



DESIGN JOINT VENTURE

Mooloolah River Interchange (Stage 1) – Preliminary and Detailed Design

Baseline Water Mouse Data Collection Program

Department of Transport and Main Roads

9 November 2022



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1. Introduction

1.1 Project overview

The Mooloolah River Interchange (MRI) Project (Stage 1) holds an existing approval under the Commonwealth *Environment, Protection and Biodiversity Act 1999* (EPBC Act) (EPBC 2008/4316). The Department of Transport and Main Roads (TMR) previously proposed the upgrade, extension, construction and operation of a section of the Sunshine Motorway between Caloundra and Maroochydore, as part of the Multi-Modal Transport Corridor (MMTC) Project in 2008. A separate Project to duplicate the Sunshine Motorway, from the Kawana Way exit to the Mountain Creek exit onto Prelude Drive, was also proposed in 2011. The Sunshine Motorway Duplication and components of the MMTC Project have been amalgamated, to enable a single Project to be progressed and delivered, thus forming the current MRI Project.

The proposed MMTC action was approved subject to conditions on the 1 September 2010. In 2015, an amendment was issued to the Department of Climate Change, Energy, the Environment and Water (DoCCEEW), (the former Department of Agriculture, Water and the Environment and Department of the Environment and Energy) to include additional areas outside the original MMTC Project area with combined conditions issued on 28 August 2015. The MMTC Project area and the additional areas are collectively referred to as the 'EPBC Act Approved Action Area' throughout this report (Figure 1.1). The full set of amalgamated conditions are attached as Appendix A.

1.2 Purpose of this monitoring program

Condition 4A (b) of EPBC 2008/4316 states:

- b. Prior to commencing the action, establish a baseline data collection program to determine:*
 - i. The area of occupancy of the Water Mouse population within the project area*
 - ii. The water quality and salinity levels at high and low tide levels*
 - iii. The condition and extent of water mouse habitat to be retained/avoided by the action, for comparison against appropriate control sites.*

The conditions also state that the Baseline Water Mouse Data Collection Program must be approved by DoCCEEW prior to the commencement of the action.

Therefore, this Baseline Water Mouse Data Collection Program has been prepared to address and satisfy the requirements of Condition 4A (b). Baseline ecology surveys have recently been completed in March/April 2022 over the entire MRI Project area which includes both areas to be directly impacted by the proposed construction works within the MRI Project area and areas adjacent to the MRI Project area. During these recent ecology surveys 'habitat critical to the survival' of the water mouse (*Xeromys myoides*) was identified and mapped in accordance with specific Commonwealth listing advice and therefore has informed the development of this Baseline Water Mouse Data Collection Program.

The water mouse (*Xeromys myoides*) is listed as vulnerable under the EPBC Act.

1.3 Definitions

The terminology presented in Table 1.1 is used throughout this report, and where appropriate, presented on Figure 1.1.

Table 1.1 Definitions used in this monitoring program

| Term | Definition |
|-------------------------------|---|
| Project footprint | The Project footprint represents the areas subject to direct development impact and proposed land clearing for MRI Project, as displayed in Figure 1.1. |
| Project area | The Project area is the likely impact area associated with the construction of the MRI Project and the habitats immediately adjacent (Figure 1.1). |
| EPBC Act Approved Action Area | The proposed MMTC action was approved subject to conditions on the 1 September 2010. In 2015, an amendment was issued to DoCCEEW (the former Department of Agriculture, Water and the Environment and Department of the Environment and Energy) to include additional areas outside the original MMTC Project area with combined conditions issued on 28 August 2015. |

1.4 Scope and limitations

This report has been prepared by the GHD|SMEC Design Joint Venture for the State of Queensland acting through the Department of Transport and Main Roads (“TMR”) and may only be used and relied on by TMR for the purpose agreed between GHD|SMEC Design Joint Venture and TMR.

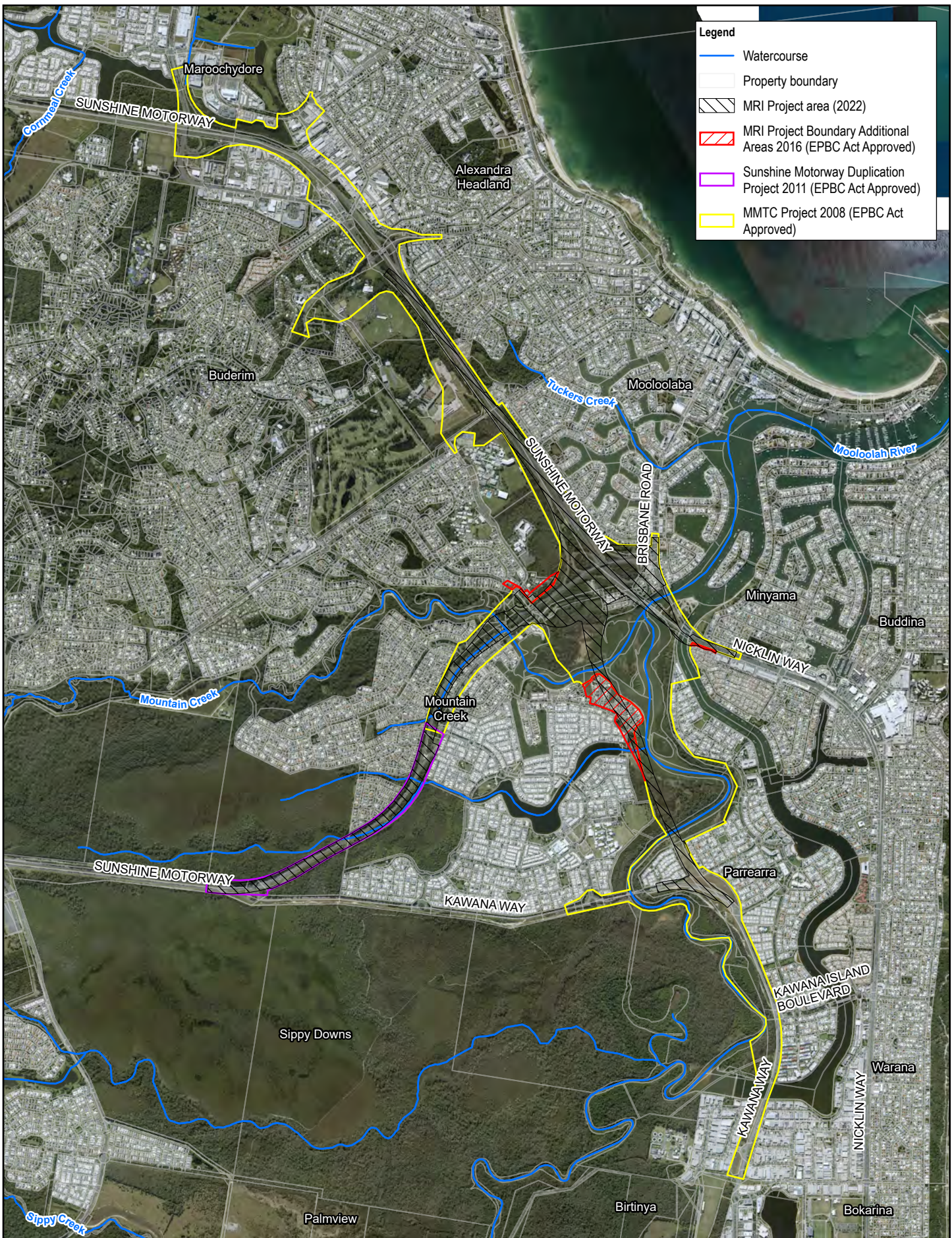
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The services undertaken by GHD|SMEC Design Joint Venture in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD|SMEC Design Joint Venture has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

