticipated that with the implementation of the <i>MRTS51 Environmental Management</i> and continuation of current weed maintenance (refer Appendix L) weed edge effects related to construction and operation will be minimal and not impact the condition threshold of the TEC.</p> <p>Given the location of the TEC upstream of the disturbance footprint, the potential for the Project to result in the introduction of fertilisers, herbicides or other chemicals or pollutants into the TEC, which kill or inhibit the growth of species in the ecological community, is considered unlikely.</p> <p>Mitigation measures (outlined in the Project EMP(C), ESCP, and Pest and Weed Management Plan) will be implemented to ensure invasive species are not established, and spill management of fertilisers, herbicides or other chemicals are managed accordingly. Potential indirect impacts will be avoided and minimised through the following:</p> <ul style="list-style-type: none"> ■ Weed and seed certificates and regular weed hygiene inspections for all machinery entering from outside will be implemented to prevent introduction of new weed infestations within the TEC ■ Based on pre-construction weed survey results, temporary washdowns will be required throughout high-risk activities (e.g. site establishment and clearing works) ■ Rehabilitation of disturbed habitat to be undertaken in suitable locations (i.e. outside road corridor) using established native species in accordance with <i>MRTS16 Landscape and Revegetation</i> and landscape drawings included in Volume 2 of TMR's TIC-CO. These specifications control the use of fertilisers to provide safe and appropriate application to native species and to manage impacts outside of applied planting areas.

Significant impact criteria	Predicted direct impacts to TEC	Predicted indirect impacts to TEC
Interfere with the recovery of an ecological community	<p>Unlikely to have a significant impact</p> <p>As no areas identified as Lowland Rainforest of Subtropical Queensland TEC will be cleared (refer Figure 7.2), the proposed action is unlikely to interfere with the recovery of the TEC.</p>	<p>Unlikely to have a significant impact</p> <p>A national recovery plan is not currently available for the Lowland Rainforest of Subtropical Australia TEC. However, it is considered that recovery should focus on the following threats identified in the approved conservation advice (DSEWPC 2011a), including:</p> <ul style="list-style-type: none"> ■ Vegetation clearance ■ Impacts associated with fragmentation of remnants and weeds. <p>Mitigation measures (outlined in the Project EMP(C), ESCP, and Pest and Weed Management Plan) will be implemented to ensure invasive species are not established, and spill management of fertilisers, herbicides or other chemicals are managed accordingly. Potential indirect impacts are avoided through the following:</p> <ul style="list-style-type: none"> ■ Regular weed hygiene inspections will be required for all machinery entering the disturbance footprint to minimise the risk of introduction of new weed infestations within the TEC ■ Based on pre-construction weed survey results, temporary washdowns may be required throughout high-risk activities (e.g. site establishment and clearing works) ■ Rehabilitation of disturbed habitat to be undertaken in suitable locations (i.e. outside road corridor) using established native species in accordance with <i>MRTS16 Landscape and Revegetation</i> and landscape drawings included in Volume 2 of the TMR TIC-CO.
Assessment of potential for significant residual impacts	The proposed action has been assessed against the criteria above and it is considered unlikely to result in a significant residual impact on the Lowland Rainforest of Subtropical Australia TEC.	



Service layers: City of Moreton Bay, Earthstar Geographics, City of Moreton Bay, MBRC; Data sources: Queensland Spatial Catalogue - 2023



Legend

- Surveyed Tree Locations
- Limit of work line
- ▭ Disturbance Footprint
- ▭ Extent of Lowland Rainforest of Subtropical Australia TEC
- ▭ TPZ radius (m)
- ▭ SRZ radius (m)

Revision: A

Date: 4/12/2025

A3 scale: 1:400



Caloundra Transport Corridor Upgrade

Figure 7.3 SRZ and TPZ surveys locations within the Lowland Rainforest TEC

7.4 Critically endangered and endangered species

SIAs have been completed for critically endangered and endangered species that are considered likely or have potential to occur within the disturbance footprint, following completion of the detailed desktop assessment and field assessment.

The MNES Significant Impact Guidelines 1.1 includes criteria to assess the potential for significant impacts to critically endangered and endangered species, these being where there is a real chance or possibility that an action will:

- lead to a long-term decrease in the size of a population
- reduce the area of occupancy of the species
- fragment an existing population into two or more populations
- adversely affect habitat critical to the survival of the species
- disrupt the breeding cycle of a population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
- introduce disease that may cause the species to decline, or
- interfere with the recovery of the species.

The MNES Significant Impact Guidelines 1.1 define 'habitat critical to the survival of a species or ecological community' as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long-term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community.

The relevant critically endangered and endangered species which have the potential to be impacted by the Project include:

- Swift parrot (*Lathamus discolor*) – Critically Endangered
- Koala (*Phascolarctos cinereus*) – Endangered.

The two species listed above have each been assessed against the MNES Significant Impact Guidelines 1.1 for MNES critically endangered and endangered species in the sections below.

7.4.1 Swift parrot (*Lathamus discolor*)

Ecology and distribution

The Swift parrot is endemic to south-eastern Australia. This species breeds only in Tasmania and migrates during the autumn and winter months to South East Queensland as well as both the coastal and south-west slopes of New South Wales (NSW) (TSSC 2016). The Swift parrot feeds predominantly on nectar, mainly from eucalypts, but also eats psyllid insects and lerps (waxy secretion on eucalypt leaves produced as a protection by young psyllid insects), seeds and fruit.

The Swift parrot typically inhabits dry sclerophyll, eucalypt forests, woodlands, suburban parks and even gardens with flowering fruit trees with records showing it occasionally inhabiting wet sclerophyll forests (TSSC 2016).

In northern NSW and South East Queensland, narrow-leaved ironbark (*Eucalyptus crebra*), forest red gum (*E. tereticornis*) forests and yellow box (*E. melliodora*) forest are commonly utilised by Swift parrots. Habitats associated with the inland slopes of the Great Dividing Range, and along the eastern coastal plains, are considered the principal wintering grounds (TSSC 2016).

The following have been identified as potentially threatening processes to the Swift parrot:

- Habitat loss associated with breeding sites as well as drought refugia habitat
- Habitat alteration through forestry operations, firewood collection and urbanisation in Tasmania
- Competition with noisy miner and aggressive honeyeaters
- Nest predation by gliders (TSSC 2016).

The Swift parrot is considered to have a potential likelihood of occurrence within the disturbance footprint as potential habitat for the species occurs throughout the disturbance footprint.

Recovery plans/threat abatement plans

The National Recovery Plan for the Swift parrot was established in 2011. The Recovery Plan notes the following potentially threatening processes identified for the Swift Parrot:

- Habitat loss and alteration
- Climate change
- Collision mortality
- Competition
- Frequent fire
- Psittacine beak and feather disease
- Illegal wildlife capture and trading
- Cumulative impacts (DCCEEW 2024).

The overall objective of the National Recovery Plan for the Swift parrot is to prevent further population decline of the species and to achieve a demonstrable sustained improvement in the quality and quantity of its habitat to increase carrying capacity. This objective is to be achieved by implementing recovery actions for each of the following specific recovery objectives:

- Objective 1: To identify and prioritise habitats and sites used by the species across its range, on all land tenures
- Objective 2: To implement management strategies to protect and improve habitats and sites on all land tenures
- Objective 3: To monitor and manage the incidence of collisions, competition and beak and feather disease
- Objective 4: To monitor population trends and distribution throughout the range (DCCEEW 2024).

Important populations and critical habitat

The Swift parrot occurs as a single, migratory population. Of particular importance for conservation management are habitats which are used:

- For nesting,
- By large proportions of the Swift parrot population,

- Repeatedly between seasons (site fidelity), or
- For prolonged periods of time (site persistence).

Site fidelity is considered to be important for the long-term survival of migrants at both breeding and non-breeding sites. Priority habitats for the species as listed in the recovery plan include:

- South East Queensland: Brisbane – Bowman Park, Bardon; Rafting Creek Reserve, and Kenmore/Fig Tree Pocket
- Toowoomba – Glen Lomond Park.

An assessment of the presence of habitat critical to the survival of the Swift parrot (as defined in the conservation advice for the species (TSSC 2016)) with the disturbance footprint is presented in Table 7.5.

Table 7.5 Assessment against the definition for habitat critical to the survival of the species

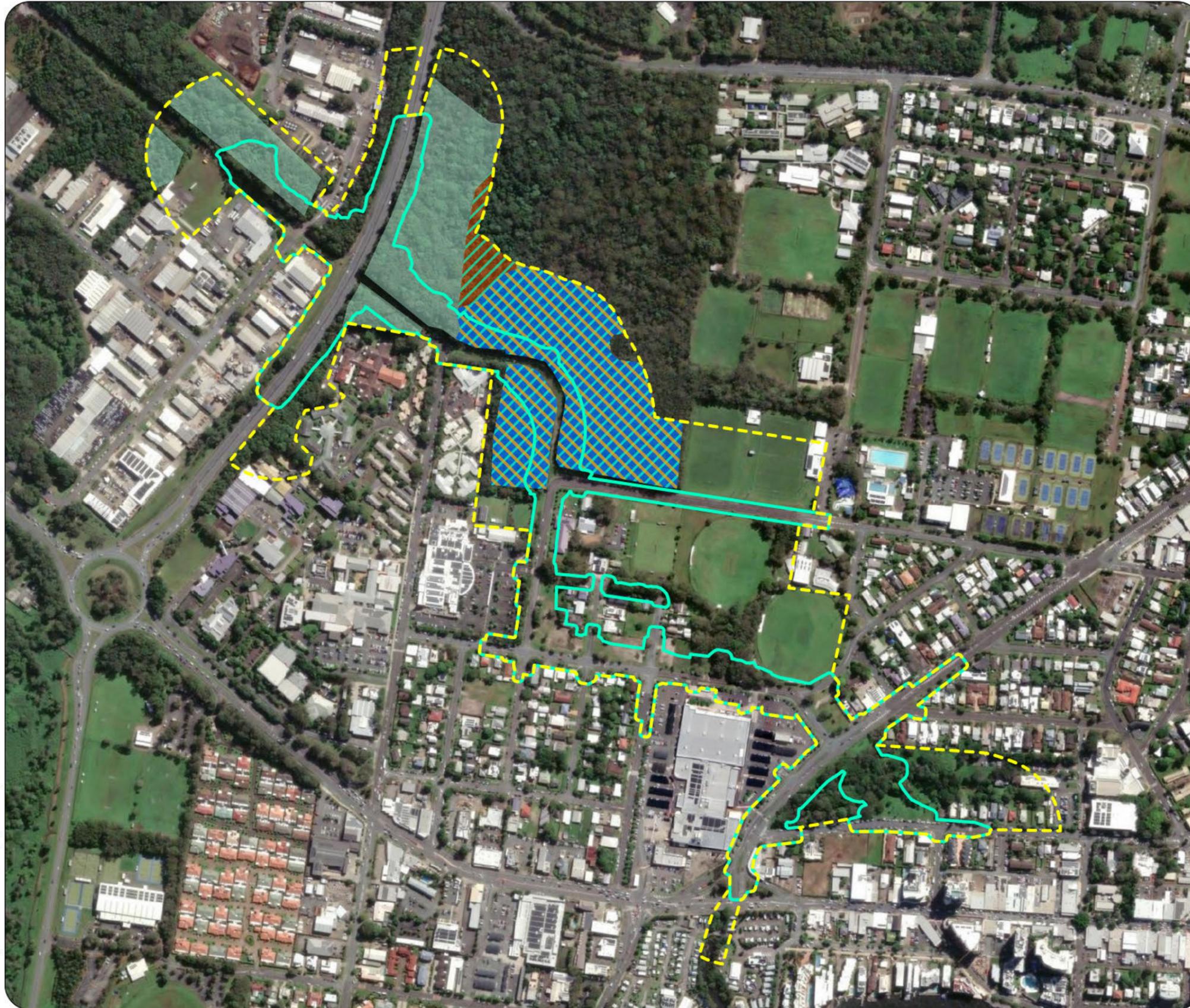
Habitat critical to the survival of the species criteria	Response
Areas that are necessary for activities such as foraging, breeding, roosting, or dispersal	<p>Yes – Swift parrots preferentially forage in large, mature trees. The species utilises select Eucalyptus species as foraging habitat on mainland Australia (during autumn and winter). These include <i>Eucalyptus leucoxylon</i>, <i>E. tricarpa</i>, <i>E. sideroxylon</i>, <i>E. microcarpa</i>, <i>E. albens</i>, <i>E. melleodora</i>, <i>E. robusta</i>, <i>E. tereticornis</i>, <i>E. pilularis</i>, and <i>Corymbia maculata</i>. Habitat outside of these trees are considered to be used opportunistically rather than provide reliable quantity and quality of resources which the species can depend on (such as planted Eucalypts).</p> <p>Mature <i>E. robusta</i> occurs within the disturbance footprint, although is restricted to the swamp sclerophyll forest.</p> <p>The breeding location for the species is in Tasmania in Blue Gum (<i>E. globulus</i>) dominated forests and woodlands and therefore, not within the disturbance footprint.</p> <p>Vegetation structure and proximity to foraging sites are important for roost site selection, however information regarding roost sites for the Swift parrot is relatively unknown. No known priority habitat of the Swift parrot occurs near the disturbance footprint.</p>
Areas that are necessary for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)	<p>No – Site fidelity is important for the long-term survival of the species at breeding and non-breeding sites. No known priority habitat for the Swift parrot has been identified within the vicinity of the disturbance footprint. Therefore, the disturbance footprint is not necessary for the long-term maintenance of the species.</p>
Areas necessary to maintain genetic diversity and long-term evolutionary development	<p>No – The breeding locations for the species occurs strictly in Tasmania. Additionally, the disturbance footprint does not support a known priority habitat. Therefore, the disturbance footprint is not considered to be necessary to maintain genetic diversity and long-term evolutionary development.</p>
Areas necessary for the reintroduction of populations or recovery of the species or ecological community	<p>No – As the disturbance footprint only contains some mature <i>E. robusta</i> that the species will utilise and the habitat is marginal and exposed to competing species (such as the Rainbow lorikeet), the disturbance footprint is not considered necessary for the reintroduction of populations or recovery of the species.</p>
Areas of priority habitat for which the Swift Parrot has a level of site fidelity or possess phenological characteristics likely to be of importance to the Swift Parrot, or are otherwise identified by the recovery team	<p>No – Priority habitat for the Swift parrot has been identified in the Brisbane suburbs of Bardon and Kenmore and not in proximity to the disturbance footprint.</p>
Conclusion of assessment:	<p>The disturbance footprint does contain habitat critical to the survival of the species.</p>

Potential ground-truthed habitat identified for the Swift parrot, and areas where it may intersect the disturbance footprint, is illustrated in Figure 7.4. Approximately 1.46 ha of suitable habitat is proposed to be removed. An assessment against the SIA criteria for this species is presented in Table 7.6.

Table 7.6 MNES significant impact criteria for: Swift parrot (*Lathamus discolor*)

MNES SIA criteria for an Endangered species	Assessment against significance criteria
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	
Lead to a long-term decrease in the size of a population of the species	<p>Unlikely to have a significant impact</p> <p>The Project is not near any breeding populations of the Swift parrot (restricted to Tasmania), nor are any Project works likely to add to abundance of competing species.</p> <p>Approximately 1.46 ha of suitable habitat is proposed to be removed. The habitat within the disturbance footprint is considered to be habitat critical to the survival of the species. However, the proposed action is not likely to remove enough habitat that will significantly fragment any existing population or reduce the size of a population to a point that will lead to a long-term decrease in the population size.</p>
Reduce the area of occupancy of a population	<p>Unlikely to have a significant impact</p> <p>The Swift parrot is known to occur within the broader region of the Project. Total habitat to be removed for the proposed action includes approximately 1.41 ha of suitable habitat. However, this removal of habitat is not expected to severely impact a population of the species, fragment an existing population, or cause any future barriers to movement further than what is already present.</p> <p>The extent of occurrence for the species is unlikely to be reduced by the Project and an abundance of suitable habitat directly surrounding the disturbance footprint is to remain intact during Project works. Therefore, the Project is unlikely to reduce the area of occupancy for any population that exists surrounding the disturbance footprint.</p>
Fragment an existing population into two or more populations	<p>Unlikely to have a significant impact</p> <p>The Project will remove approximately 1.41 ha of foraging and dispersal habitat for the species. The majority of the disturbance footprint remains at the edges of intact vegetation and does not significantly isolate intact vegetation patches. Further the species is highly mobile, and the Project is not considered to represent a barrier to movement for the species. Therefore, the proposed action is unlikely to fragment an existing population.</p>
Adversely affect habitat critical to the survival of the species	<p>Unlikely to have a significant impact</p> <p>The proposed action will remove approximately 1.41 ha of foraging habitat that is habitat critical to the survival of the species. The majority of the disturbance footprint remains to the edges of intact vegetation and considering the available habitat surround the disturbance footprint and the relatively small area impacted, the impact to habitat critical to the survival of the Swift parrot within the disturbance footprint is not considered to be adverse.</p>
Disrupt the breeding cycle of a population	<p>Unlikely to have a significant impact</p> <p>The Swift parrot breeds in Tasmania during the summer and the population migrates north to mainland Australia for the winter for the non-breeding season. The breeding range of the Swift parrot is largely restricted to the east and south-east coast of Tasmania and closely mirrors the distribution of Tasmanian blue gum (<i>Eucalyptus globulus</i>). Since the disturbance footprint is located within the species overwinter non-breeding habitat, the proposed action is unlikely to significantly disrupt the breeding cycle of the species.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely to have a significant impact</p> <p>The removal of vegetation for the Project is relatively minimal and will not affect habitat to the extent that the species is likely to decline. The proposed action will not interfere with dispersal patterns that already exist.</p>

MNES SIA criteria for an Endangered species	Assessment against significance criteria
Result in invasive species that are harmful to a Critically Endangered or Endangered species becoming established in the Critically Endangered or Endangered species habitat	<p>Unlikely to have a significant impact</p> <p>It is anticipated that the Project EMP(C) and operational environmental mitigation measures will adequately mitigate the risk of introducing or establishing an invasive species that is detrimental to the Swift parrot. Appropriate mitigation measures for biosecurity will be implemented during the Project works (outlined in the Project EMP(C) and the Pest and Weed Management Plan).</p>
Introduce disease that may cause the species to decline	<p>Unlikely to have a significant impact</p> <p>It is anticipated that the Project EMP(C) and operational environmental mitigation measures will adequately mitigate the risk of introducing or establishing a disease that is detrimental to the Swift parrot.</p>
Interfere substantially with the recovery of the species	<p>Unlikely to have a significant impact</p> <p>The proposed action is not likely to increase the trend of decline of the Swift parrot by the minimal amount of habitat removal and no long alteration to the dispersal of the species.</p>
Assessment of potential for significant residual impacts	<p>The species has been assessed against the criteria above and it has been determined that the proposed action is unlikely to constitute a significant residual impact on this species.</p>



Service layers: City of Moreton Bay, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community; Data sources: Queensland Spatial Catalogue - 2023



Legend

- Disturbance Footprint
- Habitat**
- Long-nosed potoroo
- Swift parrot
- Glossy black-cockatoo
- Three-toed snake-tooth skink**
- Critical Habitat
- Suitable Habitat
- Study Area*

*Study area has been determined based off a 100 m buffer from the disturbance footprint, where MNES have the potential to occur. Where there were no potential MNES likely to occur (i.e. preexisting residential developments) the area was not considered to form part of the Study area

Revision: A

Date: 4/12/2025

A3 scale: 1:6,000



Caloundra Transport Corridor Upgrade

Figure 7.4 Potential habitat mapping for the assessed species unlikely to be significantly impacted

7.4.2 Koala (*Phascolarctos cinereus*)

Ecology and distribution

The Koala is a medium-sized, arboreal marsupial endemic to Australia, with a range from north-eastern Queensland to the southeast corner of South Australia. Within Queensland, the highest density of the Koala population occurs in SEQ. Lower densities occur through central and eastern areas (Youngentob et al. 2021).