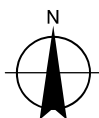
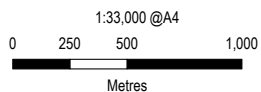
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Legend

- Watercourse
- Property boundary
- MRI Project area (2022)
- MRI Project Boundary Additional Areas 2016 (EPBC Act Approved)
- Sunshine Motorway Duplication Project 2011 (EPBC Act Approved)
- MMTC Project 2008 (EPBC Act Approved)



Map Projection: Transverse Mercator
 Horizontal Datum: GDA2020
 Grid: GDA2020 MGA Zone 56



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Department of Transport and Main Roads
 Mooloolah River Interchange

Project No. CN-17731
 Revision No. 0
 Date 14/10/2022

Project Area

FIGURE 1.1

2. Existing environment

A brief description of the existing environment has been provided as context for the proposed water mouse data collection program.

2.1 Climate

The Project is within the Southeast Queensland Bioregion, which experiences a subtropical to temperate climate of warm to hot summers and cool winters and an “average” rainfall of up to 1500 mm (BoM, 2022).

At the Sunshine Coast Airport monitoring station (Station ID 040861), located approximately 11 km to the north of the Project area, the maximum mean temperature recorded between 1994 and 2022 was 29.0°C in January and the minimum mean temperature was 9.7°C in July (Table 2.1). The average rainfall is shown in Table 2.2. All data provided by the Bureau of Meteorology (BoM, 2022).

Table 2.1 Mean minimum and maximum temperatures at Sunshine Coast Airport (1994-2022)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------|------|------|------|------|------|------|------|------|------|------|------|------|
| Max (C) | 29.0 | 28.9 | 27.9 | 26.0 | 23.5 | 21.4 | 21.2 | 22.3 | 24.4 | 25.7 | 27.3 | 28.4 |
| Min (C) | 21.3 | 21.3 | 20.2 | 17.0 | 13.7 | 11.5 | 9.7 | 9.9 | 12.9 | 15.7 | 17.9 | 19.9 |

Table 2.2 Average rainfall at Sunshine Coast Airport (1994-2022)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---------------|-------|-------|-------|-------|-------|-------|------|------|------|------|------|-------|--------|
| Rainfall (mm) | 145.0 | 223.5 | 183.1 | 150.5 | 149.9 | 115.0 | 65.7 | 69.2 | 51.7 | 91.8 | 81.7 | 156.2 | 1483.4 |

2.2 Mooloolah River catchment and tidal range

The Mooloolah River catchment covers approximately 223 km², with a stream network of approximately 455 km (DES, 2021). The main tributaries of the Mooloolah River are Addlington Creek, Mountain Creek and Sippy Creek. While Addlington Creek and Sippy Creek are located within the upper catchment, Mountain Creek and main arm of the Mooloolah River occur within the lower estuaries of the Mooloolah River Catchment where the Project area is located. Tidal variation within the Mooloolah River estuary is relatively stable and rarely exceeds 2.2 m (full moon tidal variation). Daily tidal cycles occur approximately every 6 hours and result in the lower salt flats within the Project area to be inundated.

2.3 Land use

The landscape within the Project area is characterised by low lying coastal plains, alluvial river flats and coastal estuaries. The broader landscape immediately surrounding the Project area has been largely cleared for urban development except for tidal estuarine areas, the adjacent Mooloolah River National Park and riparian corridor of Mountain Creek and the Mooloolah River. Seven protected areas are located within or immediately adjacent to the Project area, including one National Park and six environmental reserves under management by Sunshine Coast Council. Two protected areas, the Seriate Way Environmental Reserve and the Brightwater Eastern Environmental Reserve are intersected by the Project.

2.4 Watercourses and waterways

The Project is situated within the Mooloolah River estuary and Mountain Creek sub-catchment, which forms part of the broader Mooloolah River catchment. The Project is located approximately 3 km from the mouth of the Mooloolah River and intersects the following major tidal waterways:

- Mooloolah River
- Mountain Creek
- Brightwater Lake
- Parrearra Canal

2.5 Essential habitat

Essential habitat for the water mouse is mapped throughout Project area within the estuarine reaches of the Mooloolah River. Essential habitat was particularly prevalent within the adjacent Mooloolah River National Park. Essential habitat factors for the water mouse are presented in Table 2.3 and shown on Figure 2.1.

Table 2.3 Essential habitat factor for the water mouse

| Species | Conservation status | | Essential habitat requirements |
|---|---------------------|--------|---|
| | EPBC Act | NC Act | |
| Water mouse (<i>Xeromys myoides</i>) | V | V | Sedgeland, salt meadow/saline grassland, wet heathland and saltmarsh chenopod grassland behind mangroves; and in open-closed mangrove scrub forest. Corresponding with regional ecosystems (RE) 12.1.2 and RE 12.1.3. |

2.6 Vegetation communities

Vegetation communities within the Project area were field verified in March/April 2022. Field surveys have confirmed the presence of RE 12.1.2 and RE 12.1.3 within the Project area which support essential habitat factors for the water mouse.

RE 12.1.2 was found to vary between the following two vegetation descriptions:

- Saltpan with small patches of *Sporobolus virginicus* and *Juncus kraussii* with isolated chenopods such as *Suaeda australis*, *S. arbusculoides* and *Salicornia quinqueflora* subsp. *quinqueflora* with occasional low shrub *Avicennia marina* and *Excoecaria dallachyana* (Plate 2-1).
- Grassland of *Sporobolus virginicus* and *Juncus kraussii* with *Suaeda australis*. *Ruppia maritima* is present where standing water is present, with *Triglochin striata* present on the margins of pools (Plate 2-1).

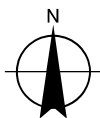
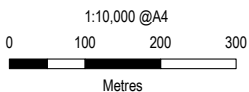
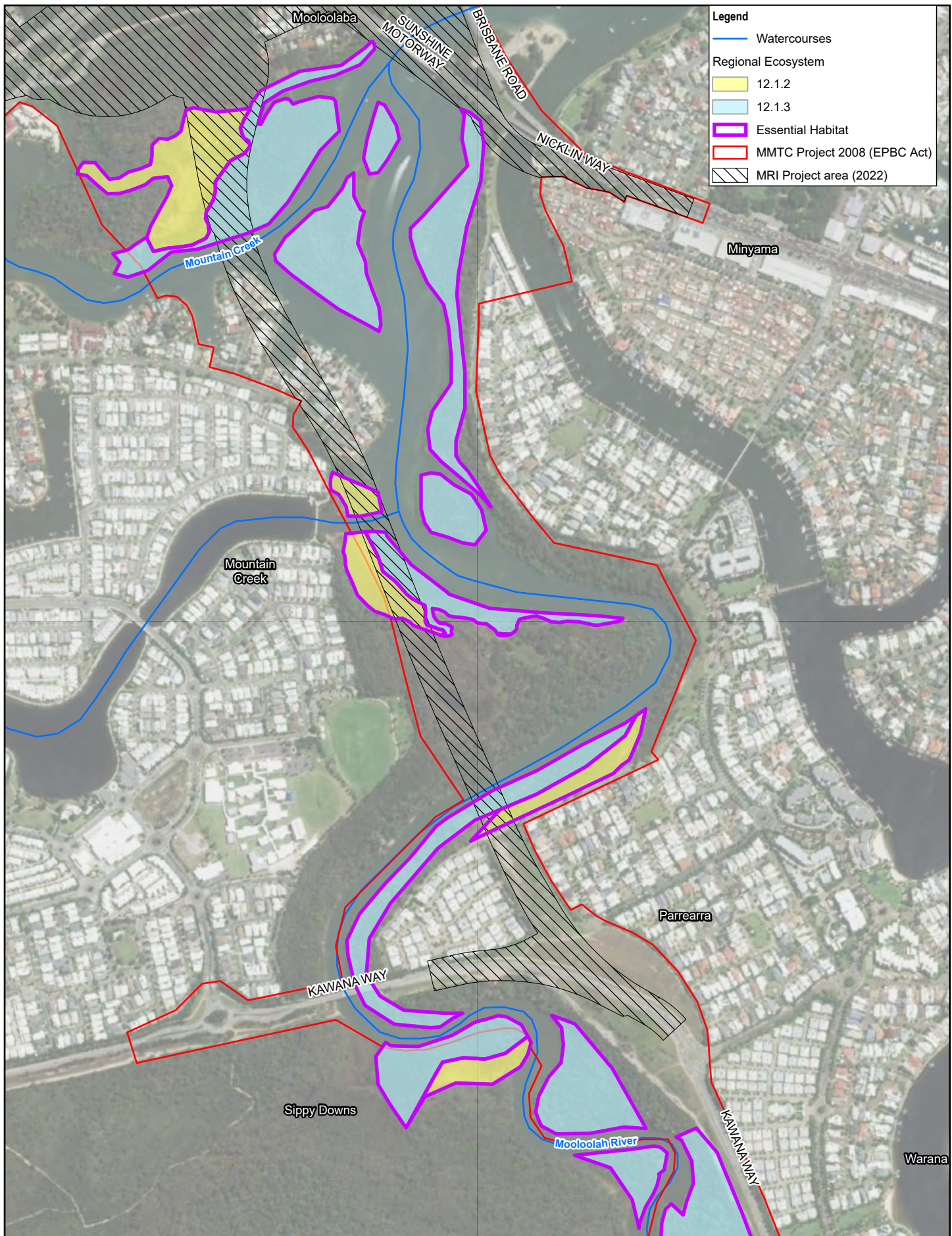


Plate 2-1 Examples of RE 12.1.2

RE 12.1.3 was found to be dominated by mangrove species on regularly inundated quaternary estuarine tidal deposits (Plate 2-2). This unit is dominated by *Avicennia marina* subsp. *australasica* (grey mangrove) with *Bruguiera gymnorhiza* (orange mangrove) sometime co-dominant or sub-dominant in the canopy with *Rhizophora stylosa* (red mangrove) a scattered subcanopy tree and *Aegiceras corniculatum* (river mangrove) a scattered shrub. *Ceriops australis* (yellow mangrove) forms small patches of shrubs on slightly higher areas less frequently inundated or for shorter periods of time. *Excoecaria agallocha* (milky mangrove) was common in the ecotone between mangroves and saltmarsh/saltpan.



Plate 2-2 Examples of RE12.1.3



Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56



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Department of Transport and Main Roads
Mooloolah River Interchange

Ecological mapping of relevance
to the water mouse
within the Project area

Project No. CN-17731
Revision No. 0
Date 1/08/2022

FIGURE 2-1

3. Relevant ecology

3.1 Species ecology

The water mouse is a small, nocturnal rodent with a maximum head and body length of 126 mm and maximum weight of 64 g. It has short, very dense and silky fur that is dark slate-grey above and pure white below. In Queensland adults are usually white-spotted dorsally. The ears are rounded and short and the eyes are very small. The hindfeet are not webbed. The tail is slender, thinly haired and very finely ringed (smooth). The water mouse has only two molars in each of the upper and lower rows (Gynther and Janetzki, 2008).

3.2 Distribution

The water mouse occurs in coastal and estuarine regions of Queensland, the Northern Territory and Papua New Guinea. The species' Australian distribution extends from the Gold Coast in south-east Queensland to Arnhem Land in the Northern Territory (DoCCEEW, 2022). In south-east Queensland, the water mouse is distributed from the Gold Coast and Moreton Bay area to the Great Sandy Strait, and as far inland to the Beerwah State Forest (DAWE, 2021a).

The modelled distribution of the water mouse within Australia is presented in Plate 3-1.