Koalas naturally inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by Eucalyptus species and their habitat can be broadly defined as any forest or woodland containing species that are known Koala food trees, or shrubland with emergent food trees. The distribution of this habitat is largely influenced by land elevation, annual temperature and rainfall patterns, soil types and the resultant soil moisture availability and fertility. Preferred food and shelter trees are naturally abundant on fertile clay soils. In coastal lowlands in Queensland, Koalas are also found in vegetation communities dominated by Melaleuca or Casuarina species (Youngentob et al. 2021).

Koalas are folivores, feeding primarily during the dawn, dusk or night periods. The Koala's diet is restricted mainly to *Eucalyptus* spp.; however, they may also consume foliage of related genera (Family: Myrtaceae), including *Corymbia* spp., *Angophora* spp. and *Lophostemon* spp. (Youngentob et al. 2021).

Whilst Koalas maintain a defined home-range, they are not considered to be territorial, and there may be significant overlap in the distribution of home-ranges. Home range size is also variable with those occurring within poorer quality habitat, being relatively larger in size, when compared to those that are located within higher quality habitat.

Koalas have naturally low fecundity, with females potentially producing a single offspring a year, with births occurring within the warmer months of the year (e.g. October through to May). The estimated lifespan of wild Koalas is generally greater than 15 years in females and 12 years in males.

The main threats to the Koala include:

- Habitat loss and fragmentation
- Mortality associated with dog attacks and vehicle strikes
- Disease (i.e. Chlamydiosis)
- Climate change and drought
- Other threats such as Bell Miner Associated Dieback and Myrtle rust, both of which impact the health and quantity of available forage (DAWE 2022c).

Recovery plans/threat abatement plans

The National Recovery Plan for the Koala (*Phascolarctos cinereus*) (combined populations of Queensland, NSW and the Australian Capital Territory) was established in March 2022 (DAWE 2022c), which replaces the *National Koala Conservation and Management Strategy 2009-2014* which expired in 2014. The Commonwealth Government approved conservation advice notes the following potential threatening processes for Koala:

- Habitat loss, modification or fragmentation as a result of urbanisation
- Secondary threats such as predation by domestic dogs, vehicle strikes and stress
- Extreme heat events and drought
- Chlamydia and other diseases (such as Koala retrovirus) which reduces the life expectancy of the species (DAWE 2022c).

The overall goal outline in the species National recovery plan is to 'stop the trend of decline in population size of the listed Koala, by having resilient, connected, and genetically healthy metapopulations across its range, and to increase the extent, quality and connectivity of habitat occupied.'

Important populations and critical habitat

Important populations are described within the Conservation Advice as populations that are valued for cultural, social, and economic reasons as well as for the species conservation. Important populations also include those that:

- Have the potential to act as source populations to adjacent areas of suitable, or potentially suitable, habitat
- Exist in areas of climatically suitable refugia during periods of environmental stress including droughts, heatwaves, and long-term climate change
- Are genetically diverse
- Are disease free and/or exhibit low rates of infection with important pathogens
- Contain genes which may confer adaptation to current and future environmental stressors
- Are geographical or environmental outliers within the species range.

Social cultural and economic reasons a population may be an important population are as follows:

- Cultural and spiritual importance to Indigenous people
- The social value and enjoyment of having Koalas close to residential areas
- The economic value brought to local business and tourism
- The iconic species value at the national and international political and community level.

The species conservation advice defines habitat critical to the survival of the species as: the areas that the species relies on to avoid or halt decline and promote the recovery of the species. Factors that may be considered as habitat critical to the Koala include:

- Whether the habitat is used during periods of stress (examples: flood, drought or fire)
- Whether the habitat is used to meet essential life cycle requirements (examples: foraging, breeding, nesting, roosting, social behaviour patterns or seed dispersal processes)
- The extent to which the habitat is used by important populations
- Whether the habitat is necessary to maintain genetic diversity and long-term evolutionary development
- Whether the habitat is necessary for use as corridors to allow the species to move freely between sites used to meet essential life cycle requirements
- Whether the habitat is necessary to ensure the long-term future of the species or ecological community through reintroduction or re-colonisation
- Any other way in which habitat may be critical to the survival of a listed threatened species or a listed threatened ecological community (DAWE 2022a).

Koala habitat for dispersal only consists of areas that may act as secondary habitat for movement between foraging, resting and breeding habitats. Areas of habitat available to the Koala within the disturbance footprint (4.65 ha) are considered to be necessary to local species populations. An assessment of the presence of habitat critical to the survival of the Koala (defined in the conservation advice for the species) within the disturbance footprint is presented in Table 7.7.

Table 7.7 Assessment against the definition for habitat critical to the survival of the species

Habitat critical to the survival of the species criteria	Response to criteria in relation to the disturbance footprint
Is the habitat used during periods of stress (examples: flood, drought or fire)?	Yes – The disturbance footprint contains approximately 4.65 ha of potential Koala foraging, resting and breeding habitat and 2.15 ha of dispersal habitat. This includes intact forest habitat with suitable food and habitat trees for the Koala. Therefore, Koalas may use areas within the disturbance footprint in times of stress as suitable habitat.

Habitat critical to the survival of the species criteria	Response to criteria in relation to the disturbance footprint
Is the habitat is used to meet essential life cycle requirements (examples: foraging, breeding, nesting, roosting, social behaviour patterns or seed dispersal processes)?	Yes – The disturbance footprint contains habitat with suitable food and habitat trees for the Koala. Additionally, there is adequate dispersal habitat within the disturbance footprint. Koalas may use areas within the disturbance footprint as foraging, breeding, and dispersal habitat.
Is the habitat used by important populations?	Yes – There is no clear indication whether there is an important population of the Koala for conservation purposes that occurs within the disturbance footprint. However, as per the definition of an important population above, any Koala that occurs may be considered part of an important population for social, cultural, or economic reasons. There are two known records of the species from the last 20 years within a 2 km radius of the disturbance footprint. Therefore, habitat is considered likely to be used by an important population.
Is the habitat necessary to maintain genetic diversity and long-term evolutionary development?	Yes – Approximately 4.65 ha of habitat necessary to maintain genetic diversity and long-term evolutionary development is identified to occur within the disturbance footprint.
Is the habitat necessary for use as corridors to allow the species to move freely between sites used to meet essential life cycle requirements?	Yes – Areas of corridors for the Koala were identified to occur within the disturbance footprint.
Is the habitat necessary to ensure the long-term future of the species or ecological community through reintroduction or re-colonisation?	No – Taking into consideration the amount of intact vegetation that will not be removed for the proposed action, and proposed action activities not causing any further fragmentation or isolation for the species, the habitat within the disturbance footprint is not considered to be necessary to ensure the long-term future of the species.
Any other way in which habitat may be critical to the survival of a listed threatened species or a listed threatened ecological community.	Not applicable.
Conclusion of assessment:	The disturbance footprint does contain habitat critical to the survival of the species.

The proposed action is situated amongst climatically suitable refugia with connectivity to areas such as Ben Bennet Bushland Park and the Town Reserve. Potential ground-truthed habitat identified for the Koala and where it may intersect the disturbance footprint is illustrated in Figure 7.5. An assessment of the Project impacts against the SIA criteria for this species is presented in Table 7.8.

Table 7.8 MNES significant impact criteria for: Koala (*Phascolarctos cinereus*)

MNES SIA Criteria for an Endangered species	Assessment against significance criteria
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	
Lead to a long-term decrease in the size of a population of the species	Unlikely to have a significant impact The Project includes the removal of 4.65 ha of potential Koala foraging, resting and breeding habitat and 2.15 ha of dispersal habitat for the Koala. The habitat within the disturbance footprint is considered to be habitat critical to the survival of the species. However, only two known database records of the species from the last 20 years exist within a 2 km radius of the disturbance footprint. No scratch or scats from the Koalas were identified during field surveys. Further no Koalas were detected from the drone survey or Koala detection dog survey (refer Section 4.7.3). Although an abundance of species records exists in the broader region, the proposed action is not likely to remove enough habitat that will significantly fragment any existing population or reduce the size of a population to a point that will lead to a long-term decrease in the population size.

MNES SIA Criteria for an Endangered species	Assessment against significance criteria
Reduce the area of occupancy of a population	<p>Unlikely to have a significant impact</p> <p>The Koala is known to occur within the broader region of the disturbance footprint. The Project includes the removal of 4.65 ha of potential Koala foraging, resting and breeding habitat and 2.15 ha of potential dispersal habitat for the Koala. However, this removal of habitat is not expected to severely impact a population of the species, fragment an existing population, or cause any future barriers to movement further than what is already present. The extent of occurrence for the species is unlikely to be reduced from the proposed action and an abundance of suitable habitat directly surrounding the disturbance footprint is to remain intact during and post Project works. Therefore, the proposed action is unlikely to reduce the area of occupancy for any population that exists surrounding the disturbance footprint.</p>
Fragment an existing population into two or more populations	<p>Unlikely to have a significant impact</p> <p>The Project includes the removal of 2.15 ha of potential Koala dispersal habitat, comprised primarily of areas devoid of Koala feeding and shelter resources. However, the dispersal functionality of this lost habitat will be maintained through the provision of dedicated infrastructure to facilitate the safe passage of Koalas across and along the Project. Within the shared underpass (6,000 m (W) x 3,000 m (H)), dedicated log and rail, will be constructed to ensure that Koala can traverse through this underpass safely and unimpeded. In addition, refuge poles will be positioned either side of the underpass entrance. A combination of retaining walls and fauna exclusion fencing will be positioned to guide Koalas to the safe crossing location (refer Figure 6.2). This will ensure that movement opportunities exist, allowing Koalas to access areas of retained habitat to the north and south of the Project area.</p> <p>The provision of safe movement opportunities with dedicated infrastructure will maintain connectivity of habitat and therefore is not likely to fragment an existing population into one of more populations.</p>
Adversely affect habitat critical to the survival of the species	<p>Likely to have a significant impact on potential Koala foraging, resting and breeding habitat</p> <p>The Project will remove 4.65 ha of potential Koala foraging, resting and breeding habitat that is considered habitat critical to the survival of the species.</p> <p>Unlikely to have a significant impact on potential Koala dispersal habitat</p> <p>The Project includes the removal of 2.15 ha of potential Koala dispersal habitat, comprised primarily of areas devoid of Koala feeding and shelter resources. However, the dispersal functionality of this lost habitat will be maintained through the provision of dedicated infrastructure to facilitate the safe passage of Koalas across and along the Project. Within the shared underpass (6,000 m (W) x 3,000 m (H)), dedicated log and rail, will be constructed to ensure that Koala can traverse through this underpass safely and unimpeded. In addition, refuge poles will be positioned either side of the underpass entrance. A combination of retaining walls and fauna exclusion fencing will be positioned to guide Koalas to the safe crossing location (refer Figure 6.2). Therefore the Project is unlikely to have a significant residual impact on potential Koala dispersal habitat. It is noted that the retention of dispersal opportunities in a north-south direction for Koalas, will result in their continued ability to access areas of habitat critical for foraging, resting and breeding that will be retained within and outside of the Project area.</p>
Disrupt the breeding cycle of a population	<p>Unlikely to have a significant impact</p> <p>The Project includes the removal of 4.65 ha of potential Koala foraging, resting and breeding habitat and 2.15 ha of potential dispersal habitat for the Koala. The Project is not considered to adversely fragment any existing population of the species within the disturbance footprint due to only two known database records of the species from the last 20 years exist within a 2 km radius of the disturbance footprint. Also no scratch or scats from the Koala were identified during targeted field surveys, and no Koalas were detected from the drone survey or Koala detection dogs (refer Section 4.7.3). The Project is unlikely to create any further barriers to dispersal habits during construction periods.</p> <p>Although an abundance of species records exists in the broader region, the proposed action is not likely to remove enough habitat that will significantly disrupt the breeding cycle of a population.</p>

MNES SIA Criteria for an Endangered species	Assessment against significance criteria
<p>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>	<p>Unlikely to have a significant impact</p> <p>The removal of vegetation for the Project is relatively minimal and will not affect habitat to the extent that the species is likely to decline. This habitat is located in a landscape that has already experienced fragmentation from residential uses, HV transmission line and is unlikely to act as a source population for adjacent areas of suitable habitat. Large intact patches of potential habitat will remain in surrounding vegetation following the construction of the proposed action. The proposed action will not interfere with dispersal patterns that already exist.</p>
<p>Result in invasive species that are harmful to a Critically Endangered or Endangered species becoming established in the Critically Endangered or Endangered species habitat</p>	<p>Unlikely to have a significant impact</p> <p>There are no particular weed species identified as relevant to Koala. The conservation advice identifies that domestic and feral dogs are a known threat to Koalas. Project-associated surveys have recorded weed species listed under the Biosecurity Act and/or as WoNS and evidence of feral predators that are identified as a threat to the species. Due to the urbanised environment, feral predators in the region that are a threat to the species are considered. Feral dogs, cats, and European red foxes are likely present in the area.</p> <p>Dog attacks are a threatening process identified within the National recovery plan for Koala. It is considered unlikely that the proposed action will increase dog attacks within the surrounding area as the proposed action will not cause any further significant barriers to movement and due to careful design considerations, including fauna fencing.</p> <p>Weed and pest control measures will be incorporated into the Project EMP(C) to control the introduction and spread of weed and pest species across the disturbance footprint. The proposed action is considered unlikely to result in invasive species becoming established in this species' habitat.</p>
<p>Introduce disease that may cause the species to decline</p>	<p>Unlikely to have a significant impact</p> <p>The Project EMP(C) and operational environmental mitigation measures will incorporate the management of invasive species which will assist in the prevention of pest plant introduction, <i>Phytophthora cinnamomi</i>, Myrtle rust outbreaks, and diseases (such as Chlamydia and Koala retrovirus) resulting from Project activities.</p> <p>This will include at a minimum vehicle washdown procedures and contractor education (including procedures regarding cleaning clothing). This will be particularly important during any revegetation activities in the vicinity of Koala habitat. Revegetation plant species will be obtained from a reliable source that is certified free of these pathogens.</p> <p>Vegetation clearing within the disturbance footprint in Koala habitat will be carried out in a manner to minimise stress on potential individuals as much as practicably possible (e.g. sequential clearing conditions as per the Queensland <i>Nature Conservation (Koala) Conservation Plan 2017</i> and minimising time of disturbance to animals) as stressed animals are more susceptible to Chlamydia infection. Where individuals are required to be handled during vegetation clearing, they will be examined by experienced personnel. If the individual is suspected of Chlamydia infection it will be taken to a veterinarian/wildlife care facility for treatment prior to release.</p> <p>Project equipment sourced from overseas will be quarantined as required under State and Commonwealth legislation. The proposed action is considered unlikely to introduce disease that may cause the species to decline.</p> <p>It is anticipated that the Project EMP(C) and operational environmental mitigation measures will adequately mitigate the risk of introducing or establishing a disease that is detrimental to the Koala.</p>

MNES SIA Criteria for an Endangered species	Assessment against significance criteria
Interfere substantially with the recovery of the species	<p>Unlikely to have a significant impact</p> <p>The National Recovery Plan for the Koala identified the following objectives to facilitate the recovery of the Koala:</p> <ul style="list-style-type: none"> ■ The area of occupancy and estimated size of populations that are declining, suspected to be declining, or predicted to decline are instead stabilised then increased ■ The area of occupancy and estimated size of populations that are suspected and predicted to be stable are maintained or increased ■ Metapopulation processes are maintained or improved ■ Partners, communities, and individuals have a greater role and capability in listed Koala monitoring, conservation, and management. <p>The proposed action is unlikely to significantly interfere with the abovementioned recovery actions for the species. In addition, the Project EMP(C) will include measures to control potential direct and indirect impacts and threats to the species. Based on this, the proposed action is unlikely to significantly interfere with the recovery of the species.</p>
Assessment of potential for significant residual impacts	<p>The species has been assessed against the criteria above and it has been determined that the proposed action is likely to constitute a significant residual impact on 4.65 ha of habitat for the Koala.</p>



Service layers: City of Moreton Bay, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Data sources: Queensland Spatial Catalogue - 2023



Legend

- Study Area*
- Disturbance Footprint
- Potential habitat for Koala (foraging, resting and breeding habitat)
- Dispersal habitat for Koala
- Significant residual impact area for the Koala Habitat (includes foraging, resting and breeding habitat)

*Study area has been determined based off a 100 m buffer from the disturbance footprint, where MNES have the potential to occur. Where there were no potential MNES likely to occur (i.e. preexisting residential developments) the area was not considered to form part of the Study area

Revision: A

Date: 4/12/2025

A3 scale: 1:6,000



Caloundra Transport Corridor Upgrade

Figure 7.5 Potential habitat mapping for the Koala

7.5 Vulnerable species

SIAs have been completed for vulnerable species that are considered likely or have the potential to occur within the disturbance footprint, following completion of detailed Project desktop assessment and field assessment.

The MNES Significant Impact Guidelines 1.1 provide criteria for assessing the potential for significant impacts to vulnerable species, these being where there is a real chance or possibility that an action will:

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

The vulnerable species SIAs commence with an evaluation of the likely importance of the population, as defined within the significant impact criteria. 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.

Project relevant vulnerable species which have the potential to be impacted by the Project include:

- South-eastern glossy black-cockatoo (*Calyptorhynchus lathami lathami*)
- Three-toed snake-tooth skink (*Coeranoscincus reticulatus*)
- Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)
- Grey-headed flying-fox (*Pteropus poliocephalus*).
- Sand yabby (*Cherax robustus*)
- Wallum sedge frog (*Litoria olongburensis*).

Each of these six species have been assessed against the MNES Significant Impact Guidelines 1.1 for MNES vulnerable species in the sections below.

7.5.1 South-eastern glossy black-cockatoo (*Calyptorhynchus lathami lathami*)

Ecology and distribution

The South-eastern glossy black-cockatoo is a small cockatoo, approximately 46 to 51 centimetres (cm) in length with a wingspan of 90 cm, a tail 21 to 23 cm and an inconspicuous crest and broad bulbous bill. Adult males have solid bright red panels in the ventral surface of their tail feathers, while females have light orange-red panels with black barring. Females also have irregular patches of yellow on the head and neck. Immature individuals also have irregular patches of yellow on the head and wing coverts. Tail barring in males is lost in successive moults as the panels become bright red (DCCEEW 2022a). The South-eastern glossy black-cockatoo is distinguished from the Red-tailed (*C. banksii*) and Yellow-tailed (*C. funereus*) black-cockatoo by its' smaller size, dull brown tinge to the head and breast, inconspicuous crest, and red rather than yellow panels in the tail (Glossy Black Conservancy 2010).

The South-eastern glossy black-cockatoo feed almost exclusively on the seeds of *Allocasuarina* spp. and *Casuarina* spp. throughout their range. In addition, within an area, feeding is often restricted to one or two individuals of a single species. This species shows a strong fidelity to particular feed trees, returning to selected trees over consecutive years (DCCEEW 2022a).

Below are species that the South-eastern glossy black-cockatoo is known to feed on, noting that *Allocasuarina littoralis* was observed within the disturbance footprint:

- *Allocasuarina torulosa*
- *Casuarina equisetifolia*
- *Allocasuarina littoralis*
- *Allocasuarina verticillata*
- *Casuarina cristata*
- *Casuarina pauper*
- *Allocasuarina gymnanthera*
- *Allocasuarina diminuta* (DCCEEW 2022a).

The South-eastern glossy black-cockatoo is dependent on large hollow-bearing eucalypts for nesting. Hollows used for nests are typically located 10 to 20 m above the ground, in vertical or near vertical branches, stems, and spouts, or in trunk cavities. The same nest will be utilised in successive seasons, and they are known to often nest in close proximity to other nesting pairs. The peak breeding season occurs from March to August in South East Queensland and north-eastern NSW and clutch size is typically comprised of a single egg (Glossy Black Conservancy 2010).

The species has a widespread distribution, ranging from Gympie to the South East Queensland border, inland to Augathella and Tambo. The distribution continues south into NSW spreading inland to the Central Western Plains of NSW and also into eastern Victoria (Schodde et al. 1993).

Recovery plans/threat abatement plans

No recovery plan or threat abatement has been identified as being relevant for this species. The NSW *Saving our Species* plan has been identified as being relevant to this species Office of Environment and Heritage, 2017).

Threats identified in the Saving our Species plan include:

- Loss of existing and future hollow-bearing trees
- Excessively frequent fires eliminating she-oaks from an area and preventing their development to maturity
- Reduced access to water in close proximity to foraging and nesting habitat

- Loss of habitat through clearing for development
- Global climate change impacting the spatial and temporal distribution of the species.

Management actions outline in the Saving our Species plan include:

- Raise awareness around the importance of large old trees, which provide roosting habitat
- Protect large and small hollow bearing trees to facilitate regenerations of habitat trees
- Encourage the retention of she-oaks in the understorey and reduce impact caused by fire, slashing/under scrubbing and over-grazing
- Maintain accessibility to surface water or provide artificial sources of water ensuring vegetation cover is maintained between roosting/foraging sites and water sources
- Raise awareness among landholders on the importance of suitable habitat for the species
- Install nest boxes to provide artificial nesting sites for the species
- Enhance and restore corridors between woodland and forest habitat.

Important populations and critical habitat

No defined important population of the Glossy Black Cockatoo have been delineated for the species. The EPBC Act Significant Impact Guidelines 1.1 outline that an important population of a vulnerable species is characterised as either:

- A key source population either for breeding or dispersal;
- Necessary for maintaining genetic diversity; and/or
- Near the limit of the species' range.

The subspecies is not within or near the limit of its range. An assessment of the disturbance footprint suggests that any utilisation by the Glossy Black Cockatoo would be unlikely to constitute a reliance on habitat present for resource strategy, breeding or dispersal. The subspecies is recognised as highly dispersive within areas of suitable habitat. Individuals potentially within the area are anticipated to occupy a broader range and exhibit sporadic occurrence, particularly given that low-fruited *Allocasuarina littoralis* are generally defined as non-preferred feed trees (Guy Castley *pers comms*, January 2025).

Glossy black cockatoo hollows requirements are defined as follows:

- Located >8 m above ground level,
- Situated in trunks or branches >30 cm in diameter,
- Angle of trunk or branch not more than 45° from vertical, and
- Minimum entrance diameter of >15 cm

No hollows meeting these requirements were observed within or immediately surrounding the disturbance footprint.

The disturbance footprint is assessed as representing an intermittent resource that is not anticipated to support an important population critical for breeding or dispersal, nor one necessary for maintaining genetic diversity. This conclusion indicates that the population utilising the disturbance footprint does not satisfy the criteria for an important population as defined by the Significant Impact Guidelines 1.1.

Habitat critical to the survival of the species refers to areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal,
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators),
- To maintain genetic diversity and long-term evolutionary development, or
- For the reintroduction of populations or recovery of the species or ecological community.

An assessment of the presence of habitat critical to the survival of the South-eastern glossy black-cockatoo within the disturbance footprint is presented in Table 7.9.

Table 7.9 Assessment against the definition for habitat critical to the survival of the species

Habitat critical to the survival of the species criteria	Response
Areas that are necessary for activities such as foraging, breeding, roosting, or dispersal	<p>Yes – Foraging</p> <p>The South-eastern glossy black-cockatoo relies on nine species of sheoaks (<i>Allocasuarina</i> spp. and <i>Casuarina</i> spp.) for feeding. <i>Allocasuarina littoralis</i> was observed with abundant fruit within the disturbance footprint.</p> <p>The site assessment noted that suitable habitat is present within the swamp sclerophyll forest. Juvenile, low-fruiting <i>Allocasuarina</i> spp. were observed within the aforementioned habitat along the edge of the disturbance footprint.</p> <p>No – Breeding</p> <p>The species is known to preference the following species of trees: Narrow-leaved ironbark (<i>Eucalyptus crebra</i>), Blue-leaved ironbark (<i>E. nubila</i>) and Blakely’s red gum (<i>E. blakelyi</i>) and River red gums (<i>E. camaldulensis</i>). They typically have the following traits:</p> <ul style="list-style-type: none"> ■ >8 m above ground ■ Located in branches >30 cm in diameter ■ Branch or stem no more than 45 degrees from vertical, and ■ Minimum entrance diameter of >15 cm. <p>There were no hollows or trees observed within the disturbance footprint that were suitable for the species breeding habitat.</p>
Areas that are necessary for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species, such as pollinators)	<p>No – Habitat within the disturbance footprint is limited and will not support or maintain a population long-term. Although the species can adapt to use a variety of habitats, prolonged use of these and coexistence with aggressive species that inhabit disturbed areas (i.e. Rainbow lorikeets) may be energetically expensive and reduce the overall fitness and survival of the species. Therefore, the disturbance footprint is not necessary for the long-term maintenance of the species.</p>
Areas necessary to maintain genetic diversity and long-term evolutionary development	<p>No – The disturbance footprint does not support breeding habitat. Therefore, the disturbance footprint is not considered to be necessary to maintain genetic diversity and long-term evolutionary development.</p>
Areas necessary for the reintroduction of populations or recovery of the species or ecological community	<p>No – The disturbance footprint only contains some <i>Allocasuarina</i> trees that the species will utilise, however the habitat is limited and restricted in area. The disturbance footprint is not considered necessary for the reintroduction of populations or recovery of the species.</p>
Conclusion of assessment:	<p>The disturbance footprint does contain habitat critical for the survival of the South-eastern glossy black-cockatoo.</p>

Potential ground-truthed habitat identified for the South-eastern glossy black-cockatoo and where it may intersect the disturbance footprint is illustrated in Figure 7.4. An assessment against the significant impact criteria for this species is presented in Table 7.10.

Table 7.10 MNES significant impact criteria for: South-eastern glossy black-cockatoo (*Calyptorhynchus lathami lathami*)

Criteria	Assessment against significance criteria (vulnerable species)
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Lead to a long-term decrease in the size of an important population of the species	<p>Unlikely to have a significant impact</p> <p>There is no indication that there is an important population of the South-eastern glossy black-cockatoo utilising habitat within the disturbance footprint. The South-eastern glossy black-cockatoo may only potentially occur within the disturbance footprint where there is presence of <i>Allocasuarina</i> or <i>Casuarina</i> spp. Fragmentation of the habitats within the disturbance footprint has already occurred and the species is highly mobile. Additionally, the proposed action activities are unlikely to limit available resources to the amount that an important population declines, as habitat available is already limited. It is considered unlikely that the proposed action will lead to a long-term decrease in the size of an important population.</p>

Criteria	Assessment against significance criteria (vulnerable species)
Reduce the area of occupancy of an important population	Unlikely to have a significant impact There is no indication that there is an important population of the South-eastern glossy black-cockatoo utilising habitat within the disturbance footprint, and as such it is extremely unlikely that the removal or modification of the habitat will significantly reduce the area of occupancy of an important population of the South-eastern glossy black-cockatoo.
Fragment an existing important population into two or more populations	Unlikely to have a significant impact The species is highly mobile, and the proposed action is not considered to represent a barrier to movement for the species. Fragmentation of the habitats within the disturbance footprint has already occurred. It is considered unlikely that the proposed action will fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of the species	Unlikely to have a significant impact No individuals or indirect evidence for this species was observed within the disturbance footprint. Approximately 1.43 ha of habitat critical was identified for the species within the disturbance footprint based on foraging resource. Foraging habitat within the disturbance footprint is restricted and scattered and unlikely to support the species, therefore the proposed action is not likely to adversely affect habitat critical to the survival of this species.
Disrupt the breeding cycle of an important population	Unlikely to have a significant impact The disturbance footprint does not contain breeding habitat or any hollows to support breeding habitat. There is no indication that there is an important population of the South-eastern glossy black-cockatoo utilising habitat within the disturbance footprint, is not considered to disrupt the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely to have a significant impact Approximately 1.43 ha of habitat to be removed is minimal and is not considered sufficient in extent to cause the species to decline. The habitat within the disturbance footprint is outside of the species' important populations and use of this area by the species is considered as only potential for foraging and roosting.
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species habitat	Unlikely to have a significant impact The habitat within the disturbance footprint is already highly fragmented and the risk of exacerbating threats to the species as a result of the works is not likely to occur as a result of this Project as the habitat fragmentation has already occurred.
Introduce disease that may cause the species to decline	Unlikely to have a significant impact It is anticipated that the implementation of the Pest and Weed Management Plan as a sub-plan to the EMP(C) will be sufficient to ensure the risk of introducing new diseases/pathogens that could be detrimental to the South-eastern glossy black-cockatoo (such as the Psittacine Beak and Feather Disease) are as low as reasonably practicable.
Interfere substantially with the recovery of the species	Unlikely to have a significant impact The disturbance footprint is located outside of important populations and the minimal removal of vegetation within the disturbance footprint is unlikely to significantly reduce the available foraging, breeding, resting or dispersal habitat. The proposed action does not present major clearing and therefore is unlikely to interfere substantially with the recovery of the species.
Assessment of potential for significant residual impacts	The species has been assessed against the criteria above and it has been determined that the proposed action is unlikely to constitute a significant residual impact on this species.

7.5.2 Three-toed snake-tooth skink (*Coeranoscincus reticulatus*)

Ecology and distribution

The Three-toed snake-tooth skink (*Coeranoscincus reticulatus*) has reduced limbs, each with three digits and a total length of approximately 483 to 565 millimetres (mm). Adults are usually dark around the eyes and ears with a distinct wedge-shaped, pointed pale snout. Dorsal colour in adults is generally brown to yellowish

brown or grey with a dark brown collar. Ventral scales are normally greyish and dark-edged to form a fine reticulum like pattern (TSSC 2008). Juveniles are cream to brown dorsally with prominent, irregular transverse dark bands that are more conspicuous on the anterior and often absent on the posterior. In juveniles, the scales on the sides of the body are dark-edged, forming irregular longitudinal streaks (TSSC 2008).

The Three-toed snake-tooth skink occurs from Crescent Head in north-east NSW to Fraser Island in South East Queensland. Most records are from the Border Ranges in the vicinity of the NSW/Queensland border. In Queensland, the Three-toed snake-tooth skink has a disjunct north-south distribution, with the species absent from apparently suitable habitat in the D'Aguilar Ranges, between the lowland areas of Fraser Island and Cooloola and upland records from Blackall Range and Conondale Range (TSSC 2008).

The Three-toed snake-tooth skink has been found in loose, well mulched friable soil, in and under rotting logs, forest litter, bark and under decomposing cane mulch. In Queensland, the Three-toed snake-tooth skink has been recorded in rainforest, closed forest, wet sclerophyll forest, tall open Blackbutt forest, tall layered open eucalypt forest and closed Brush Box forest and regrowth in heavily logged areas. In NSW, the Three-toed snake-tooth skink has been recorded in dry rainforest, northern warm temperate rainforest, subtropical rainforest, grassy wet sclerophyll forest and shrubby sclerophyll forest (TSSC 2008). The species eat earthworms, beetle larvae and insects. It is believed that they encounter earthworms on the forest floor at night and in the loose soil that the skink burrows. Females have been recorded with 2 to 6 oviducal eggs, 23.7 to 28.9 mm in size (TSSC 2008).

The total extent of occurrence is estimated to be 20,000 square kilometres (km²) (7,000 km² in Queensland and 13,000 km² in NSW) and the area of occupancy for Queensland is 1,300 km² (TSSC 2008).

The following have been identified as potentially threatening processes to the Three-toed snake-tooth skink:

- Clearing of habitat for agriculture and grazing
- Removal of fallen logs and leaf litter through frequent fire
- Soil compaction from livestock grazing
- The domestic cat and the red fox are also known to prey on skinks (TSSC 2008).

Recovery plans/threat abatement plans

No adopted/made recovery plans or threat abatement plans have been identified as relevant for this species.

Coeranoscincus reticulatus is assigned to the landscape species management under the NSW Saving our Species plan as it is distributed over a large area and is subject to threatening processes that effect at the landscape scale.

Threats identified in the Saving our Species plan include:

- Alterations to fire regime resulting in a loss of habitat within rainforest (considered to be an emerging threat due to climate change)
- Grazing stock causing loss of leaf litter and compaction of soil
- Firewood collection resulting in reduced habitat in fallen logs and leaf litter
- Habitat degradation, loss of shelter and forage habitat through feral pig activity.

Management activities to protect this species at the sites are:

- Raise awareness with relevant landholders and reduce deliberate burning that is likely to affect this species
- Promote strategic grazing that maintains the structure and function of the ground layer
- Educate private and commercial firewood collectors on the importance of retaining woody debris in areas of known habitat
- Identify important areas of habitat within state forests so disturbance to the ground layer can be minimised

- Monitor pig activity in the species habitat and control via cage trapping and/or poison ground-baiting.

Important populations and critical habitat

No defined important population of the *Coeranoscincus reticulatus* have been delineated for the species. The EPBC Act Significant Impact Guidelines 1.1 outline that an important population of a vulnerable species is characterised as either:

- A key source population either for breeding or dispersal;
- Necessary for maintaining genetic diversity; and/or
- Near the limit of the species' range.

The species is not within or near the limit of its range. An assessment of the disturbance footprint suggests that any utilisation by the species would be unlikely to constitute a reliance on habitat present for breeding or dispersal.

The disturbance footprint is assessed as representing an intermittent resource that is not anticipated to support an important population critical for breeding or dispersal, nor one necessary for maintaining genetic diversity. This conclusion indicates that the population utilising the disturbance footprint does not satisfy the criteria for an important population as defined by the Significant Impact Guidelines 1.1.

Habitat critical to the survival of the species as defined by the MNES Significant Impact Guidelines 1.1 refers to areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal,
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators),
- To maintain genetic diversity and long-term evolutionary development, or
- For the reintroduction of populations or recovery of the species or ecological community.

Habitat mapping for the species, based on the species habitat description, is divided into two categories: preferred critical habitat (rainforest vegetation communities) and suitable habitat (sclerophyll and eucalypt forest). 2.48 ha of suitable habitat analogous to RE 12.2.7 and RE 12.9-10.14 occurs within the disturbance footprint.

An assessment of the presence of habitat critical to the survival of the Three-toed snake-tooth skink within the disturbance footprint is presented in Table 7.11.

Table 7.11 Assessment against the definition for habitat critical to the survival of the species

Habitat critical to the survival of the species criteria	Response
Areas that are necessary for activities such as foraging, breeding, roosting, or dispersal	No – There is critical rainforest habitat adjacent to the disturbance footprint and suitable habitat in the form of eucalypt and swamp sclerophyll forest within or directly adjoining the disturbance footprint. Although the species was not confirmed during the field assessment the precautionary principle has been applied using a proxy of suitable habitat. It is unlikely for the disturbance footprint to contain habitat necessary for activities such as foraging, breeding, roosting, or dispersal.
Areas that are necessary for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species, such as pollinators)	No – In Queensland, the species has been recorded in eight national parks and one forest reserve. These include Binna Burra, Emuvale, Tamborine Mountain, Beechmont, Lamington, and Cunningham's Gap National Park and Cooloola State Forest. This evidence suggests the species prefers areas that are relatively undisturbed. The disturbance footprint, although containing some suitable rainforest habitat, is limited in extent, fragmented, and does not facilitate good connectivity to areas where the species is mapped as 'likely to occur' on its distribution mapping. The disturbance footprint is not considered necessary for the long-term maintenance of the species.

Habitat critical to the survival of the species criteria	Response
Areas necessary to maintain genetic diversity and long-term evolutionary development	No – No records have been recorded of the species within or surrounding the disturbance footprint. Although the disturbance footprint is adjacent to an area that is mapped as 'habitat likely to occur' on the species distribution mapping, habitat within the disturbance footprint is limited in extent, fragmented, and does not facilitate good connectivity to other suitable habitat areas. Due to this level of fragmentation, it is unlikely the disturbance footprint is necessary to maintain genetic diversity and long-term evolutionary development of the species.
Areas necessary for the reintroduction of populations or recovery of the species or ecological community	No – No records have been recorded of the species within or surrounding the disturbance footprint. The disturbance footprint, although containing some suitable rainforest habitat, is limited in extent, fragmented and does not facilitate good connectivity to areas where the species is mapped as 'likely to occur' on its distribution mapping. The limited available habitat for the species within the disturbance footprint is unlikely to be able to support any reintroduction of populations to the area or the recovery of the species.
Conclusion of assessment:	The disturbance footprint does not contain habitat critical for the survival of the Three-toed snake-tooth skink.

Potential ground-truthed habitat identified for the Three-toed snake-tooth skink and where it may intersect the disturbance footprint is illustrated in Figure 7.4. An assessment against the significant impact criteria for this species is presented in Table 7.12.