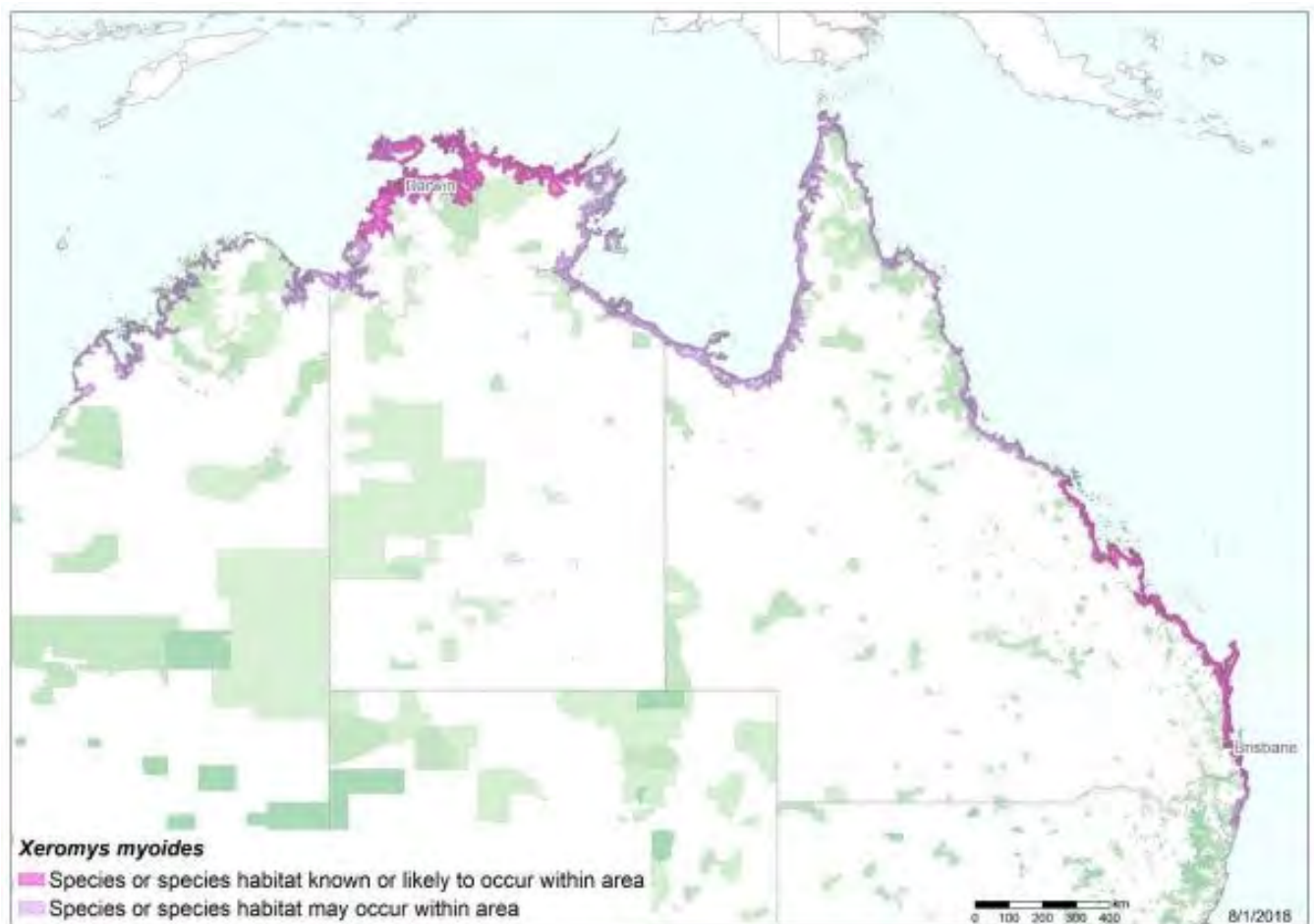


Plate 3-1 Modelled distribution of the water mouse (DAWE, 2021)

3.3 Habitat preference

The water mouse inhabits intertidal saltmarsh, mangroves and adjacent freshwater wetland habitats, favouring habitat with connectivity throughout the supralittoral zone (DAWE, 2021a; Kaluza, 2018). Low-tide saltmarsh communities are often utilized for foraging, particular areas supporting salt couch (*Sporobolus virginicus*) and samphire (*Sarcocornia quinqueflora*), and an abundance of prey species (i.e. crabs, molluscs and flatworms).

Nesting habitat occurs below the high-tide mark and amongst dense saltmarsh and mangrove vegetation. Nest structures are primarily as a freestanding, termite-style mound (Van Dyck and Gynther, 2003); however several nest variations are known, including within hollow trunks of mature mangroves, internal use of tidal banks of swamp oak (*Casuarina glauca*), or man-made or soil heap structures, typically located on the terrestrial fringe (DoCCEEW, 2022).

3.4 Home range and movement

The home range and foraging movements of the water mouse are not well studied; however both are thought to vary between localities and resource availability. The species is highly territorial and larger home ranges are the result of microhabitat complexity, the width of the mangrove zone at a site, habitat type, landscape topography and recent weather may impact capacity for dispersal (Van Dyck 1997). The water mouse has been observed to travel up to 3 km a night, while criss-crossing home ranges averaging 0.7 ha (Gynther and Janetzki, 2008). This is similar to estimates by Van Dyck (1997) at Rainbow Channel on North Stradbroke Island, who calculated an average home range of 0.64 ha. Males were also reported to have a larger home range than females (male average 0.77 ha; female 0.53 ha). Home range estimates differed greatly between sites with animals radio tracked further south at Canalpin Creek, Queensland, having a much larger home range estimate of 3.42 ha.