Table 7.12 MNES significant impact criteria for: Three-toed snake-toothed skink (*Coeranoscincus reticulatus*)

Criteria	Assessment against significance criteria (vulnerable species)
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Lead to a long-term decrease in the size of an important population of the species	Unlikely to have a significant impact There is no indication that there is an important population of the Three-toed snake-tooth skink within the disturbance footprint as the area is mapped as 'species or species habitat may occur' on the species distribution mapping and no evidence of the species have been recorded in close proximity to the disturbance footprint. Although there is some potential suitable rainforest habitat within the disturbance footprint, fragmentation to this area has already occurred. It is considered unlikely that the proposed action will lead to a long-term decrease in the size of an important population.
Reduce the area of occupancy of an important population	Unlikely to have a significant impact As per the species Conservation Advice (TSSC 2008), the total extent of occurrence is estimated to be 20,000 km ² (7,000 km ² in Queensland and 13,000 km ² in NSW). The area of occupancy for Queensland is 1,300 km ² . Due to the limited area of habitat to be removed from the disturbance footprint, the proposed action is not expected to reduce the area of occupancy of an important population of the species.
Fragment an existing important population into two or more populations	Unlikely to have a significant impact There is no indication that there is an important population of the Three-toed snake-tooth skink within the disturbance footprint as the area is mapped as 'species or species habitat may occur' on the species distribution mapping and no evidence of the species have been recorded in close proximity to the disturbance footprint. Although there is some potential suitable rainforest habitat within the disturbance footprint, fragmentation to this area has already occurred. It is considered unlikely that the Project will fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of the species	Unlikely to have a significant impact There is some suitable rainforest and eucalypt forest habitat within or directly adjoining the disturbance footprint. Although there is potential suitable habitat (3.14 ha of swamp sclerophyll forest on sand habitat and open sclerophyll forest) for the species (but not preferred habitat) is to be removed for the proposed action. However, this habitat is not considered habitat critical to the survival of the species. Therefore, the proposed action is not likely to adversely affect habitat critical to the survival of this species.

Criteria	Assessment against significance criteria (vulnerable species)
Disrupt the breeding cycle of an important population	Unlikely to have a significant impact There is no indication that there is an important population of the Three-toed snake-tooth skink within the disturbance footprint as the area is mapped as 'species or species habitat may occur' on the species distribution mapping and no records of the species have been recorded in close proximity to the disturbance footprint. Although there is some potential suitable rainforest habitat within the disturbance footprint, fragmentation to this area has already occurred. It is considered unlikely that the Project will disrupt the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely to have a significant impact There is no indication that there is an important population of the Three-toed snake-tooth skink within the disturbance footprint as the area is mapped as 'species or species habitat may occur' on the species distribution mapping and no records of the species have been recorded in close proximity to the disturbance footprint. Although there is some potential suitable rainforest habitat within the disturbance footprint, fragmentation to this area has already occurred. No rainforest habitat is to be directly removed by the proposed action. Therefore, it is considered unlikely that the proposed action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species habitat	Unlikely to have a significant impact The habitat within the disturbance footprint is already highly fragmented and the risk of exacerbating threats to the species as a result of the works is not likely to occur as a result of the proposed action, as the habitat fragmentation has already occurred. It is anticipated that the Project EMP(C) and operational environmental mitigation measures will adequately mitigate the risk of introducing or establishing an invasive species that is detrimental to the Three-toed snake-tooth skink.
Introduce disease that may cause the species to decline	Unlikely to have a significant impact It is anticipated that the Project EMP(C) and operational environmental mitigation measures will adequately mitigate the risk of introducing or establishing an invasive species that is detrimental to the Three-toed snake-tooth skink.
Interfere substantially with the recovery of the species	Unlikely to have a significant impact There is no indication that there is an important population of the Three-toed snake-tooth skink within the disturbance footprint. Furthermore, the minimal removal of vegetation within the disturbance footprint is unlikely to significantly reduce the available foraging, breeding, resting or dispersal habitat if a population of the species occurs within the disturbance footprint. The proposed action does not present major clearing and therefore is unlikely to interfere substantially with the recovery of the species.
Assessment of potential for significant residual impacts	The species has been assessed against the criteria above and it has been determined that the proposed action is unlikely to constitute a significant residual impact on this species.

7.5.3 Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)

Ecology and distribution

The Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*) is a medium sized marsupial. Males and females have a body length (excluding the tail) between 31 to 34 cm and tail lengths of 23 cm. Males have longer tails and are typically heavier than females (660 to 1,640 grams (g) for males and 660 to 1,350 g for females). The species has small, rounded ears, large eyes and a long muzzle. The species has two fur layers, one being grey and the other ranging in colour from yellow-white to brown with black tips. The underside of the species is pale, white or grey fur (DAWE 2022b).

In general, the Long-nosed potoroo occurs in a range of vegetation types from coastal scrub and heathy woodland to wet sclerophyll forest and rainforest (DAWE 2022b). The species prefers vegetation with a dense understorey layer and sufficient open space beneath the sub-canopy for foraging. However, the species also occurs in gullies near creeks, which provide refuge during fire and drought.

The Long-nosed potoroo northern subspecies occurs in low altitude and coastal habitat of *Eucalyptus signata* (scribbly gum) woodlands with a heathy understory. Species may include *Banksia aemula*, *Eucalyptus pilularis*, *Callitris columellaris*, *Banksia ericifolia* and *Melaleuca quinquenervia*, often with dense ground covers of *Xanthorrea* sp., sedges, ferns, forbs and heath species (DAWE 2022b). The subspecies will rarely occur in remnant vegetation patches smaller than 0.1 km².

The Long-nosed potoroo (northern) is omnivorous and is known to consume flowers, fruits, seeds, leaves, stems, roots and bulbs. They also feed on both hypogeous and epigeous components of fungal fruit bodies as well as invertebrates. The species breeds all year round with a single joey born after a gestation of 37 days, remaining in their mother's pouch for 100 to 125 days reaching sexual maturity at about 12 months. They have a lifespan of approximately 10 years (DAWE 2022b).

The species has a broad and fragmented distribution across South East Queensland and the NSW north coast. Altitudinally, the species typically occurs up to 800 m above sea level (although has been recorded up to 1,000 m) and to habitats receiving an annual rainfall greater than 760 mm. In Queensland, populations occur in lowland heath and coastal habitats and further inland in forested ranges. In NSW, the species is distributed from Cobaki Lake (near Queensland) to the Sydney basin (DAWE 2022b).

Recovery plan/threat abatement plans

There is no adopted or made recovery plan for this subspecies. Two federal threat abatement plans have been identified for the Long-nosed potoroo (northern), including:

- Threat abatement plan for predation by feral cats
- Threat abatement plan for predation by the European red fox.

Threats identified for this species are listed as:

- Fires that are too intense or too frequent
- Predation and competition from invasive and domestic species
- Increased drought and temperature from changing weather patterns
- Habitat loss, degradation and fragmentation through clearing, logging, and forest dieback caused by *Phytophthora cinnamomi* or *Manorina melanophrys*
- Predation and competition from native species for fungal food resources
- Disease – toxoplasmosis caused by *Toxoplasma gondii*.

Important populations and critical habitat

The Long-nosed potoroo (northern) inhabits a range of vegetation types, including rainforest, wet and dry woodland, scrubland, and coastal heathlands, and gullies near creeks (DAWE 2022b). The species requires wooded habitat with dense vegetation in the shrub or ground layer to provide cover, but lower vegetation density increase feeding opportunities.

Habitat critical to the survival of the Long-nosed potoroo (northern) is listed in the Conservation Advice (DAWE 2022b) as habitat that includes:

- Occupied forested habitats larger than 0.1 km²
- Unoccupied forested areas (larger than 0.1 km²) which are either adjacent or proximal to extant subpopulations if they have the potential to provide future habitat for the species as either a natural range expansion or as a translocation site for at-risk populations
- Areas of habitat that supported the Long-nosed potoroo (northern) in the past, but from which they are now absent (for example, because of high predation following a bushfire event) but the species can be reintroduced to these sites in the future.

Important populations for the survival of the Long-nosed potoroo (northern) include populations at the limits of the species' range, outlying populations, stronghold populations, island populations, research populations and other populations where recovery actions, such as predator control and reintroductions, are being

implemented (DAWE 2022b). Although there are likely important populations of the subspecies that have yet to be identified, the Conservation Advice provides an indicative list of important populations. These are:

- Queensland populations:
 - Many Peaks Range (northernmost population)
 - Fraser Island (monitoring via camera traps occurring)
 - Wide Bay Military Training Area, Tin Can Bay (only remaining coastal population in Queensland)
 - Sunshine coast hinterlands (previous research population and ongoing camera trap surveys)
 - D’Aguilar Ranges
 - Lamington Plateau and Springbrook Plateau (trap monitoring occurring).

As the Proposed Action does not fall within the above areas, no important population is likely to occur.

An assessment of the presence of habitat critical to the survival of the Long-nosed potoroo (northern) within the disturbance footprint is presented in Table 7.13.

Table 7.13 Assessment against the definition for habitat critical to the survival of the species

Habitat critical to the survival of the species criteria	Response
Occupied forested habitats larger than 0.1 km ²	No – There is no evidence to suggest forested habitats within the disturbance footprint are occupied as no species were confirmed during field assessment and no records have been recorded of the species within or surrounding the disturbance footprint in over 40 years.
Unoccupied forested areas (larger than 0.1 km ²) which are either adjacent or proximal to extant subpopulations and have the potential to provide future habitat for the species as either a natural range expansion or as a translocation site for at-risk populations	No – Habitat within and surrounding the disturbance footprint could support or maintain a population long-term. Although the species could be susceptible to edge effects due to the urban nature of the area. Two patches consisting of <i>Melaleuca</i> open forest and rainforest within the disturbance footprint provide approximately 1.43 ha of suitable habitat within the disturbance footprint. This is connected to larger patches adjoining the disturbance footprint. These patches, being 6.12 ha of <i>Melaleuca</i> open forest, and 2 ha of rainforest are both below the 0.1 km ² (10 ha) threshold for the species. These patches may not have potential to provide future habitat for the species as either natural range expansion or as a translocation site for at-risk populations.
Areas of habitat that supported the Long-nosed potoroo (northern) in the past, but from which they are now absent (for example, because of high predation following a bushfire event) but the species can be reintroduced to these sites in the future	Yes – The disturbance footprint is mapped on the species distribution map as 'likely habitat' and was likely to support the Long-nosed potoroo (northern) in the past. Habitat within and surrounding the disturbance footprint could support or maintain a population long-term. Although the species could be susceptible to edge effects due to the urban nature of the area. Long-nosed potoroo (northern) rely on hypogean sporocarps (fruit bodies of underground fungi) for feeding. These fungi are likely to be present within and surrounding the disturbance footprint.
Conclusion of assessment:	The disturbance footprint does contain habitat critical for the survival of the Long-nosed potoroo (northern).

Potential ground-truthed habitat identified for the Long-nosed potoroo (northern) and where it may intersect the Project is displayed in Figure 7.4. An assessment against the significant impact criteria for the vulnerable species follows in Table 7.14.

Table 7.14 MNES significant impact criteria for: Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)

Criteria	Assessment against significance criteria (vulnerable species)
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	

Criteria	Assessment against significance criteria (vulnerable species)
Lead to a long-term decrease in the size of an important population of the species	Unlikely to have a significant impact No important populations as identified within the species Conservation Advice occur within the disturbance footprint (DAWE 2022b). No evidence of the species has been recorded within the last 40 years within a 30 km radius of the disturbance footprint. Therefore, it is unlikely an important population of the species occurs within the area and thus, the proposed action is unlikely to lead to the long-term decrease in the size of an important population.
Reduce the area of occupancy of an important population	Unlikely to have a significant impact No important populations as identified within the species Conservation Advice occurs within the disturbance footprint (DAWE 2022b). No evidence of the species has been recorded within the last 40 years within a 30 km radius of the disturbance footprint. Therefore, it is unlikely an important population of the species occurs within the area and thus, the proposed action is unlikely to reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations	Unlikely to have a significant impact No important populations as identified within the species Conservation Advice occurs within the disturbance footprint (DAWE 2022b). No evidence of the species has been recorded within the last 40 years within a 30 km radius of the disturbance footprint. In addition, the disturbance footprint is in an urban environment that has already undergone fragmentation. Therefore, it is unlikely the proposed action will fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of the species	Unlikely to have a significant impact Habitat critical to the survival of the Long-nosed potoroo (northern) exists within the disturbance footprint as suitable habitat is connected to habitat patches over 10 ha in size and can support a recovering population. However, approximately 1.43 ha of suitable habitat is to be removed as part of the proposed action, which exists on an already fragmented landscape. The removal of this habitat is minimal and will not reduce the habitat patch to below 0.1 km ² (requirement for the species) nor put these patches of habitat critical to the survival of the species at risk. Therefore, the proposed action is unlikely to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely to have a significant impact No important populations as identified within the species Conservation Advice occurs within the disturbance footprint (DAWE 2022b). No records of the species have been recorded within the last 40 years within a 30 km radius of the disturbance footprint. Therefore, it is unlikely an important population of the species occurs within the area and thus, the proposed action is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely to have a significant impact Approximately 1.43 ha of habitat to be removed is minimal and is not considered sufficient in extent to cause the species to decline. The habitat within the disturbance footprint is outside of the species' important populations and although does qualify for habitat critical for the species, the disturbed nature of the surrounding environment suggests that use of this area by the species is considered to be potential but not likely and the Project is unlikely to decrease the availability of habitat to the extent the species will decline.
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species habitat	Unlikely to have a significant impact Invasive species will be managed by the Project EMP(C) and operational environmental mitigation measures and will not cause introduction or establishment of a species that is harmful to the Long-nosed potoroo (northern). Appropriate mitigation measures for biosecurity will be implemented during the Project works.
Introduce disease that may cause the species to decline	Unlikely to have a significant impact It is anticipated that the Project EMP(C) and operational environmental mitigation measures will adequately mitigate the risk of introducing or establishing an invasive species that is detrimental to the Long-nosed potoroo (northern).

Criteria	Assessment against significance criteria (vulnerable species)
Interfere substantially with the recovery of the species	Unlikely to have a significant impact A Recovery Plan for the species is yet to be developed. The total amount of vegetation to be removed is unlikely to reduce the species distribution, area of occupancy or available habitat within the local area or regional context. Therefore, the proposed action is unlikely to interfere substantially with the recovery of the species.
Assessment of potential for significant residual impacts	The species has been assessed against the criteria above and it has been determined that the proposed action is unlikely to constitute a significant residual impact on this species.

7.5.4 Grey-headed flying-fox (*Pteropus poliocephalus*)

Ecology and distribution

The Grey-headed flying-fox is one of the largest bat species in the world, weighing up to 1 kilogram (kg) and having a head and body length of up to 289 mm. A collar of orange fur completely encircles the neck of this species, making it unique among Australian flying-foxes. The head is grey, as is the fur of the belly. This species is the only flying-fox that is endemic to the Australian continent (DAWE 2021b).

The Grey-headed flying-fox is distributed from Rockhampton to southern Victoria, though this species is nomadic or migratory, following generally seasonal and ephemeral food supplies and as such only a portion of this distribution range is used at any time. Seasonal trends see this species widely dispersing in the summer and retracting to coastal habitats in autumn and further retracting north of the Hunter Valley in winter. Urban populations in Brisbane, Sydney and Melbourne have become year-round residents, though the Brisbane population is known to disperse inland over winter. Vagrants are known as far south as Tasmania and as far west as Adelaide (DAWE 2021b).

Habitats occupied by this species are varied and are utilised in response to available food resources. Foraging is mostly in the canopy and is generally on the nectar of trees of the Myrtaceae family, especially blossoms of Eucalyptus but also related genera such as Angophora and Corymbia and a range of rainforest fruits. Habitats that fulfil the needs of this species and are commonly used are rainforests, open forests, closed and open woodlands, Melaleuca swamps and Banksia woodlands (DAWE 2021b).

This species commutes nightly to foraging areas, normally within 15 km of the roost site, though may on occasion commute up to 50 km if resources are scarce.

Roosts for the Grey-headed flying-fox are normally adjacent to water such as lakes, rivers, or the coastline. Vegetation at the roosts usually consists of rainforest patches, Melaleuca stands, mangroves or riparian vegetation. Urban colonies use highly modified vegetation. This species often maintains high roost site fidelity for long periods (DAWE 2021b).

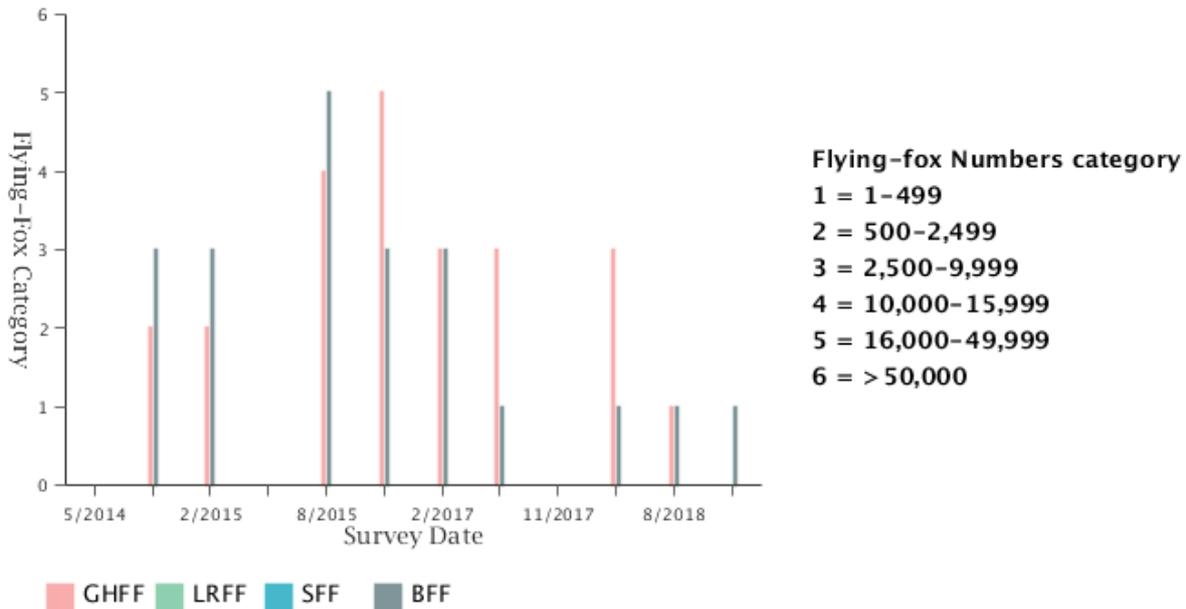
Distribution in context to the proposed action

A review of the National Flying-fox Viewer⁹ (DCCEEW 2025b) identified Nationally Important Roost sites for the species located approximately 20 km north-west of the Project (Palmwoods, Jubilee Drive (789)) and approximately 16 km north of the Project (Maroochydore, Stella Maris CS (390)). There are no Grey-headed flying-fox camps located within the disturbance footprint. Figure 7.6 and Figure 7.7 illustrate the number of Grey-headed flying-fox individuals recorded at each of these camps, respectively.

Areas of native, mature woody vegetation present within the disturbance footprint provide potential habitat for the species (including habitat critical to the species survival due to location with 20 km of a Nationally Important camp). This includes an area of approximately 5.20 ha, supporting habitat critical to the survival of the species. This habitat area has been derived via analysis of vegetation community mapping to identify areas of vegetation supporting Grey-headed flying-fox foraging habitat within a 20 km radius of a Nationally Important Camp. Remnant, regrowth, urban forest, and non-remnant vegetation community areas were

⁹ It is noted that the National Flying-fox Viewer (DCCEEW, 2025b) was decommissioned on 25 June 2025. The data presented here was collected prior to this decommissioning.