3.5 Species presence in the Project area

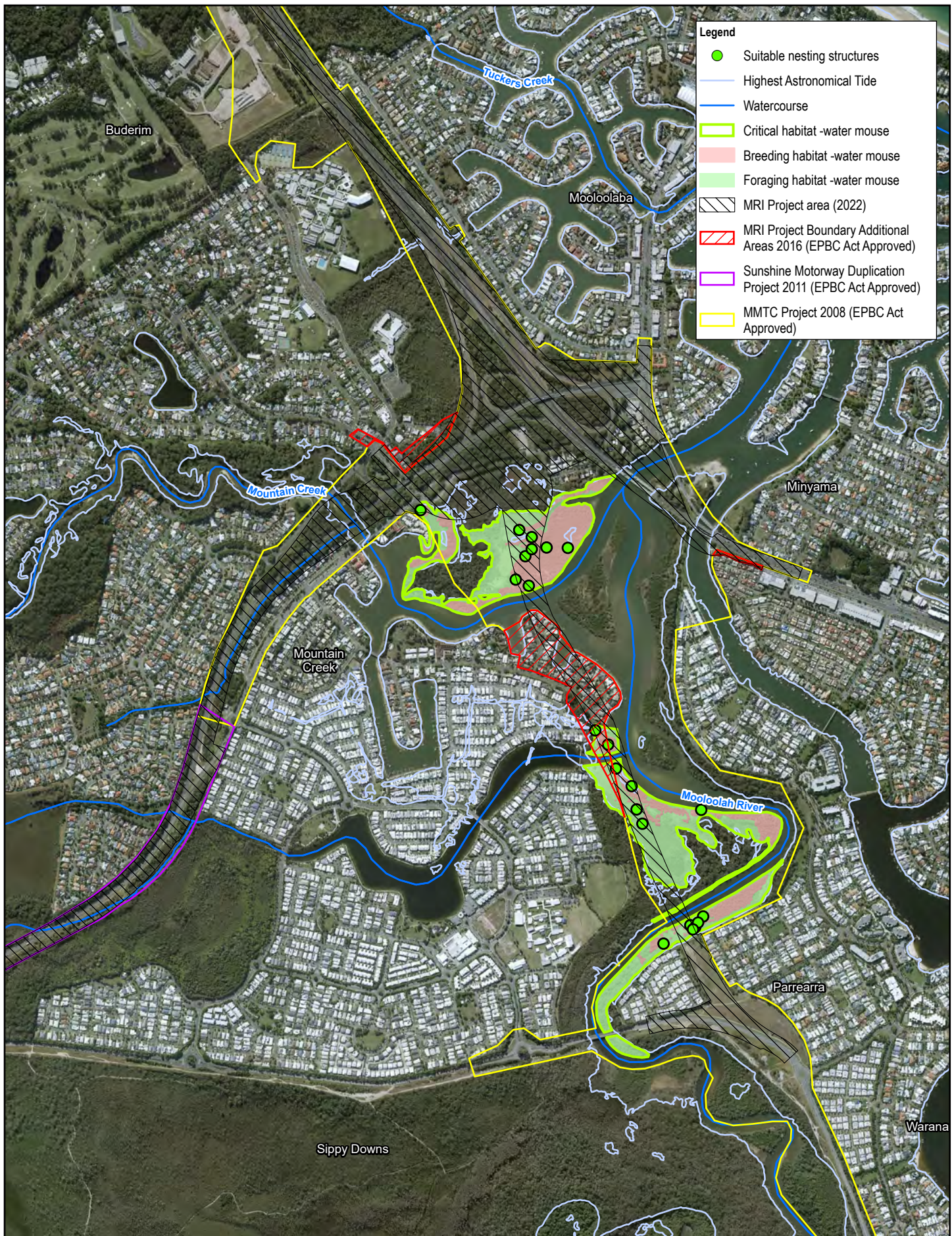
Suitable foraging and breeding habitat for the water mouse was identified in surveys undertaken within the Project area in March 2022. Suitable habitat was recorded in intertidal areas along with Mooloolah River, particularly within the Brightwater Eastern Conservation Area and the Seriata Environmental Reserve (Figure 3.1 and Plate 3-2) (DJV, 2022a). Field surveys identified 36 potential nesting locations for the species and a confirmed nest site, and two potential nest sites were also reported within the Brightwater Eastern Environmental Reserve by WSP (WSP, 2015). The species is known from the Sunshine Coast region and has been recorded within the Beerwah State Forest (Thomas, 1889), Pumicestone Passage (Kaluza, 2018) and the Maroochy River (Kaluza et al., 2016), with local density estimates ranging from 0.44 – 0.66 individuals per hectare of suitable habitat (Kaluza et al., 2016).



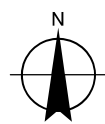
Plate 3-2 Suitable habitat for the water mouse within the Project area: suitable nesting structure (left) and nesting habitat (right)

3.6 Significance of habitat within the Project area

The Project area supports habitat critical to the survival of the water mouse. Habitat within and adjacent to the MRI Project area which corresponds to critical habitat has been identified within the Fauna, Fauna Breeding Places and Fauna Connectivity Report (DJV, 2022b) and presented in Figure 3.1. Areas of habitat critical to the survival of the species were identified within the Seriata Way Environmental Reserve and the Brightwater Eastern Environmental Reserve. Additionally, an area immediately east of the Brightwater Eastern Environmental Reserve supports suitable habitat for the species and a potential fauna movement corridor through to the Mooloolah River National Park.



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 Metres



Map Projection: Transverse Mercator
 Horizontal Datum: GDA2020
 Grid: GDA2020 MGA Zone 56



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Department of Transport and Main Roads
 Mooloolah River Interchange

**Distribution of water mouse
 habitat within the MRI Project area**

Project No. CN-17731
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 Date 14/10/2022

FIGURE 3.1

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 Layout: CN-17731_CSR_007_SuitableHab_WaterMouse_Rev0.
 Print date: 14/2022 Oct - 10:56.

Data source: DoR - Roads, Watercourse, Suburbs, HAT (2022), GHD-SMEC -Field records, Species breeding habitat, Species foraging habitat (2022), MRI Project area (2022), MRI PBAA (2016), SMDP (2011), MMTC (2008), Metromap Tile Service: (extracted date: 14/10/2022), Created by: cburns2

4. Monitoring program

4.1 Relevant guidelines

A comprehensive literature review was conducted to detail the current knowledge on the water mouse and recommended survey guidelines and methodologies for inclusion into this monitoring program. This included a review of Government and public reports, conservation plans, listing documents, independent published articles and peer-reviewed papers. Key resources utilised are presented in Table 4.1.

Table 4.1 Literature reviewed for this report

| Author | Year | Document title |
|--|------|---|
| Commonwealth resources | | |
| DAWE | 2021 | Conservation Advice for <i>Xeromys myoides</i> (Water Mouse). |
| DAWE | 2021 | National Recovery Plan for the water mouse ' <i>Xeromys myoides</i> '. |
| Department of Sustainability, Environment, Water, Population and Communities (DEWHA) | 2009 | Significant impact guidelines for the vulnerable water mouse (<i>Xeromys myoides</i>). |
| DEWHA | 2009 | Background paper to EPBC Act policy statement 3.20 - Significant impact guidelines for the vulnerable water mouse (<i>Xeromys myoides</i>). |
| DEWHA | 2011 | The Survey Guidelines for Australia's Threatened Mammals |
| State resources | | |
| Erye, et al. – Department of Environment and Science (DES) | 2018 | Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland. |
| Public resources | | |
| Van Dyck, S | 1997 | <i>Xeromys myoides</i> in mangrove communities of North Stradbroke Island, southeast Queensland |
| Ball, D. | 2004 | Distribution and habitat of the false water rat, <i>Xeromys myoides</i> in intertidal areas of central eastern Queensland. |
| Kaluza et al. | 2016 | The distribution and density of water mice (<i>Xeromys myoides</i>) in the Maroochy River of southeast Queensland, Australia. |
| Kaluza, J. | 2018 | The ecology and conservation of the water mouse (<i>Xeromys myoides</i>) along the Maroochy River Catchment in southeast Queensland. |

4.2 Ethics statement

Field surveys were conducted in accordance with the following permits and approvals:

- Department of Employment, Economic Development and Innovation Scientific Users Registration Certificate (Registration Number 132)
- DES Scientific Purposes Permit (permit number WISP15723315)
- DES Rehabilitation Permit (permit number WA0042164)
- Animal Researcher Authority issued by the accredited GHD Animal Ethics Committee
- Queensland Code of Practise – Care of Sick, Injured or Orphaned Protected Animals in Queensland
- Australian Code of Practice for the Care and Use of Animals for Scientific Purposes.

In accordance with Part 13 of the EPBC Act, no killing, injuring, taking, trading, keeping or moving of a member of the following occurred as a part of the survey efforts:

- Listed threatened species or ecological community (refer to Sections 196 and 196A-196E of the EPBC Act).
- Listed migratory species (Sections 211, 211A-211E).

4.3 Monitoring schedule

Two rounds of surveys are proposed to assess the presence of water mouse within the Project area. Field surveys will be scheduled to incorporate seasonal variation, with surveys proposed both during winter and summer. Seasons surveys have been proposed to capture any seasonal or climate variation.

- **Survey 1 (summer)** – Proposed to occur between December – February 2022/2023.
- **Survey 2 (winter)** – Proposed to occur between late May – August 2023.

Specific dates within the proposed 2 survey events will be finalised with consideration of the Mooloolah River tidal cycle. A night-time low tide (preferably near midnight) is preferred to allow sufficient opportunity for the species to forage throughout the intertidal mudflats and therefore increase the chances of capture. In addition to optimal tidal range, the scheduling of specific survey dates is dependent on optimal weather events, accessibility to properties, safety of field teams and also internal approval from GHD’s Animal Ethics Committee.

4.4 Area of occupancy

The baseline monitoring program will use an integrated approach of habitat assessment, daytime searches and night-time Elliott trapping, in accordance with the *Background paper to EPBC Act policy statement 3.20 - Significant impact guidelines for the vulnerable water mouse (Xeromys myoides)* (DEWHA, 2009b).

A description of the proposed methodology is presented in Table 4.2.

Table 4.2 Proposed survey methodology

| Survey method | Description |
|---|---|
| Habitat assessments | <p>Targeted habitat assessments will be undertaken with the aim of recording all notable habitat features in the Project area including vegetation types and species, presence of prey species and prey middens, hollow-bearing trees etc. Habitat assessments will be done in conjunction with daytime searching and will include photos and GPS reference.</p> <p>The assessments considered the follow habitat characteristics:</p> <ul style="list-style-type: none"> – The connectivity of habitats between low and high tide. – The structural complexity and type of estuarine vegetation – Presence of foraging resources (i.e small crabs) and habitat features (i.e hollow mangroves). – The level of disturbance and potential threats to the species. |
| Habitat assessments will be conducted to identify the quality of habitat for the water mouse within the Project area | |
| Daytime active searches | <p>Daytime active searches for nesting structures will be conducted in a transect style and spaced at 50-100 m intervals. Active searches will be conducted in every hectare of intertidal an/or supralittoral water mouse habitat within the Project area. Special attention will be afforded to supralittoral banks and habitat features listed in the DEWHA (2009b).</p> <p>Nesting structure will be assessed using the following features:</p> <ul style="list-style-type: none"> – Mounds usually 20–60 cm in height with a basal circumference of 1.6–4.8 m, with one to three entrance holes, although other entrances may be hidden. Burrow entrances can be at the top, sides or bottom, or in adjoining banks or fallen timber. – Fresh mud plastering on the top may indicate that a mound has been built up to maintain its height above high tide level. Mud pathways also may be present on the side of mounds where the water mouse has excavated mud from a tunnel and spread it along a track. Mud plastering’s may include bits of vegetation, dried leaves, sedges and crab shells. – A distinctive musty odour indicating animals are present in the mound. – Mounds overgrown with sedges or incorporated into the roots or trunk of emergent trees such as casuarinas may be active. – Mound nests in good indication that other, cryptic nests may also be present in mangrove trees and supralittoral banks. Water mouse nests have also been recorded in sites adapted from spoil heaps, such as excavated or bulldozed sand, rocks and earth, and tree-stump waste. |
| Daytime active searches will be conducted to determine the water mouse’s area of occupancy within the Project area | |

| Survey method | Description |
|---|---|
| Elliot trapping | Elliot trapping is the only reliable method for estimating water mouse population density (DEWHA, 2009b). Nocturnal Elliot trapping will be conducted over 4 consecutive nights in areas of water mouse habitat located within the Project area. Elliot traps (n = 25) will be deployed in a zigzag or sinusoidal curve along 8 x 200 m transects through the intertidal zone to the low-water edge of the mangroves. Four transects will be used for every 5 ha of suitable habitat, in accordance with DEWHA, 2009b) – resulting in 320 trap nights per 5 ha (i.e. four transects x 20 traps x four nights). Each Elliot trap will be deployed at least 10 m apart and positioned as far as considered practical while being able to check for trapped animals before inundation by the high tide. Traps will be baited with either pilchards cut in half, mullet pieces or commercial cat food. The final configuration of trapping transects will be informed by information gathered from daytime searches for nesting structures. |
| Elliot trapping will be conducted to determine the water mouse’s area of occupancy within the Project area | |
| BioCondition assessments | BioCondition assessments will be conducted in areas identified as suitable water mouse habitat during the initial 2022 fauna field surveys. Assessments will be conducted in accordance with the methodology outlined in <i>BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland Version 2.2</i> (Eyre, et al., 2015). Five survey sites and one reference site are proposed within the MMTC Corridor, as presented in Figure 4.2. Field data will be compared against benchmark data for each surveyed RE to quantify the value and condition of vegetation and water mouse habitat. |
| Habitat assessments will be conducted to identify the quality of habitat for the water mouse within the Project area | |




4.4.1 Trapping program

Trapping locations have been identified through a detailed desktop assessment and incorporating the findings of the fauna surveys completed for the Project in March/April 2022 (DJV, 2022a). The number of transects has been determined in accordance with the survey guidelines in DEWHA (2009b) which state that a minimum recommended trap effort is 320 trap nights per 5 ha of potential water mouse habitat (DEWHA, 2009b).

In total, 8 trapping transects are proposed, 2 within the Seriata Way Environmental Reserve and 6 within the Brightwater Eastern Environmental Reserve. Traps will be deployed in a zigzag or sinusoidal curve along 200 m transects orientated perpendicular to the tide as recommended by DEWHA (2009b).

The location of the proposed trapping transects is presented in Table 4.3 and displayed on Figure 4.1.

Table 4.3 Proposed water mouse baseline sampling plan

| Survey area | Size | Recommended number of trap nights in guideline | Number of transects | Duration | Actual trap nights | Reference map |
|---|--------|--|---------------------|----------|--------------------|--|
| Seriata Way Environmental Reserve | 3.4 ha | 217 | 2 x 25 traps | 5 | 250 |  |
| Brightwater Eastern Environmental Reserve | 6.5 | 416 | 4 x 25 traps | 4-5 | 500 |  |
| Brightwater Eastern Environmental Reserve | 3.1 | 198 | 2 x 25 traps | 4 | 200 |  |

4.5 Water quality monitoring

Condition 4A (b)(ii) requires that prior to commencing the action a baseline data collection program is established to determine the water quality and salinity levels at high and low tide within the water mouse (*Xeromys myoides*) habitat to be impacted by the project. A Baseline Surface Water Quality Monitoring Program has been developed for the project which includes two monitoring locations within water mouse habitats immediately adjacent to the Project area. The location of water quality monitoring locations is presented in Figure 4.1 and described in Table 4.4. Monitoring sites have been selected to be suitable for all stages of the project, including baseline assessment, pre-construction, construction and post-construction, and are located either upstream or downstream of the project area. Baseline monitoring will provide an indication of water quality conditions in the vicinity of the corridor without any potential influence from the project. During construction and operation, sites located upstream of the project area can be used to provide an indication of water quality without any potential influence from the project, while sites located downstream of the footprint will allow for the assessment of potential impacts associated with construction of the project.