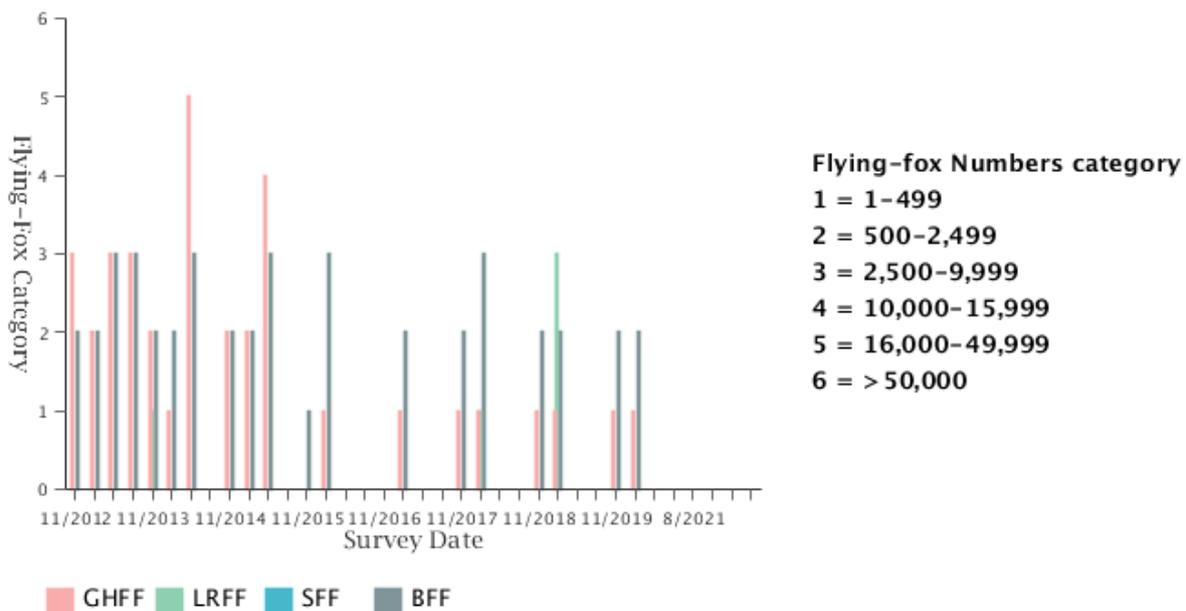
considered in this habitat assessment. This habitat area is considered to be a conservative estimate, reflective of the areas of potential species habitat present within the disturbance footprint.



Palmwoods, Jubilee Drive(789) Flying-fox camp chart

Mon Jun 02 2025

Figure 7.6 Grey-headed flying-fox numbers at Palmwoods, Jubilee Drive (789)



Maroochydore, Stella Maris CS(390) Flying-fox camp chart

Mon Jun 02 2025

Figure 7.7 Grey-headed flying-fox numbers at Maroochydore, Stella Maris CS (390)

Recovery plan/threat abatement plans

There is currently a Recovery Plan for the Grey-headed flying-fox (DAWE 2021b). The Plan identifies the following threatening processes as applicable to the species:

- Loss of roosting and foraging sites (particularly winter foraging habitat)
- Human animal conflict, particularly in rural areas where flying-foxes can impact fruit orchards and in urban areas where roosts are perceived to impact local residents. This is a particular issue applicable to flying - fox camps in urban areas

- Heat stress during extreme heat waves
- Entanglement in backyard netting and electrocution on power lines
- Potential threats include the impacts of climate change (particularly with reference to extended heat waves) and zoonotic diseases.

Important populations and critical habitat

All the Grey-headed flying-fox in Australia are regarded as one population that moves around freely within its entire national range (DAWE 2021b). Therefore, the entire population would constitute an important population. As the species was observed flying overhead during surveys and suitable habitat exists, it is assumed that an important population utilises the disturbance footprint.

Habitat critical to the survival of the species is centred around availability of spring and particularly winter flowering species of trees from the families Myrtaceae and Proteaceae especially: *Eucalyptus tereticornis*, *E. albens*, *E. crebra*, *E. fibrosa*, *E. melliodora*, *E. paniculata*, *E. pilularis*, *E. robusta*, *E. seeana*, *E. sideroxylon*, *E. siderophloia*, *Banksia integrifolia*, *Castanospermum australe*, *Corymbia citriodora citriodora*, *C. eximia*, *C. maculata*, *Grevillea robusta*, *Melaleuca quinquenervia* or *Syncarpia glomulifera*.

The Grey-headed flying-fox is known to fly up to 40 km from its camps to foraging locations in the course of a night. Therefore, the potential habitat known to contain the species listed above and within 40 km of known camps that contain this species will be regarded as 'habitat critical to the survival of the species'.

In addition, as directly stated in the recovery plan (DAWE 2021b) for the Grey-headed flying-fox:

Where the existence of these important winter and spring flowering vegetation communities is verified in the field, they are considered habitat critical to the survival of the Grey-headed flying-fox. Back yard fruit trees, orchards or non-native trees that may be used for foraging are not considered to be habitat critical to the survival of the Grey-headed flying-fox.

Habitat critical to the survival of the Grey-headed flying-fox may also be vegetation communities not containing the above tree species but which:

- Contain native species that are known to be productive as foraging habitat during the final weeks of gestation, and during the weeks of birth, lactation, and conception (August to May)
- Contain native species used for foraging and occur within 20 km of a nationally important camp as identified on the DCCEEW's interactive flying-fox web viewer (DCCEEW 2025b), or
- Contain native and or exotic species used for roosting at the site of a nationally important Grey-headed flying-fox camp as identified on the DECEEW's interactive flying-fox web viewer.

An assessment of the presence of habitat critical to the survival of the Grey-headed flying-fox within the disturbance footprint is presented in Table 7.15.

Table 7.15 Assessment against the definition for habitat critical to the survival of the species

Habitat critical to the survival of the species criteria	Response
Contains the following species: <i>E. tereticornis</i> , <i>E. albens</i> , <i>E. crebra</i> , <i>E. fibrosa</i> , <i>E. melliodora</i> , <i>E. paniculata</i> , <i>E. pilularis</i> , <i>E. robusta</i> , <i>E. seeana</i> , <i>E. sideroxylon</i> , <i>E. siderophloia</i> , <i>Banksia integrifolia</i> , <i>Castanospermum australe</i> , <i>Corymbia citriodora citriodora</i> , <i>C. eximia</i> , <i>C. maculata</i> , <i>Grevillea robusta</i> , <i>Melaleuca quinquenervia</i> or <i>Syncarpia glomulifera</i> .	Yes – There is approximately 5.20 ha of regulated vegetation and urban forest within the disturbance footprint which contains one or more of the identified species.
Habitat known to contain the species listed above and within 20 km of known camps	Yes – The Nationally important camp Palmwoods, Jubilee Drive (789) is located approximately 20 km north-west of the Project and the Nationally important camp Maroochydore, Stella Maris CS (390) is located approximately 16 km north of the Project.

Habitat critical to the survival of the species criteria	Response
Contain native species that are known to be productive as foraging habitat during the final weeks of gestation, and during the weeks of birth, lactation and conception (August to May)	Yes – There is approximately 5.20 ha of regulated vegetation within the disturbance footprint which contains one or more of the identified species and urban forest within the disturbance footprint.
Contain native species used for foraging and occur within 20 km of a nationally important camp as identified on the Department's interactive flying-fox web viewer	Yes – The Nationally important camp Palmwoods, Jubilee Drive (789) is located approximately 20 km north-west of the Project and the Nationally important camp Maroochydore, Stella Maris CS (390) is located approximately 16 km north of the disturbance footprint.
Conclusion of assessment:	The disturbance footprint is likely to contain approximately 5.20 ha of regulated vegetation and urban forest habitat critical to the survival of the species.

Potential ground-truthed habitat identified for the Grey-headed flying-fox, and where it may intersect the disturbance footprint, is illustrated in Figure 7.8. An assessment against the significant impact criteria for the Grey-headed flying-fox is provided in Table 7.16.

Table 7.16 MNES significant impact criteria for: Grey-headed flying-fox (*Pteropus poliocephalus*)

Criteria	Assessment against significance criteria (vulnerable species)
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Lead to a long-term decrease in the size of an important population of the species	<p>Unlikely to have a significant impact</p> <p>The Nationally important camp Palmwoods, Jubilee Drive (789) is located approximately 20 km north-west of the disturbance footprint and the Nationally important camp Maroochydore, Stella Maris CS (390) is located approximately 16 km north of the disturbance footprint. There are no species roost sites located within the disturbance footprint.</p> <p>The disturbance footprint incorporates approximately 5.20 ha of potential foraging habitat for this species, located within a 20 km radius of a Nationally important roost site. Habitat described in the draft recovery plan includes an association with winter flowering tree species located largely in the coastal lowlands of northern NSW and South East Queensland. However, potential foraging habitat for the species within the disturbance footprint is largely persisting as fragmented road reserve vegetation. The Project is linear but generally impacts areas which are already subject to extensive fragmentation and border to urban or industrial development. There is abundant similar habitat in the surrounding region and directly surrounding the disturbance footprint. Therefore, the proposed action is unlikely to lead to a long-term decrease in the size of an important population of Grey-headed flying-fox.</p>
Reduce the area of occupancy of an important population	<p>Unlikely to have a significant impact</p> <p>The Nationally important camp Palmwoods, Jubilee Drive (789) is located approximately 20 km north-west of the Project and the Nationally important camp Maroochydore, Stella Maris CS (390) is located approximately 16 km north of the disturbance footprint. There are no species roost sites located within the disturbance footprint.</p> <p>The disturbance footprint incorporates approximately 5.20 ha of potential foraging habitat for this species, located within a 20 km radius of a Nationally important roost site. However, potential foraging habitat for the species within the disturbance footprint is largely persisting as fragmented road reserve vegetation. The disturbance footprint is linear but generally impacts areas which are already subject to extensive fragmentation and border to urban or industrial development. There is abundant similar habitat in the surrounding region and directly surrounding the disturbance footprint. Therefore, the proposed action is unlikely to reduce the occupancy of an important population of the species.</p>
Fragment an existing important population into two or more populations	<p>Unlikely to have a significant impact</p> <p>Due to the highly mobile nature of the species across its distribution, the proposed action is not considered likely to fragment an existing important population into two or more populations.</p>

Criteria	Assessment against significance criteria (vulnerable species)
Adversely affect habitat critical to the survival of the species	<p>Likely to have a significant impact</p> <p>The National recovery plan describes habitat critical to the survival of the species as winter and spring flowering tree species, native vegetation that is relied upon at integral life stages, and native vegetation in close proximity to Nationally important camps. This is a highly mobile species, and the linear nature of the Project will not impact dispersal or breeding capacity but will impact foraging capacity. The disturbance footprint is predicted to require clearing of up to approximately 5.20 ha of its foraging habitat.</p> <p>As such, the proposed action is considered likely to adversely affect habitat critical to the survival of the Grey-headed flying-fox.</p>
Disrupt the breeding cycle of an important population	<p>Unlikely to have a significant impact</p> <p>The Nationally important camp Palmwoods, Jubilee Drive (789) is located approximately 20 km north-west of the disturbance footprint, and the Nationally important camp Maroochydore, Stella Maris CS (390) is located approximately 16 km north of the disturbance footprint. There are no species roost sites located within the disturbance footprint.</p> <p>The disturbance footprint is located in a highly urbanised and disturbed environment. Activities associated with the proposed action are not anticipated to be significant differentiated from those associated within the existing landscape. Furthermore, the disturbance footprint is not located within or directly adjacent to roost sites which support breeding activities for the species.</p> <p>It is considered unlikely the proposed action will disrupt the breeding cycle of an important population.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely to have a significant impact</p> <p>There is suitable foraging habitat for the species in the disturbance footprint. However, there is abundant suitable habitat for the species in the area surrounding the Project and the wider region. The species distribution extends from Rockhampton south to Victoria and South Australia. It is considered unlikely the proposed action will impact the availability or quality of habitat to the extent that the species is likely to decline.</p>
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat	<p>Unlikely to have a significant impact</p> <p>There are no particular weed species identified as relevant to Grey-headed flying-fox. Project-associated surveys have recorded restricted weed species listed under the Biosecurity Act and/or as Weeds of National Significance.</p> <p>Feral predators are identified as a threat to the species (DAWE 2021b). Evidence of feral dog, cat, and European red fox were recorded as present in the area during Project-associated surveys.</p> <p>A Pest and Weed Management Plan will be prepared by the Contractor as a sub-plan to the EMP(C), approved by SCC and TMR prior to ground disturbance works commencing and implemented for the duration of the Project works to avoid and minimise potential for pest and weed invasion. Pest measures will ensure feral predators (i.e. wild dogs/dingo) are controlled in areas associated with proposed action activities. The proposed action is considered unlikely to result in invasive species becoming established in this species' habitat.</p>
Introduce disease that may cause the species to decline	<p>Unlikely to have a significant impact</p> <p>The Project Pest and Weed Management Plan will incorporate the management of invasive species which will assist in the prevention of pest plant introduction, <i>Phytophthora cinnamomi</i>, and Myrtle rust outbreaks.</p> <p>The Plan will consider relevant guidelines to control <i>Phytophthora cinnamomi</i> and Myrtle rust associated with proposed action activities. This will include at a minimum vehicle washdown procedures and contractor education (including procedures regarding cleaning clothing). This will be particularly important during any revegetation activities in the vicinity of Grey-headed flying-fox habitat. Revegetation plant species will be obtained from a reliable source that is certified free of these pathogens.</p> <p>Project equipment sourced from overseas will be quarantined as required under State and Commonwealth legislation. The proposed action is considered unlikely to introduce disease that may cause the species to decline.</p>
Interfere substantially with the recovery of the species	<p>Likely to have a significant impact</p> <p>The <i>National Recovery Plan for the Grey-headed flying-fox (Pteropus poliocephalus)</i> (DAWE 2021b) identifies the following nine recovery objectives for the species:</p>

Criteria	Assessment against significance criteria (vulnerable species)
	<ul style="list-style-type: none"> ■ Identify, protect, and increase native foraging habitat that is critical to the survival of the Grey-headed flying-fox. ■ Identify, protect, and increase roosting habitat of Grey-headed flying-fox camps. ■ Determine trends in the Grey-headed flying-fox population so as to monitor the species' national distribution, habitat use and conservation status. ■ Build community capacity to coexist with flying-foxes and minimise the impacts on urban settlements from new and existing camps while avoiding interventions to move on or relocate entire camps. ■ Increase public awareness and understanding of Grey-headed flying-foxes, the recovery program, and involve the community in the recovery program where appropriate. ■ Improve the management of Grey-headed flying-fox camps in areas where interaction with humans is likely. ■ Significantly reduce levels of licenced harm to Grey-headed flying-foxes associated with commercial horticulture. ■ Support research activities that will improve the conservation status and management of Grey-headed flying-foxes. ■ Reduce the impact on Grey-headed flying-foxes of electrocution on power lines, and entanglement in netting and on barbed-wire. <p>The proposed action will employ a range of mitigation measures to minimise these impacts. However, the proposed action will remove approximately 5.20 ha of habitat for the species. This removal of habitat does not align with the recovery objectives of protecting and increasing habitat critical to the survival of the species. Therefore, the proposed action is likely to interfere with the recovery of the Grey-headed flying-fox.</p>
Assessment of potential for significant residual impacts	The species has been assessed against the criteria above and it has been determined that the proposed action is likely to constitute a significant residual impact on 5.20 ha of habitat for the Grey-headed flying-fox.



Service layers: City of Moreton Bay, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Data sources: Queensland Spatial Catalogue - 2023



Legend

- Study Area*
- Disturbance Footprint
- Potential habitat for Grey-headed flying-fox
- Significant residual impact area for the GHFF Habitat (includes direct and indirect impacts)

*Study area has been determined based off a 100 m buffer from the disturbance footprint, where MNES have the potential to occur. Where there were no potential MNES likely to occur (i.e. preexisting residential developments) the area was not considered to form part of the Study area

Revision: A

Date: 5/12/2025

A3 scale: 1:6,000



Caloundra Transport Corridor Upgrade

Figure 7.8 Potential habitat mapping for the Grey-headed flying-fox

7.5.5 Sand yabby (*Cherax robustus*)

Ecology

Cherax robustus is largely restricted to the sandy, lowland coastal areas of South East Queensland often referred to as “wallum”. Within coastal wallum, the species is primarily found in sedgeland, wet heaths and fens within woodlands/open forests dominated or co-dominated by broad-leaved paperbark. These habitats have low nutrient, siliceous sand soils and low pH groundwater (DCCEE 2023a).

Distribution in context to the proposed action

Within South East Queensland, the species is best known on the large sand islands, namely K’gari (Fraser), Bribie, Moreton, and North Stradbroke Island, as well as the Sunshine Coast mainland (DCCEE 2023a). It may be that this species was never abundant on the mainland, although it can be relatively abundant in some ideal conditions. One specimen was recorded on Atlas of Living Australia, within approximately 2 to 4 km of the disturbance footprint in 2016, noting that the recorded coordinates have been generalised to 2 km.

Recovery plan/threat abatement plans

There is no recovery plan or threat abatement plan for this species.

Important populations and critical habitat

It is unlikely that a population exists within the disturbance footprint. Surveys for the species (refer Section 4.7.2) did not identify the species, and noted that the water quality within areas that were considered as potentially suitable habitat for the species did not align with the required water quality for the species. The water quality readings taken at the time of the survey found the onsite pH to be around 6.6 to 6.8, however it is noted that *Cherax robustus* is limited to acidic waters (pH of 3.3 to 5.3) (Brooks 1987). It is unlikely that suitable habitat for the Sand yabby exists within or surrounding the disturbance footprint.

An assessment against the habitat critical criteria for this species follows in Table 7.17.

Table 7.17 Assessment against the definition for habitat critical to the survival of the species

Habitat critical to the survival of the species criteria	Response
Areas that are necessary for activities such as foraging, breeding, roosting, or dispersal	No – <i>Cherax robustus</i> prefers acidic, soft, tannin-stained freshwater marsh, swamps, fens, lakes, and small creeks, often surrounded by <i>Melaleuca</i> (paperbark) and dominated by sedges. The swamp sclerophyll forest within the disturbance footprint had a pH reading of 6.6 to 6.8, well above the preferred acidity (3.5 to 5.3) for the species. It is unlikely for habitat to exist within the disturbance footprint.
Areas that are necessary for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species, such as pollinators)	No – Any area that provides habitat for the species would be considered necessary for the long-term maintenance of the species. No habitat exists in the disturbance footprint.
Areas necessary to maintain genetic diversity and long-term evolutionary development	No – Any area that provides habitat for the species would be considered necessary to maintain genetic diversity and long-term evolutionary development. No habitat exists in the disturbance footprint.
Areas necessary for the reintroduction of populations or recovery of the species or ecological community	No – Any area that provides habitat for the species would be considered necessary for the reintroduction of populations or recovery of the species or ecological community. No habitat exists in the disturbance footprint.
Conclusion of the assessment	The disturbance footprint is unlikely to contain habitat critical to the survival of the species.

An assessment against the significant impact criteria for the Sandy yabby is presented in Table 7.18.

Table 7.18 MNES significant impact criteria for Sand yabby (*Cherax robustus*)

Criteria	Assessment against significance criteria (vulnerable species)
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Lead to a long-term decrease in the size of an important population of the species	Unlikely to have a significant impact The disturbance footprint does not contain habitat for this species, nor were any individuals observed during targeted surveys. It is not considered that works associated with the proposed action will reduce the size of an important population.
Reduce the area of occupancy of an important population	Unlikely to have a significant impact The disturbance footprint does not contain habitat for this species, nor were any individuals observed during targeted surveys. It is not considered that works associated with the proposed action will reduce the size of an important population. No suitable habitat is proposed to be removed from the disturbance footprint, therefore the proposed action is not expected to reduce the area of occupancy of an important population of the species.
Fragment an existing important population into two or more populations	Unlikely to have a significant impact The disturbance footprint does not contain habitat for this species, nor were any individuals observed during targeted surveys. It is not considered that works associated with the proposed action will fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of the species	Unlikely to have a significant impact The disturbance footprint does not contain habitat for this species, nor were any individuals observed during targeted surveys. It is not considered that works associated with the proposed action would adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely to have a significant impact No important population has been identified for this species within the disturbance footprint. It is considered unlikely the proposed action will disrupt the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely to have a significant impact The disturbance footprint does not contain habitat for this species, nor were any individuals observed during targeted surveys. It is considered unlikely the proposed action will impact the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat	Unlikely to have a significant impact Feral pigs are identified as a threat to the species (DCCEEW 2023a). No evidence of feral pigs were recorded as present in the disturbance footprint during surveys. Weed and pest control measures will be incorporated into the Project Pest and Weed Management to control the introduction and spread of weed and pest species across the disturbance footprint during Project construction. The Pest and Weed Management Plan will be prepared by the Contractor, approved by SCC and TMR prior to ground disturbance works commencing and implemented for the duration of the Project works. Pest measures will ensure feral predators are not introduced in areas associated with Project activities. The proposed action is considered unlikely to result in invasive species becoming established in this species' habitat.
Introduce disease that may cause the species to decline	Unlikely to have a significant impact The Pest and Weed Management Plan will incorporate the management of invasive species which will assist in the prevention of pest plant introduction, <i>Phytophthora cinnamomi</i> , and Myrtle rust outbreaks (which can impact habitat quality for the species). The Plan will consider relevant guidelines to control <i>Phytophthora cinnamomi</i> and Myrtle rust (e.g. DoE, 2015c) associated with proposed action activities. This will include at a minimum vehicle washdown procedures and contractor education (including procedures regarding cleaning clothing). Revegetation plant species will be obtained from a reliable source that is certified free of these pathogens.

Criteria	Assessment against significance criteria (vulnerable species)
	Project equipment sourced from overseas will be quarantined as required under State and Commonwealth legislation. The proposed action is considered unlikely to introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species	Unlikely to have a significant impact The disturbance footprint does not contain habitat for this species, nor were any individuals observed during targeted surveys. The proposed works are not likely to interfere with the recovery of a population of the species occurring within the disturbance footprint.
Assessment of potential for significant residual impacts	The species has been assessed against the criteria above and it has been determined that the proposed action is unlikely to constitute a significant residual impact on this species.

7.5.6 Wallum sedge frog (*Litoria olongburensis*)

Ecology and distribution

The Wallum sedge frog (*Litoria olongburensis*) is listed as vulnerable under the EPBC Act. No evidence of the species presence was detected during the field surveys (refer Section 4.7.3).

There is no suitable habitat present within the disturbance footprint, the species requires perched swamps containing acidic water to breed (pH <4) (Filer 2023), with well-established beds of sedges and rushes (i.e. *Lepironia* spp. and *Baumea* spp.). Whilst water sampled from areas within the disturbance footprint was slightly acidic (i.e. pH of 6.6 to 6.8), this level is not considered acidic enough to exclude habitat generalist species that share a similar ecological niche (e.g. Eastern dwarf tree frog (*Litoria fallax*)) from competitive excluding the less fecund Wallum sedge frog. The Eastern dwarf tree frog was identified throughout the disturbance footprint in all areas where suitable habitat for frogs existed. The ALA shows numerous records of the Wallum sedge frog much further to the south (<2 km) near Caloundra Airport where there is suitable habitat for the species, where extensive stands of sedges and rushes occurred, but such areas were not contained within the disturbance footprint. Noting that competitive process are present within all areas containing frog habitat within the disturbance footprint, and the absence of specific microhabitat features required by the Wallum sedge frog (i.e. sedge and rush beds in waters of relatively low/acidic pH), it is considered that there is no dispersal habitat or functionality within or adjacent to the Project disturbance footprint for this species.

Recovery plan/threat abatement plans

Threats to the Wallum sedge frog identified by the National recovery plan for the Wallum sedge frog (Meyer et al, 2006) are predominantly habitat loss, habitat degradation, fragmentation, inappropriate fire regimes, vehicle mortality and invasive flora and fauna species becoming established.

Important populations and critical habitat

An assessment of the presence of habitat critical to the survival of the Wallum sedge frog within the disturbance footprint is presented in Table 7.19.

Table 7.19 Assessment against the definition for habitat critical to the survival of the species

Habitat critical to the survival of the species criteria	Response
Areas that are necessary for activities such as foraging, breeding, roosting, or dispersal	No – The Wallum sedge frog prefers tannin-stained, low nutrient, and highly acidic (pH 3.4 to 6) wetlands that have perched swamps that are a result of inundation during the rainy season. The swamp sclerophyll forest within the disturbance footprint had a pH reading of 6.6 to 6.8, well above the preferred acidity (pH 3.4 to 6) for the species. It is unlikely for habitat to exist within the disturbance footprint.

Habitat critical to the survival of the species criteria	Response
Areas that are necessary for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species, such as pollinators)	No – Any area that provides habitat for the species would be considered necessary for the long-term maintenance of the species. No habitat exists in the disturbance footprint.
Areas necessary to maintain genetic diversity and long-term evolutionary development	No – Any area that provides habitat for the species would be considered necessary to maintain genetic diversity and long-term evolutionary development. No habitat exists in the disturbance footprint.
Areas necessary for the reintroduction of populations or recovery of the species or ecological community	No – Any area that provides habitat for the species would be considered necessary for the reintroduction of populations or recovery of the species or ecological community. No habitat exists in the disturbance footprint.
Conclusion of the assessment	The disturbance footprint is unlikely to contain habitat critical to the survival of the species.

An assessment against the significant impact criteria for the Wallum sedge frog is presented in Table 7.20.

Table 7.20 MNES significant impact criteria for Wallum sedge frog (*Litoria olongburensis*)

Criteria	Assessment against significance criteria (vulnerable species)
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Lead to a long-term decrease in the size of an important population of the species	Unlikely to have a significant impact The disturbance footprint does not contain habitat for this species, nor were any individuals observed during targeted surveys. It is not considered that works associated with the proposed action will reduce the size of an important population.
Reduce the area of occupancy of an important population	Unlikely to have a significant impact The disturbance footprint does not contain habitat for this species, nor were any individuals observed during targeted surveys. It is not considered that works associated with the proposed action will reduce the size of an important population. No suitable habitat is proposed to be removed from the disturbance footprint, therefore the proposed action is not expected to reduce the area of occupancy of an important population of the species.
Fragment an existing important population into two or more populations	Unlikely to have a significant impact The disturbance footprint does not contain habitat for this species, nor were any individuals observed during targeted surveys. It is not considered that works associated with the proposed action will fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of the species	Unlikely to have a significant impact The disturbance footprint does not contain habitat for this species, nor were any individuals observed during targeted surveys. It is not considered that works associated with the proposed action would adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely to have a significant impact No important population has been identified for this species within the disturbance footprint. It is considered unlikely the proposed action will disrupt the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely to have a significant impact The disturbance footprint does not contain habitat for this species, nor were any individuals observed during targeted surveys. It is considered unlikely the proposed action will impact the availability or quality of habitat to the extent that the species is likely to decline.

Criteria	Assessment against significance criteria (vulnerable species)
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat	<p>Unlikely to have a significant impact</p> <p>Feral pigs are identified as a threat to the species (DSEWPC 2011c). No evidence of feral pigs were recorded as present in the disturbance footprint during surveys.</p> <p>Weed and pest control measures will be incorporated into the Pest and Weed Management Plan to control the introduction and spread of weed and pest species across the disturbance footprint during the Project works. Pest measures will ensure feral predators are not introduced in areas associated with Project works. The proposed action is considered unlikely to result in invasive species becoming established in this species' habitat.</p>
Introduce disease that may cause the species to decline	<p>Unlikely to have a significant impact</p> <p>The Pest and Weed Management Plan will incorporate the management of invasive species which will assist in the potential for indirect project impacts associated with pest plant introduction, <i>Phytophthora cinnamomi</i>, and Myrtle rust outbreaks.</p> <p>The Pest and Weed Management Plan will consider relevant guidelines to control <i>Phytophthora cinnamomi</i> and Myrtle rust (e.g. DoE, 2015c) associated with the Project works. This will include at a minimum vehicle washdown procedures and contractor education (including procedures regarding cleaning clothing). Revegetation plant species will be obtained from a reliable source that is certified free of these pathogens.</p> <p>Project equipment sourced from overseas will be quarantined as required under State and Commonwealth legislation. The proposed action is considered unlikely to introduce disease that may cause the species to decline.</p>
Interfere substantially with the recovery of the species	<p>Unlikely to have a significant impact</p> <p>The disturbance footprint does not contain habitat for this species, nor were any individuals observed during targeted surveys. The proposed works are not likely to interfere with the recovery of a population of the species occurring within the disturbance footprint.</p>
Assessment of potential for significant residual impacts	<p>The species has been assessed against the criteria above and it has been determined that the proposed action is unlikely to constitute a significant residual impact on this species.</p>

7.6 Cumulative impact assessment

7.6.1 Overview

Cumulative impacts to MNES have the potential to occur where a proposed action's construction and operational phases occur at the same time as other developments (which also impacts MNES) in the surrounding landscape. Cumulative impacts may be temporal in nature (e.g. construction traffic) or spatial (e.g. habitat loss). The construction phase typically poses the greatest risk for cumulative impacts to MNES when compared to the operational phase, as it results in new disturbances being introduced into an area and typically a larger extent of impact (being a larger temporary construction footprint when compared to a smaller permanent works footprint).

7.6.2 Assessment

Table 7.21 details the projects that have been considered in the cumulative impact assessment, based on the criteria detailed in Section 3.11. Included within Table 7.21 is detail regarding the relationship of each project to the Project and identification of the relevant MNES with the potential for cumulative impact.

Based on the included projects, Table 7.22 presents an assessment of potential cumulative impacts to MNES. The cumulative impact assessment has only been undertaken for those MNES identified in Table 7.1 where the SIA determined that the Project is likely to have a significant impact. The criteria used to rate the significance of the Project's contribution to cumulative impacts are defined in Section 3.11.

Table 7.21 Projects included or excluded in the cumulative impact assessment

Project, proponent and EPBC reference	Location	Description of the Project	Source	Project status and dates	MNES with the potential for cumulative impact ¹	Relationship to the proposed action
Direct Sunshine Coast Rail Line TMR EPBC 2024/09972	200 m west of the Project (at the closest point near Industrial Avenue)	New 37.8 km dual-track rail line running from the North Coast Line at Beerwah to Maroochydore via Caloundra and Birtinya. Under a staged delivery, Stage 1 involves a dual-track rail line to Caloundra, new Caloundra station and associated facilities south of Caloundra Road	EPBC Public Portal 2024/09972 https://www.tmr.qld.gov.au/projects/direct-sunshine-coast-rail-line-planning	Determined to be a controlled action, to be assessed by Public Environment Report. Guidelines issued March 2025 Stage 1 to be delivered by 2032, with major construction activities expected to commence in 2026	Listed threatened species and communities – Coastal Swamp Sclerophyll Forest TEC, Koala.	Potential overlap of construction times Operational at the same time
Aura South Self-contained master planned community Stocklands EPBC 2023/09548	6.2 km south of the Project between Bells Creek and the Beerwah State Forest. Noted as outside the approximate CIA study area (5 km) however included for completeness	Self-contained master planned community within a 1,200 ha site (approximately)	EPBC Public Portal 2023/09548	Determined to be a controlled action, assessment by Public Environment Report August 2023. Guidelines issued December 2023. Under Assessment (2032-2052)	Listed threatened species and communities – Coastal Swamp Sclerophyll Forest TEC, Koala, Grey-headed flying-fox.	Potential overlap of construction times

Table note:

- Being those MNES that this preliminary documentation has determined likely to result in a significant residual impact. For all other MNES, the proposed action has been determined in this preliminary documentation to not result in SRI and therefore the proposed action's contribution to cumulative impacts is considered negligible. Note MNES identified have been compiled based on information and records contained on the EPBC Act public portal and in some instances is limited to the original referral information as at 24 April 2025.

Table 7.22 Assessment of potential cumulative impacts to MNES

MNES	Potential cumulative impacts	Proposed action phase/duration of impact	Significance of proposed action's contribution to broader cumulative impacts*
Listed threatened species and communities			
<p>Coastal Swamp Sclerophyll Forest TEC</p>	<p>The Coastal Swamp Sclerophyll Forest TEC is anticipated to be significantly impacted by the Project due to the direct removal of approximately 1.43 ha. Elsewhere within the CIA study area:</p> <ul style="list-style-type: none"> ■ Approximately 41.9 ha of Coastal Swamp Sclerophyll Forest TEC is currently proposed to be directly impacted by the Direct Sunshine Coast Rail Line Project referral area. The Direct Sunshine Coast Rail Line Project and its associated clearing activities may also alter local hydrology and further exacerbate the fragmentation of this community. ■ Whilst approximately 143.31 ha of Coastal Swamp Sclerophyll Forest TEC is located within the Aura South Self-Contained Master Planned Community referral area, no direct impact is proposed. Potential indirect impacts have however been identified in relation to the potential for the project to alter hydrological regimes. <p>Habitat clearing involves a direct and local impact and can also result in habitat fragmentation at a regional scale, when assessed cumulatively. Fragmentation caused by clearing may lead to a reduction in the ecological values of intact vegetation communities nearby. Further cumulative impacts are unlikely to arise from change to local surface hydrology and groundwater levels due to negligible impacts from the Project and distances from the other assessable projects.</p>	<p>The proposed action's potential impacts related to habitat removal are anticipated to be local and permanent, as the proposed action will clear 1.43 ha of Coastal Swamp Sclerophyll Forest TEC. The Coastal Swamp Sclerophyll Forest TEC within the cumulative impact assessment's spatial extents is under ongoing removal which is expected to extend throughout the construction phase of the Project and construction and operational phases of other developments</p>	<p>Low – While the direct impacts are quantifiably significant, the overall assessment suggests that the cumulative impacts resulting from the Project and assessable projects may not lead to a substantial regional decline in the TEC. The Project is anticipated to impact the local population of this TEC through habitat removal, hindering recovery efforts for the community in the immediate vicinity, but the cumulative impacts from other developments combined with the Project impacts are unlikely to affect the regional viability of this TEC. Flood modelling conducted for the Project has shown no discernible flood depth change, velocity or regime flow change for 1% AEP for the TEC comparing the baseline and design case (refer Section 5.2). It is therefore considered that abiotic factors necessary for the ecological community's survival will remain unaltered by impacts associated with the Project. As such a significant impact from cumulative effects is unlikely.</p>

MNES	Potential cumulative impacts	Proposed action phase/duration of impact	Significance of proposed action's contribution to broader cumulative impacts*
Koala	<p>The Project proposes clearing of 4.65 ha of habitat critical for the survival of the Koala, which is considered to result in a significant impact on the Koala. SCC (2009) have identified 149,058 ha of potential Koala habitat in the Sunshine Coast region (with the proposed Project clearance representing 0.003% of this area).</p> <p>Elsewhere in the CIA study area:</p> <ul style="list-style-type: none"> ■ Approximately 112.9 ha of Koala habitat is proposed to be directly impacted by the Direct Sunshine Coast Rail Project. The Direct Sunshine Coast Rail Project is located approximately 200 m west of the Project (at the closest point near Industrial Avenue). ■ Known areas of Koala food and shelter trees will be avoided by the Aura Self-Contained Master Planned Community. <p>There is a paucity of Koala records in the broader region, however the extent of habitat removal associated with the Project and other developments, such as the Direct Sunshine Coast Rail Line project, which involves the clearing of approximately 112.9 ha of suitable Koala habitat, may result in a regional impact on the species due to loss of habitat, and further habitat fragmentation.</p> <p>Increased vehicle traffic from both the Project and other infrastructure developments may also elevate the risk of Koala mortality due to vehicle strikes, particularly if the habitat becomes increasingly fragmented.</p>	<p>The habitat removal and installation of fauna exclusion fencing associated with the Project will create additional fragmentation, potential barriers and mortality risk to the Koala. This is likely to extend throughout the construction and operational phase of the Project and other assessable developments compounding existing pressures on local Koala populations who are already experiencing stress from habitat loss and fragmentation.</p> <p>Risk of Koala mortality may increase over the duration of the design life of the proposed action as traffic volumes increase on the proposed action as well as the other assessable developments.</p>	<p>Moderate – As the disturbance footprint is classified as an urban area, there are existing effects of habitat loss, fragmentation, vehicle strikes and dog attacks. The disturbance footprint has been co-located with existing roads and HV powerline easement to minimise fragmentation. However, all Koala habitat within the disturbance footprint is considered habitat critical to the survival of the species.</p> <p>Clearing from other assessable developments will increase pressure on local and regional populations by reducing suitable habitat and fragmenting existing habitat. As such a significant impact from cumulative effects is likely.</p> <p>Mitigation of some of the impacts is possible through design improvements, construction mitigation measures and appropriate offsetting arrangements.</p>

MNES	Potential cumulative impacts	Proposed action phase/duration of impact	Significance of proposed action's contribution to broader cumulative impacts*
Grey-headed flying-fox	<p>The Project proposes the clearing of 5.20 ha of vegetation critical to the survival of the Grey-headed flying-fox which is considered to result in a significant impact on the Grey-headed flying fox. Using the area of potential Koala habitat as a proxy quantum guide due to overlapping habitat characteristics, there is 149,058 ha of potential species habitat in the Sunshine Coast region (SCC 2009) (with the proposed Project clearance representing 0.003% of this area).</p> <p>Elsewhere in the CIA study area:</p> <ul style="list-style-type: none"> ■ Approximately 112.9 ha of Grey-headed flying fox habitat is proposed to be impacted by the Direct Sunshine Coast Rail Project ■ No direct impact to Grey-headed flying fox habitat associated with the Aura Self-Contained Master Planned Community <p>Collectively, the Project and the Direct Sunshine Coast Rail Project could significantly disrupt local and regional populations of Grey-headed flying-fox due to the reduction of availability of critical resources necessary for their survival.</p> <p>Habitat loss from both projects is likely to lead to:</p> <ul style="list-style-type: none"> ■ Limitation of foraging opportunities, and reduce access to potential roosting areas. ■ Disruption of ecological processes: The cumulative effects might cause additional stress as the species is required to fly further afield for . <p>The cumulative impact from development projects, which involves disturbance and clearing of habitat critical for the survival of the Grey-headed flying-fox, can contribute to increased population stress from fragmentation. While the species is highly mobile, as distances between suitable habitats become greater, it is more challenging for flying-foxes to access necessary resources. As ongoing developments modify the landscape and reduce connectivity among existing habitats, the ability of Grey-headed flying-foxes to navigate their environment and maintain stable populations will be significantly challenged. Additionally, increased traffic and human activity associated with these projects could further disrupt their foraging patterns and degrade remaining habitats.</p>	<p>The Project will remove Grey-headed Flying-fox habitat. However, given the species is highly mobile; this Project and other assessable projects will not create a barrier to Grey-headed Flying-fox movement in the area.</p> <p>The areas of Project impact to Grey-headed Flying-fox habitat are located primarily in association with existing road corridor and HV powerline easement, minimising disruption to the species current movement pathways across the landscape.</p> <p>The construction phase will involve foraging habitat disturbance, and as other development project progress, this will increase habitat fragmentation.</p> <p>The duration of impacts is expected to be permanent, as the loss of critical habitat will not be easily reversible. The immediate impact of the Project will occur during the construction phase, and long-term implications of cumulative habitat loss and fragmentation are likely to extend through the operational life of other developments.</p>	<p>Low – As the disturbance footprint is classified as an urban area, there are existing effects of habitat loss and fragmentation on the Grey-headed flying fox. The disturbance footprint has been co-located with existing roads and HV powerline easement to minimise fragmentation and impacts to the species current movement pathways across the landscape. However, all Grey-headed flying fox habitat within the disturbance footprint is considered habitat critical to the survival of the species.</p> <p>Clearing from other assessable projects will increase pressure on local and regional populations of the Grey-headed flying fox by reducing suitable habitat and fragmenting existing habitat. As such a significant impact from cumulative effects is likely. While the cumulative significant impacts may be likely, the significance of the proposed actions contribution to these cumulative impacts is assessed as low, as the direct impacts from the Project are not expected to be substantial comparatively.</p> <p>Mitigation of some of the impacts is possible through design improvements, construction measures and appropriate offsetting arrangements.</p>

8 Offsets

The Project's significant residual impacts after the implementation of the avoidance, mitigation and management measures detailed in Section 7.6 are the loss of:

- Coastal Swamp Sclerophyll Forest TEC
- Koala habitat
- Grey-headed flying-fox habitat.