At each monitoring site, monthly water quality sampling will be undertaken for a period of a maximum of 12 months. Monitoring for water quality and salinity levels will include:

- Visual observations of the presence of potential pollutants and contaminants (e.g. rubbish or other gross pollutants, hydrocarbons (i.e. shine, film or slick to the water surface), tannins and/or paint)
- *In situ* measurements of:
 - Water temperature (°C)

- Electrical conductivity ($\mu\text{S}/\text{cm}$)
- pH
- Dissolved oxygen (percent saturation and mg/L)
- Turbidity (NTU)

All water quality monitoring will be undertaken by a qualified environmental scientist with appropriate training and experience.

Table 4.4 Description of water quality monitoring sites

| Site Code | Upstream/Downstream | Site Description | Catchment | Location | Access | Lot Plan |
|-----------|---------------------|--------------------------------|-----------|----------------------|---|------------------------|
| WM01 | North | Mooloolah River, northern bank | Mooloolah | -26.69650, 153.11384 | Via footpath at the end of Mara Court | Unallocated State Land |
| WM02 | South | Mooloolah River, southern bank | Mooloolah | -26.71012, 153.11656 | Via the footpath along the high bank of the Mooloolah River | Unallocated State Land |



Figure 4.1 Proposed trapping transects (yellow), water quality monitoring points (purple). Study areas in orange.

4.6 Quality of habitat

Condition 4A (b)(iii) requires that the condition and extent of water mouse habitat to be retained/avoided by the action, for comparison against appropriate control sites. Habitat quality will be assessed using the framework outlined in the *Guide to determining terrestrial habitat quality Version 1.3* (DES, 2020). Site-based attributes are assessed in accordance with the Queensland Herbarium's BioCondition method and indicate the general vegetation condition in the matter area compared to a reference site (a BioCondition benchmark).

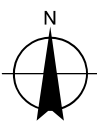
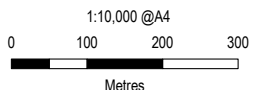
Seven BioCondition Sites (BC1, BC2, BC3, BC4, BC5, BC11, BC13) have been proposed, one within each individual REs and a Reference Site adjacent to the Project area (REF-BC-2) (Figure 4.2). BC1, BC3 and BC4 are located within areas to be retained/avoided by the project and will be compared against results from the Reference Site (REF-BC-2).

BCs have been selected to provide representative sites of the surrounding Project area and in areas of habitat where the water mouse has been previously recorded. The location of the proposed survey sites is presented in Figure 4.2, with the majority of the proposed sites located within the Brightwater Eastern Environmental Reserve and the Serjata Way Environmental Reserve.



Legend

- ★ Bio Condition Site
- Watercourses
- ▨ MRI Project area
- ▭ EPBC Act Approved Action Area



Map Projection: Transverse Mercator
 Horizontal Datum: GDA2020
 Grid: GDA2020 MGA Zone 56

Department of Transport and Main Roads
 Mooloolah River Interchange

Project No. CN-17731
 Revision No. 0
 Date 1/08/2022

Location of proposed water mouse BioCondition sites

FIGURE 4-2

G:\4112553095\GIS\Maps\APRX\CN-17731_WaterMouseMonitoring.aprx. Layout: CN-17731_002_BioCondition_Rev0. Print date: 01/2022 Aug - 11:00.
 Data is provided by the QLD DoR 2022. The State gives no warranty in relation to the data and accepts no liability for any loss, damage or costs relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

Data source: DoR - Roads, Watercourse, Suburbs (2022), GHD-SMEC-EPBC Area, MRI Project area, BioConditions sites (2022), Metro Map (Captured 16/10/21, Extracted 17/02/22), Created by:cburns2

5. Data analysis and reporting

Following the completion of the following three baseline monitoring requirements including the area of occupancy surveys, water quality monitoring and habitat quality assessments a single consolidated deliverable (Baseline Water Mouse Monitoring Report) will be prepared to document the baseline data within and immediately adjacent to the Project area relevant to the water mouse to demonstrate compliance with Condition 4A (b). Specifically, the Baseline Water Mouse Monitoring Report will include:

- Detailed methodologies completed during the surveys
- Description of the location of all monitoring locations and trapping transects
- Results of the area of occupancy surveys for the water mouse to meet Condition 4A (b) (i)
- Results of the water quality and salinity levels recorded the proposed water quality monitoring program to meet Condition 4A (b) (ii)
- Habitat quality conditions recorded within habitat to be retained/avoided by the Project compared to habitat quality condition of the proposed Reference site.
- Recommendations to improve survey methodologies during future survey events.

The Baseline Water Mouse Monitoring Report will be supported by a number of figures to show the results of the habitat assessments, trapping transects, water quality monitoring sites, BioCondition sites and relevant established reference sites. Monitoring data will be prepared with regards to DoCCEEW's *Guidelines for Biological Survey and Mapped Data*.

6. References

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- Kaluza, J. (2018) *The ecology and conservation of the water mouse (Xeromys myoides) along the Maroochy River Catchment in southeast Queensland*. The University of Queensland.
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- Van Dyck, S. (1997) *Xeromys myoides* Thomas (Rodentia: Muridae) in mangrove communities of North Stradbroke Island, southeast Queensland. *Memoirs of the Queensland Museum* 42: 337-366.
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Appendices

Appendix A

EPBC 2008/4316 Consolidated Conditions



Consolidated Notice:

Multi-Modal Transport Corridor (MMTC), Sunshine Coast, Qld (EPBC 2008/4361)

This decision is made under section 145D and 143 of the *Environment Protection and Biodiversity Conservation Act 1999*.

Approved action

person to whom the approval is granted Department of Transport and Main Roads

proponent's ABN (if applicable) 39 407 690 291

approved action The proposal involves the upgrade, extension and construction of approximately 10km of a Multi-Modal Transport Corridor (MMTC) up to 6 lanes (with provision for 8 lanes) and 2 railway lines between Caloundra and Maroochydore, on the Sunshine Coast, QLD as described in the referral document accepted by the Department on 30 July 2008 and the preliminary documentation published on 8 May 2010.

Approval

| Controlling Provision | Decision |
|---|----------|
| Listed threatened species and communities (sections 18 & 18A) | Approved |

Conditions of approval

This approval is subject to the conditions specified below. This is a consolidated set of conditions.

Extension of Period of Effect of Approval

Period for which approval is extended The approval has been extended until 1 September 2040

Date of effect The extension has effect on the date the instrument is signed

Decision-maker

name and position Shane Gaddes
Assistant Secretary
Compliance & Enforcement Branch

signature 

date of decision 28 August 2015

Conditions attached to the approval

conditions of approval

This approval is subject to the conditions specified below.