SCC proposes securing and delivery of a land-based offset that meets 100% of the Project offset obligation under the EPBC Act. The SCC proposed offset site is located within the SCC local government area and SEQ bioregion, approximately 6 km west of Caloundra and the proposed action, off Racecourse Road in Corbould Park, Queensland. The proposed offset site is located within a single land parcel identified as Lot 900 on SP209288. Lot 900 comprises 37.1 ha and is Reserve land owned by the State of Queensland (represented by the Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (DNRMMRRD)).

An Offset Proposal has been prepared in accordance with the DCCEE RFI requirements detailing the Site, the offset assessment undertaken to determine its suitability and compliance with EOP. The Offset Proposal is provided in Appendix I.

Additionally, an Offset Management Plan (OMP) has been prepared detailing the proposed management and monitoring approach for the Site in accordance with Part 9 of the EOP, seeking to ensure no net loss to these MNES, including:

- Legal security to ensure that the Site is legally protected through legal instruments that prevent future development or land-use changes that could negatively impact biodiversity values.
- Fire, weed and pest management regimes to respond to the ecological needs of the habitat and species to maintain or improve habitat quality, and minimise threats.
- Targeted replanting approach to accelerate natural regeneration, connectivity and enhance foraging availability.

The OMP is provided in Appendix J.

9 Economic and social matters

9.1 Economic and social costs and/or benefits

9.1.1 Overview

Economic evaluations for each of the Works Package A and Works Package B have been undertaken during the Project business case phase by SCC (PSA Consulting 2022) and TMR (TMR 2020a), respectively, with the findings of the TMR's evaluation incorporated into the SCC evaluation. It should be noted that Works Package C was determined to be required separately to the Project to address local stormwater capacity requirements and will be delivered as part of the Project. As such it does not form part of the cost estimates, cost-benefit assessment, or options assessments for the Project.

The sections below present a combined summary of the methodology and findings of these evaluations.

9.1.2 Methodology

Economic evaluations, comprising a cost estimate and cost benefit analysis were undertaken by TMR and SCC for the Project. The key steps undertaken were:

- For Works Package B (undertaken in 2020):
 - A Category 4 (i.e. project with 30 to 65% definition but prior to a developed design) cost estimate was prepared in accordance with TMR's *Project Cost Estimating Manual* (TMR 2021a) (medium confidence)
 - A cost benefit analysis was undertaken to determine the economic viability of Works Package B based on a benefit cost ratio
 - Economic capital and recurrent costs were incorporated in real 2018 dollars, using a 6% discount rate. Costs were calculated over an evaluation period, including development phase, construction and for 30 years post construction
 - Quantify and model benefits were determined, including:
 - **Avoided travel time cost** – diversion of road users away from the Nicklin Way/Caloundra Road intersection, reducing delays and avoiding main road congestion
 - **Avoided vehicle operating cost** – provision of an alternative, less congested route, meaning drivers spend less time on the road. In turn, this reduces costs of operating a vehicle (i.e. fuel, oil, tyres, maintenance, depreciation)
 - **Avoided crash cost (dis-benefit)** – reduction of traffic through the Nicklin Way/Caloundra Road intersection, however additional crashes incurred at the new intersection are greater than the reduction of crashes at the Nicklin Way/Caloundra Road intersection
 - Identified and quantifiable benefits were modelled 30 years post construction, starting July 2021 and flatlined after 2036 due to new routes reaching capacity
 - Any other qualitative benefits unable to be included in the cost benefit analysis model were identified.
- For Works Package A (undertaken in 2022) which incorporated the findings of TMR's evaluation for Works Package B (undertaken in 2020):
 - Total Works Package A capital and operational (maintenance) cost estimate was prepared, inclusive of total property cost (including full/partial land resumptions), civil estimates, lighting and asset relocations, and incorporate TMR Works Package B costs to calculate a total Project capital cost and operating (maintenance costs) over a 30 year project cycle

- A cost benefit analysis was undertaken to determine the economic viability of the total Project based on a benefit cost ratio (BCR), with modelling of the following Project benefits identified during the Project option analysis phase, including:
 - **Travel time savings** – calculated for Works Package A using the Australian Transport Assessment and Planning average cost per vehicle hour (\$41.87) for an urban environment, and applied using the AM and PM peak vehicle hours of travel reduction of the Project alignment and incorporating the same for Works Package B as determined by TMR's cost benefit analysis
 - **Vehicle operating savings** – calculated using the Australian Transport Assessment and Planning cost per vehicle kilometre (\$0.75/km) and applied using the AM and PM peak vehicle kilometres travelled reduction of the Project alignment, and incorporating the same for Works Package B as determined by TMR's cost benefit analysis
 - **Crash cost savings** – calculated using the Black Spot BCR calculation form provided by South Australia's Department of Planning, Transport and Infrastructure and using the previous five years of TMR crash history data.

For Works Package A and Works Package B, cost estimates have been adjusted (undertaken in 2025) to reflect the Project's current status, including:

- The availability of a fully detailed and approved design,
- Completion of land acquisitions and associated costs,
- Adjustment of deliverables (including scope, quantities, and material and construction/maintenance specifications)
- Adjustment of rates and prices to reflect current economic climate.

9.1.3 Findings

Cost estimate

The total capital and operational (maintenance) cost estimate for the Project is \$118 million. These are the estimated costs in 2025 for the delivery, operation and maintenance (over a 15 year period) of the Project infrastructure. Included in the 15 year estimate are costs associated with:

- Investigation and design
- Construction
- Land acquisition
- Asset operation
- Asset maintenance
- Asset renewal.

Cost benefit analysis

Table 9.1 provides a summary of the economic benefits of the Project as modelled with regards to travel time savings, vehicle operating savings and crash cost savings.

Table 9.1 Summary of economic benefit

Cost benefit parameter	Value*
Avoided cost of maintenance	\$0
Travel time savings	\$251,230,000
Delay reduction savings	\$23,817,000
Vehicle operating cost savings	\$42,319,000
Crash cost savings	-\$62,718,000
Avoided cost of diversion (including externalities)	\$0
Residual/salvage value	\$0
Total cost benefit	\$254,648,000

Table note:

* Figures taken from the Oval Avenue Options Analysis Business Case report, 2022, by PSA Consulting and adjusted to reflect economic and inflationary data to 2025

The economic benefits of delivering the Project far outweigh the expected capital and operational investment costs, and the additional crash costs. The Project cost estimate is approximately \$118 million, with an estimated direct cost benefit of approximately \$255 million (over a 15 year period). This results in a BCR of 2.16. Based on TMR decision criteria, which recommends a Project only be undertaken if the BCR is 1 or greater, the Project is recommended from an economic perspective to proceed.

Broader social and economic benefits are out of scope for the Project's cost-benefit assessment. Social and economic benefits represent significant additional benefits resulting from the direct investment into the transport infrastructure project.

9.1.4 Additional qualitative benefits

Additionally, as part of the TMR economic analysis (TMR 2021a), the following qualitative benefits were identified and assessed in terms of their economic and social benefits:

- **Reliability of travel time** – Research has shown that road users value the reliability of travel time in addition to avoided costs of travel time. Compared with studies focused on the valuation of avoided travel costs, research on the valuation of travel time reliability is comparatively new. Li et al. (2010) suggest that travel time reliability in 2010 was \$40.39/hour (2010 dollars) which is approximately three times the value per hour of avoided travel costs. This applies not to actual time spent diverted, but to a road user's expectation of being diverted.
- **Improved active transport** – Active transport includes non-motorised transport that provides socio-economic benefit by creating a better sense of community, promoting daily physical activity levels (walking or cycling) and reducing greenhouse gas emissions due to less vehicles on roads. The Project promotes improved active transport through provision and connectivity for pedestrians and cyclists in the design, including intersection crossings, continuity with the current SCC path network and direct access to existing tracks within Ben Bennett Bushland Park.
- **Improved access** – The new connecting road network will provide improved access and reliability between residential, industrial and employment, health, educational and recreational facilities and service centres located north of Caloundra Road.
- **Alignment with State and local government objectives** – The Project aligns with State and local government plans and objectives, including those identified in Section 10.3.1.

9.2 Public stakeholder consultation

9.2.1 Overview

Public stakeholder consultation and engagement has occurred for the Project over the past 10 years, with the final corridor alignment being determined as a result of lengthy and detailed assessment processes considering planning, environmental, social, cultural heritage and engineering factors. In particular, the new transport link has formed part of SCC's consultation and engagement on a variety of strategic and project specific plans over the last 10 years, being:

- Caloundra Area Transport Study (2013) – which included engagement on potential transport options, including upgrading Oval Avenue and Third Avenue
- Sunshine Coast Regional Economic Strategy (2023b)
- SCC Planning Scheme (2014)
- Caloundra Centre Master Plan (2017) – inclusion of the Oval Avenue and Third Avenue transport upgrade
- Sunshine Coast Environment and Liveability Strategy (2023a)
- Caloundra Traffic Route Upgrade Analysis detailed analysis and selection of the most beneficial transport upgrade option, with the Oval Avenue and Third Avenue alignment identified as preferred (SCC 2025a)
- SCC Local Government Infrastructure Plan (2018) – inclusion of the upgrade of Oval Avenue and Third Avenue
- Sunshine Coast Integrated Transport Strategy (2019)
- Sunshine Coast Community Strategy (2024).

Between 2018 and 2020, SCC continued to liaise with key stakeholders, including adjacent landowners and businesses along the Project corridor and in 2020, SCC revised the Project design based on feedback received.

A Communications and Engagement Plan has been prepared and is being implemented by SCC for the Project. In 2021, SCC, in consultation with TMR, released the Project concept design and undertook further engagement with the community and local stakeholders. Engagement included community drop-in sessions and the collection of community feedback.

In 2022, a Stakeholder Interest Group (SIG) was formed as part of the detailed design process.

9.2.2 Stakeholder Interest Group

Since its formation in 2022, the role of the SIG has been to facilitate community input and provide an opportunity for community issues to be discussed with and understood by the Project team. Guided by the SIG Terms of Reference (TMR 2022), the SIG primary objectives have been to:

- Share local knowledge between community stakeholders, TMR and SCC
- Test ideas and approaches and act as a 'sounding board' for the Project team
- Encourage the development of a collegiate and cooperative relationship between TMR, SCC and stakeholders to understand issues that affect the community
- Provide comment on Project design and construction planning
- Act as a conduit to the broader community to share information and generate understanding about the Project within the terms of the SIG.

The SIG has helped represent the interests of the local community and has provided valuable feedback to help shape features of the Project design.

9.2.3 Community updates and notifications

SCC has been committed to keeping the community informed throughout all stages of the Project. Since mid-2021, SCC has maintained a Project website and issued regular updates and construction notifications, throughout the planning, development and early works phases, to the local community and other interested and registered stakeholders (SCC 2025b). These updates and notifications have covered matters such as:

- Outline Project history, past transport studies and community engagement processes
- Progress on the planning and design phases, including concept and detailed design
- Details of community drop-in sessions providing an opportunity to view the design and meet with the Project team
- Details of the SIG, including the original application process, its subsequent membership, key activities and outcomes
- Project timing and key milestones
- Notification of planned early works and investigations
- Details on how to register for further Project updates and/or contact the SCC Project team.

SCC will continue to provide updates and notifications as the Project progresses.

9.2.4 Avoidance, minimisation and mitigation

The extensive feedback and information obtained during stakeholder and community engagement has been captured and utilised throughout the various Project design and options assessment reports as well as stakeholder feedback register and reports by both SCC and TMR to inform Project planning and development.

Outcomes of the meetings between the SIG, SCC and TMR regarding stakeholder feedback have been considered in design outcomes and the development of construction specifications, with this feedback having a key influence on the following Project aspects:

- The importance of continued connectivity between Ben Bennett Bushland Park and neighbouring properties, including aged care facilities on West Terrace
- The need to reduce vegetation impacts, including to mature vegetation, in Ben Bennett Bushland Park and Bicentennial Park, including by reducing infrastructure extents
- Design inclusions and specifications to reduce or eliminate risk of potential impact to adjacent receptors (i.e. fauna habitat, residential dwellings) and corridor users
- Opportunities to provide accessible, safe and efficient active transport connections for cyclists and pedestrians for all ages and abilities.

This feedback has driven a reduction in the portion of the Project disturbance footprint within Ben Bennett Bushland Park, minimising the extent of vegetation clearing through measures, including utilising the existing cleared Energex corridor and incorporating retaining walls as detailed in Section 2.5.

9.3 Indigenous stakeholder engagement

9.3.1 Native title

Portions of the disturbance footprint, predominantly associated with Ben Bennett Bushland Park are located on land within the external boundary of the Kabi Kabi First Nation native title area (National Native Title Tribunal reference: QC2018/007). QC2018/007 was determined on 17 June 2024, and covers a wider area across the region. Relevantly, the QC2018/007 determination confirms the Kabi Kabi People's non-exclusive native title rights and interests to these areas, which includes the following parcels of Reserve land within the disturbance footprint:

- Lot 745 CG6381
- Lot 525 CG813466

Further, an Indigenous Land Use Agreement (QI2024/006), registered on 25 October 2024, is in effect between the Kabi Kabi Peoples Aboriginal Corporation ICN 8996 and the State of Queensland. The Indigenous Land Use Agreement is an area agreement pertaining to tenure resolution and covers a wider area of approximately 210 km² in the areas of Maroochydore, Gympie and Maryborough. It includes the following land parcels within the disturbance footprint where native title rights and interests have been surrendered:

- Lot 100 CG813124
- Lot 101 SP238966
- Lot 525 CG813466.

TMR is currently completing the land acquisition process for these portions of Reserve land within the disturbance footprint. As part of this process, a Native Title Assessment has been undertaken.

The construction related works for the new road is a valid future act under section 24KA of the *Native Title Act 1993* (Cth) to which the “non-extinguishment principle” applies (that is, the native title is not extinguished but suppressed).

9.3.2 Cultural heritage

Overview

The Kabi Kabi First Nation Native Title Claim Group is the registered Aboriginal Cultural Heritage Party for the land within the disturbance footprint.

Aboriginal cultural heritage has been assessed throughout various stages of the Project, and documented within:

- Environmental Assessment Report (Aurecon 2017a)
- Preliminary Environmental Assessment (Flow Environmental 2021)
- Cultural Heritage Assessment (Converge Heritage + Community 2021)
- Cultural Heritage Risk Assessment (TMR 2023a)
- Review of Environmental Factors (Aurecon 2024e).

This section describes the cultural heritage assessments and consultation that has occurred to date. It should be noted that some consultation activities pertaining to re-engagement with Kabi Kabi People representatives prior to construction are still underway, and therefore not all final outcomes are available for discussion in this report.

Cultural heritage assessment in partnership with the Kabi Kabi People

As part of the Project business case phase, Converge Heritage + Community were engaged by SCC to undertake a cultural heritage assessment (desktop and field assessment) along the Project alignment, which included facilitating consultation with the Kabi Kabi People together with a field assessment by their representatives. The aim of the field assessment was to determine, in partnership with Kabi Kabi People, the presence of any Aboriginal cultural heritage values, inclusive of objects, significant Aboriginal areas and/or significant cultural values (tangible and intangible) along the Project alignment and identify management and mitigation options, in consultation with the Kabi Kabi People to manage the potential Project impacts on Aboriginal cultural heritage (Converge Heritage + Community 2021).

Desktop assessments of aerial imagery identified an ongoing use and disturbance of land in the southern and western portions of the Project alignment for residential, recreational and commercial development since 1958. By 1992, the eastern side of Ben Bennett Bushland Park had been cleared of vegetation to accommodate additional sports grounds. Undisturbed areas of remnant vegetation remain to the north and north-west of Arthur Street associated with Ben Bennett Bushland Park and the north side of Mark Road East (opposite side of Nicklin Way) which intersects with Industrial Avenue. Searches of the Aboriginal Cultural Heritage Database and Register were undertaken in November 2020 (now maintained by the Department of Women, Aboriginal and Torres Strait Islander Partnerships, Communities and the Arts) did not identify any registered Aboriginal cultural heritage. Field investigations undertaken on 11 June 2021 did not identify any Aboriginal cultural heritage material. Nevertheless, due to survey limitations (with respect to ground surface visibility and ground surface integrity) and the proximity of the Project alignment to the coastline, Mooloolah River and volcanic mountains, there remains potential for undocumented Aboriginal cultural heritage to exist along the Project alignment.

During field investigations, the Kabi Kabi People also identified areas of high historical and cultural heritage values, including the mature vegetation (paperbarks, bloodwoods and eucalypts) within Ben Bennett Bushland Park and a fig tree in Bicentennial Park. Recommendations from the cultural heritage assessment were:

- SCC continue to consult with Kabi Kabi People as the Project progresses to ensure all practical and feasible measures are taken to minimise impacts on the cultural heritage of the Kabi Kabi People
- Inclusion of cultural heritage inductions for staff and contractors undertaking ground disturbance activities to be developed and presented where practical by the Kabi Kabi People representatives
- Design to avoid and retain, where practical, mature, culturally significant vegetation
- Development and implementation of an ongoing monitoring program for initial ground disturbing activities
- Development and implementation of an incidental finds procedure in consultation with the Kabi Kabi People.

Cultural Heritage Risk Assessment

The Cultural Heritage Risk Assessment completed by TMR in 2023 identified the Project as having a high risk to cultural heritage under the ACH Act *Duty of Care Guidelines* due to the presence of extensive areas of remnant vegetation, little prior ground disturbance and/or vegetation clearance and the presence of a potential scarred tree (remanent) adjacent to Ben Bennett Bushland Park.

9.3.3 Avoidance, minimisation and mitigation

The Project has undertaken considerable design revisions to maximise the opportunity to avoid areas of high historical and cultural heritage value to the Kabi Kabi People, including modifications of the corridor alignment and disturbance footprint to avoid a number of mature and culturally significant trees, including the fig tree within Bicentennial Park.

In addition, for the Project preconstruction and construction phases, the Project will re-engage with Kabi Kabi representatives prior to the commencement of construction to facilitate compliance with the following contract specific management requirements for cultural heritage, as set out in *MRTS51.1 Environmental Management*:

- Preparation of a suitable agreement is currently being prepared between SCC and Kabi Kabi People for the Project
- Early works and construction to be undertaken in accordance with Cultural Heritage Assessment (Converge Heritage + Community 2021) and Cultural Heritage Risk Assessment (TMR 2023a) for High Risk (Category 5) areas
- For ground disturbance works within Ben Bennett Bushland Park:
 - Consultation with the Kabi Kabi People is required regarding the potential impacts to Aboriginal cultural heritage. Works may not progress where consultation, mitigation strategies and a suitable agreement is not formed.
 - Avoidance of mature vegetation in the first instance is recommended. Where this is not possible alternative solutions to reuse of timber and/or offsetting should be investigated.
 - Consultation with the Kabi Kabi People regarding a potential remnant stump of a scarred tree to achieve a suitable mitigation strategy
- For ground disturbance works within Lot 525 CG813466 (Arthur Street):
 - Further ground investigation of the vegetation adjacent to Roy Henzell Park should occur to ascertain whether the vegetation is consistent with Ben Bennett Bushland Park
 - Consultation on this area should be undertaken with the Kabi Kabi People.
- Contractor to develop a Project EMP(C) in accordance with *MRTS51 Environmental Management* (Section 3 Cultural Heritage). The Project EMP(C) will incorporate the appropriate management measures as identified in the relevant agreement between the Principal and Kabi Kabi People for the Project (once available).
- All sub-contractors, construction personnel (especially the Project Contractor Workplace Health and Safety officer) and all relevant stakeholders will receive an appropriate cultural heritage induction in accordance with the TMR standard. The Cultural Heritage Induction is to be delivered by TMR's Cultural Heritage Officer for the Project in conjunction with the Kabi Kabi People. The successful contractor will contact the Principal's Representative for advice regarding the TMR cultural heritage induction.
- Following the initial presentation of the Cultural Heritage Induction, it will be the responsibility of the Project Contractor Workplace Health and Safety Officer (or equivalent as nominated by the contractor), to present the cultural heritage component as part of the onsite Project specific induction in accordance with the requirements of *MRTS51 Environmental Management*
- Implement TMR's *Find-Stop-Notify-Manage Work Instruction* where a potential incidental find is identified. Contact TMR's Cultural Heritage Officer for any incidental finds of either Aboriginal or historical cultural heritage or possible human remains.

10 Ecologically sustainable development

10.1 Overview

SCC, together with project partner TMR, are committed to meeting the intent of the EPBC Act and DCCEEW's requirements for ecologically sustainable development. In addition, the Project is committed to meeting the infrastructure sustainability objectives set by the Queensland State government.

This section provides responses to each of the principles of ecologically sustainable development (ESD), as defined in Section 3A of the EPBC Act. Further detail regarding the Project approach to State infrastructure sustainability under the Infrastructure Sustainability Council (ISC) Infrastructure Sustainability (IS) Rating Scheme, which enhances compliance with Section 3A of the EPBC Act, is described in Section 10.3.

10.2 Commonwealth

Table 10.1 details how the proposed action meets the principles of ESD, as defined in Section 3A of the EPBC Act.

Table 10.1 Project consistency with the ESD principles under Section 3A of the EPBC Act

Principle	Response
Decision making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations.	<p>The Project detailed design has been developed with a key objective of minimising potential impacts to MNES and surrounding environmental values, particularly for the portion of the Project corridor that traverses Ben Bennett Bushland Park. Section 2.5 details the alternative options that were developed and evaluated for the design within Ben Bennett Bushland Park together with Project wide measures to avoid/minimise impacts, particularly associated with vegetation clearing extents.</p> <p>Sections 5 and 9 have identified the environmental, social and economic consequences of the Project, with proposed avoidance, minimisation and mitigation measures set out in Section 7.6 to address significant impacts.</p> <p>Further, the Project commits to the delivery of environmental offsets to address residual significant impacts on MNES as detailed in Section 8 to address residual significant impacts on MNES in accordance with the requirements of the <i>EPBC Act Environmental Offset Policy</i>.</p> <p>The Project Infrastructure Sustainability Management Plan (ISMP) (refer Section 10.3.2) sets the Project target of achieving a 'Silver' rating under the ISC IS Rating Scheme.</p>
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.	<p>Desktop investigations and field surveys have been undertaken by suitably qualified and experienced personnel to understand the existing environment and inform the nature and extent of the potential Project environmental impacts. These studies, which have been undertaken for the Project since 2017 are described in detail in Section 2.8.</p> <p>Further, recent ecological investigations have:</p> <ul style="list-style-type: none"> ■ adopted a conservative approach with respect to disturbance, assessing the disturbance footprint together with an additional 100 m buffer area ■ made reference to relevant MNES Guidelines, Species Recovery Plans, Conservation Advice and Threat Abatement Plans for the relevant MNES ■ been discussed with DCCEEW to confirm proposed survey methodologies (refer DCCEEW meeting minutes contained in Appendix C). <p>The outcomes of these assessments have been used to inform the identification of measures to avoid, minimise, mitigate the potential Project significant impacts to MNES, as well as the development of the Project Offset Strategy to address residual significant impacts (refer Section 8).</p>

Principle	Response
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.	<p>The construction and operation of new and upgraded linear infrastructure, such as the Project, has the potential to result in environmental and social impacts despite being necessary infrastructure that will result in social benefits through addressing traffic congestion and enabling improved travel choice for public transport users, cyclists, pedestrians, and motorists now and into the future. The extensive number of studies that have been undertaken as part of Project planning have identified a strong social need and justification for the proposed action.</p> <p>The Project has been intentionally designed to minimise potential impact to the existing environment through a range of design decisions (refer Section 2.5, which have often resulted in additional economic cost to the Project), together with mitigation measures (refer Section 7.6) to ensure that the health, diversity and productivity of the existing environment is maintained or enhanced for future generations whilst meeting current and future needs for improved transport infrastructure.</p> <p>Further, the Project commits to the delivery of environmental offsets in accordance with the requirements of the <i>EPBC Act Environmental Offset Policy</i> to address residual significant impacts on MNES as detailed in Section 8.</p>
The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making.	<p>Wherever possible, the Project has been designed to conserve biological diversity and ecological integrity, which has included consideration of alternative options to vary the Project design both corridor wide, and with specific focus on the Ben Bennett Bushland Park in order to minimise impact on MNES (refer Section 2.5).</p> <p>Additionally, mitigation measures have been proposed to reduce the magnitude and severity of potential impacts upon the environment, including to flora, fauna and fauna breeding places during the construction and operational phases (refer Section 7.6).</p> <p>The Project ISMP (refer Section 10.3.2) sets the Project target of achieving a ‘Silver’ rating under the ISC IS rating scheme which includes objectives and targets for ecological protection and the environment.</p>
Improved valuation, pricing and incentive mechanisms should be promoted.	<p>Sections 5 and 9 have identified the environmental, social and economic consequences of the Project, with proposed avoidance, minimisation, mitigation and offset measures set out in Sections 7.6 and 8 to address residual significant impacts on MNES.</p> <p>To date, the Project has applied the latest version of the <i>EPBC Act Environmental Offsets Policy</i> (DSEWPC 2012a) and undertaken offset calculations to inform the development of both the Offset Proposal (refer Appendix I) and Offset Management Plan (refer Appendix J) in accordance with the <i>EPBC Act Offsets Assessment Guide</i> (DSEWPC 2012b).</p> <p>If approved to proceed, construction and operation of the Project will be undertaken in accordance with relevant legislation, approval conditions and environmental management plans as well as TMR’s <i>Environmental Processes Manual</i> and relevant Main Roads Technical Specifications, which represent an additional economic cost to both SCC and TMR.</p> <p>As part of the contractor procurement process, SCC will incorporate selection criteria regarding sustainability credentials and ISC IS Rating Scheme experience for tenderers to respond to.</p>

10.3 State

10.3.1 State and regional sustainability objectives

TMR and other State departments have a number of strategies and plans that have informed the development of the Project, including the setting of long-term State and local objectives. These include:

- State Infrastructure Strategy (DSDILGP 2022)
 - Sets a priority action to explore the widespread adoption of sustainability assessments for all Queensland Government infrastructure projects with budgets exceeding \$50 million in accordance with schemes such as the ISC IS Rating Scheme or the Green Building Council of Australia’s Green Star rating tool. This continues previous actions set under the former *State Infrastructure Plan 2016*.

- Queensland Transport Strategy (TMR 2020b)
 - Sets the strategic outcome of achieving sustainable, resilient and liveable communities, recognising that whilst transport plays an important role in the liveability and sustainability of communities, it impacts on the environment including air quality and noise. The strategy highlights the need for greater focus on more sustainable forms of transport, such as active transport (walking, cycling) to make Queensland’s communities more liveable and sustainable, which in turn helps protect our natural assets.
- Transport Coordination Plan 2017-2027 (TMR 2017)
 - Sets an ‘environment and sustainability’ objective of ensuring ‘transport contributes to a cleaner, healthier and more liveable environment and is resilient to Queensland’s weather extremes’
- South East Queensland Regional Transport Plans 2021 (North Coast, Metropolitan, South Coast) (TMR 2021b)
 - Aligning with the objective of the *Transport Coordination Plan 2017-2027*, this regional transport plan sets a priority to sustain a transport system that ‘contributes to the environmental sustainability and resilience of the region’ and that provides for infrastructure and services that minimise environmental impacts, with a transport system that is ‘sustainable and supports the region’s environmental and lifestyle values’. The plan reinforces TMR’s objective to obtain formal IS ratings for TMR projects with a business case estimate of \$100 million or more, or undertaking sustainability assessments on projects between \$50-100 million. It identifies Nicklin Way as a key corridor impacted by road congestion.

10.3.2 Infrastructure sustainability

ISC is a not-for-profit industry body that has developed a comprehensive rating system for evaluating economic, social and environmental performance of infrastructure in Australia and New Zealand. The system spans the planning, design, construction and operational phase of infrastructure assets. Under TMR’s transport infrastructure sustainability commitments, the Project is undertaking an IS Essentials rating assessment and is targeting a score of ‘Silver’.

To support achieving an ISC IS Rating Scheme score of ‘Silver’, the Project is currently developing an ISMP for the design phase. The ISMP is the primary means of documenting the Project sustainability strategy and pathway at a whole of project level, and forms the evidence package for the IS rating. The scope of the ISMP is to:

- Provide an overview of the sustainability aspirations for the Project
- Provide background on the IS rating processes undertaken in this phase of the Project
- Provide background on the sustainability strategy for the Project
- Introduce the weighting assessment and points pathway
- Detail any identified risks to the rating.

A separate ISMP for the construction phase will also be developed.

As part of developing the Project approach to sustainability, a materiality assessment has been undertaken to analyse what areas of sustainability are relevant, or material, to the Project. It considers the size, location, scope, value and type of development as well as the operating conditions. This helps to direct the IS rating to areas of greatest benefit from a sustainability perspective. The outcomes of this assessment identified the following as the top five categories for points weighting:

- Resources
- Environment
- Stakeholder engagement
- Ecology
- Place.

Further assessment of the points weighting of individual credits within these categories identified the top three most material credits as being:

- Eco-1 Ecological Protection and Environment
- Rso-6 Material Life Cycle Impact Measurement and Management
- Pla-2 Urban and Landscape Design.

The Project sustainability objectives have been developed in line with the relevant rating credits, with consideration to the objectives set by SCC's *Environment and Liveability Strategy* and with input from relevant stakeholders via the Project SIG (refer Section 9).

To support the ISMP, a Sustainability Action Plan has also been developed which supports the broader strategy set by the ISMP, by assigning a responsible party to deliver the actions associated with each credit.

In developing the detailed design, the Project has focused on the following priority sustainability opportunities:

- Material selection to prioritise materials with low embodied energy
- Reduction and reuse of material and waste
- Investigation of opportunities for the protection and enhancement of local biodiversity
- Development of an urban and landscape design plan
- Investigation of other opportunities to reduce potential environmental impacts, including:
 - Assessment and management of light spill and impacts to adjoining areas
 - Design of noise barriers to minimise noise and vibration impacts
 - Appropriate staging of construction activities, where practical to manage noise and vibration impacts.

11 Environmental record of the person proposing to take the action

Delivery of the Project, including contract administration will be the responsibility of SCC as the Project proponent, with TMR providing delivery support as SCC's project partner. Project planning, design and reporting has been undertaken to date in accordance with all relevant TMR technical standards, environmental assessment and reporting requirements, including TMR's *Environmental Processes Manual* (TMR 2023b).

SCC has a satisfactory record of responsible environmental management. SCC (as the person proposing to take the action) has not been subject to past or present proceedings under the EPBC Act or other Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources.

SCC's project partner, TMR, has not been subject to proceedings under the EPBC Act or other Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources.

SCC and TMR are highly experienced in the planning, delivery and operation of local and State transport infrastructure projects, respectively, with TMR's core role being for the planning, building and maintaining of Queensland's road, rail, freight and maritime infrastructure.

TMR undertakes works in accordance with the *Environmental Processes Manual*. This manual sets out the processes for assessing and managing the environmental impacts of the department's infrastructure projects and is implemented under the TMR Environmental Management System.

Project delivery and environmental compliance will continue to be managed during the delivery stage through TMR environmental reporting, compliance and contractor requirements, with TMR providing an ongoing reviewer role.

12 Conclusion

The proposed action is a critical road infrastructure project jointly funded by the Queensland State government (TMR) and SCC, with SCC holding overall Project delivery responsibility as the Project proponent, with support from TMR as SCC's Project delivery partner.

The proposed action will deliver a 1.6 km new two way/two lane, dual carriageway urban sub-arterial road link connecting the Caloundra central business, tourism and development district between Omrah Avenue and Nicklin Way (a State-controlled road), with connection through to Industrial Avenue, north of the existing Caloundra Road roundabout.

The Project integrated transport corridor upgrade forms part of a long-term plan to provide better access, and improved travel choice to and from Caloundra for public transport users, cyclists, pedestrians, and motorists now and into the future by reducing congestion, preserving function and efficiency of existing roads, enhancing connectivity accessibility and safety, supporting improvements in public and activity transport travel choices whilst minimising potential environmental, social and economic impacts.

On 30 October 2024, the proposed action was determined to be a 'controlled action' requiring assessment and approval under the EPBC Act by preliminary documentation (EPBC Reference 2024/09956).

This preliminary documentation provides responses to each of the items raised by DCCEEW within the RFI issued to SCC dated 14 November 2024 under Section 95A(2) of the EPBC Act, and in doing so, seeks to inform DCCEEW's assessment of the potential Project impacts, and the evaluation of the Project proposed strategies for avoiding and mitigating any adverse impacts.

As requested by DCCEEW, this preliminary documentation has been prepared as a standalone response to support an independent assessment of the proposed action. This has been achieved by:

- Incorporating information from the original EPBC Act referral, augmented and updated with new or additional information in response to the RFI and to reflect progression of detailed design in the time since original referral was made
- Providing a description of all key Project changes that have occurred in the time since the original referral was made
- Providing a cross-referenced table detailing each of the items requested in the formal RFI (which comprises two parts; Attachments A and B), together with section locations and links of where to find the responses within this document.

This report presents the methodology and findings of desktop assessments and targeted ecological assessments of threatened species and ecological communities within and adjacent to the disturbance footprint. This report also presents a suite of measures that have been developed to avoid, minimise and mitigate potential impacts to MNES. These measures adhere to relevant legislation, guidelines, and best-practice techniques to ensure that the Project's potential environmental impacts are avoided/minimised to acceptable levels.

In accordance with the Significant Impact Guidelines 1.1, this report also details the SIAs undertaken to assess the nature, likelihood, consequence and extent of potential significant impacts to listed threatened species and communities, and the ecological character of the declared Ramsar wetland identified with a potential to be impacted from the proposed action after the application of all avoidance, minimisation and management measures.

The assessment concluded significant residual impacts are likely for the following MNES:

- Coastal Swamp Sclerophyll Forest TEC – up to 2.09 ha
- Koala – up to 4.65 ha
- Grey-headed flying-fox – up to 5.20 ha.

Biodiversity offsets are provided in accordance with the EOP for significant residual impacts to the Coastal Swamp Sclerophyll Forest TEC, Koala habitat and Grey-headed flying-fox habitat. To address the proposed action offset requirements, and in response to the DCCEEW RFI, an Offset Proposal and OMP have been developed.

The OMP demonstrates compliance with Part 9 of the EOP and identifies management requirements ensuring a no net loss to these MNES, including:

- Legal security to ensure that offset areas are legally protected through legal instruments that prevent future development or land-use changes that could negatively impact biodiversity values.
- Fire, weed and pest management regimes to respond to the ecological needs of the habitat and species to maintain or improve habitat quality, and minimise threats.
- Targeted replanting approach to accelerate natural regeneration, connectivity and enhance foraging availability.

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Appendix A

DCCEEW request for additional information cross reference table

Appendix B

Design drawings

[Redacted]

[Redacted]

Appendix D

Protected Matters Search Tool results

Appendix E

Likelihood of occurrence

Appendix F

Water quality modelling results and risk assessment

Appendix G

Afflux mapping

Appendix H

Species occurrence records

Appendix I

Offset Proposal

Appendix J

Offset Management Plan

Appendix K

Koala occupancy report

Appendix L

Ben Bennett Bushland Park Regeneration Works Plan

Appendix M

Sunshine Coast Council Drone Survey

Appendix N

Environmental Management Plans (Outline)

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