1. The person taking the action must not clear more than 4.2 hectares of habitat for the flora species *Acacia attenuata*, and 2.1 hectares of habitat for the Wallum Sedge Frog (*Litoria olongburensis*).

A report and maps verifying compliance with this condition must be submitted to the Minister within three months of the completion of construction.

2. The person taking the action must submit a Biodiversity Offset Strategy to the Minister for approval. The strategy must address the following requirements:
 - a. The acquisition and conservation of 3 ha of land containing occupied habitat for the *Acacia attenuata* for every 1 ha of habitat cleared or degraded for the *Acacia attenuata*. The land acquired must contain habitat that is equal or greater in quality to that removed; and
 - b. In addition to land pertaining to 2(a), the acquisition and conservation of land containing a minimum of 3 ha of land which is potential habitat for the *Acacia attenuata* for every 1 ha of habitat cleared or degraded for the *Acacia attenuata* that will be revegetated to provide occupied habitat for this species, that is of equal or greater quality to that removed; and
 - c. Details of revegetation work required to achieve the requirements of condition 2(b). The works must be consistent with advice from a suitably qualified expert; and
 - d. The acquisition and conservation of land containing a minimum of 10 hectares of occupied habitat for the Wallum Sedge Frog (*Litoria olongburensis*) for every 1 ha of habitat cleared or degraded for the Wallum Sedge Frog, that is equal or greater quality to that removed; and
 - e. The acquisition and conservation of land containing a minimum 92.5 ha of foraging habitat for the Grey-headed Flying Fox that is of equal or greater quality to that removed for the Multi-Modal Transport Corridor at the Sunshine Coast; and
 - f. The land referred to in condition 2(a), 2(b), 2(d) and 2(e) must address the following:
 - i. provide connectivity to other large tracts of remnant vegetation, preferably existing protected areas; and
-

-
- ii. be protected by a legal instrument under relevant nature conservation legislation, that ensures the land is conserved in perpetuity.
 - g. The strategy must include commitments to ongoing management of the land referred to in condition 2(a), 2(b), 2(d) and 2(e) for the life of the approved project; and
 - h. The strategy must include key milestones, performance indicators, corrective actions and timeframes for the completion of all actions outlined in the strategy; and

The approved strategy must be implemented.

The person taking the action must not clear any habitat for *Acacia attenuata* or the Wallum Sedge Frog until the Minister approves the strategy.

3. The person taking the action must:

- a. undertake pre-construction surveys to identify and map the location, extent and quality of habitat for *Acacia attenuata* (including occupied habitat) that occurs adjacent to the MMTC corridor. This information should be provided to the Department prior to commencement of construction;
 - b. ensure that all habitat identified under condition 3(a) be retained and its extent and quality maintained to the same quality or better;
 - c. demonstrate compliance with b) above, through audit reports at intervals of 2, 5 and 10 years following completion of construction. These audit reports must be made immediately available to the Department in the event that the Department requests to view the report;
 - d. In the event that a reduction in the extent or quality of habitat for *Acacia attenuata* is detected, a report must be provided to the Department within 3 months of detection, that describes the deterioration of habitat, and outlines the measures that will be implemented to address the reduction in quality or extent;
 - e. In the event that the population occupying the habitat identified in 3(a) is declining or is determined to be no longer viable, the offset strategy outlined under condition 2 will be revised to take account of this further loss to achieve a similar additional ratio of outcomes achieved under condition 2(a) and 2(b).
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4. The person taking the action must:

- a. undertake pre-construction surveys to identify and map the location, extent, quality and level of occupancy of habitat for the Wallum Sedge Frog (including occupied habitat) that occurs adjacent to the MMTC construction footprint. This information should be provided to the Department prior to commencement of construction;
 - b. ensure that all habitat identified under condition 4(a) be retained and its extent and quality maintained to the same quality or better and that measures consistent with recommendations 2 and 3, outlined in the report prepared by Ingram & Agnew (2010), are implemented;
 - c. ensure that the level of occupancy of the Wallum Sedge Frog within all habitat pertaining to 4(a), remains the same or higher, unless the person taking the action can adequately demonstrate (e.g. with the use of control sites) that any decline is due to other factors unrelated to the construction and operation of the MMTC corridor;
 - d. demonstrate compliance with b) and c) above, through audit reports at
-

intervals of 2, 5 and 10 years following completion of construction. These audit reports must be made immediately available to the Department in the event that the Department requests to view the report.

- e. In the event that a reduction in the extent or quality of habitat or in the level of occupancy for the Wallum Sedge Frog, is detected, a report must be provided to the Department within 3 months of the detection, that describes the deterioration of habitat or decrease in occupancy levels, and outlines the measures that will be implemented to address these.
 - f. In the event that the population occupying the habitat identified in 4(e) is declining and is determined to be no longer viable, the offset strategy outlined under condition 2 will be revised to take account of this further loss to achieve a similar additional ratio of outcomes achieved under condition 2(d).
-

- 5. The person taking the action must ensure all reports, plans, strategies and programs required by the approval conditions are publicly available on the proponent's website within three months of finalisation of the report, plan, strategy or program.
-

- 6. If the Minister believes that it is necessary or desirable for the better protection of listed threatened species and communities or migratory species, the Minister may request that the person taking the action make specified revisions to the plans, programs or strategies approved pursuant to condition 2 and submit the revised plan, program or strategy for the Minister's approval. The person taking the action must comply with any such request. If the Minister approves a revised plan, program or strategy pursuant to this condition, the revised approved plan, program or strategy must be implemented in place of the plan, program or strategy originally approved.
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- 7. If the person taking the action wishes to carry out any activity other than in accordance with a plan, program or strategy approved pursuant to condition 2 the person taking the action must submit for the Minister's approval a revised version of any such plan, program or strategy. If the Minister approves the revised plan, program or strategy so submitted, the person taking the action must implement that plan, program or strategy instead of the plan, program or strategy as originally approved.
-

- 8. The person taking the action must maintain accurate records substantiating all activities associated with or relevant to the above conditions of approval and make them available upon request to the Department. Such records may be subject to audit by the Department or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the Department's website. The results of audits may also be publicised through the general media.
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- 9. If, at any time after 10 years from the date of this approval, the Minister notifies the person taking the action in writing that the Minister is not satisfied that there has been substantial commencement of the action, the action must not thereafter be commenced without the written agreement of the Minister.
-

Definitions

Acquisition

The acquiring of land via the transfer of money or the transfer of ownership.

Clear

To cut down, fell, thin, log, remove, kill, destroy, poison, ringbark, uproot or burn native vegetation.

Construction

Includes all works in respect of the action other than survey, acquisitions, fencing, investigative drilling or excavation, building/road dilapidation surveys, minor clearing (except where threatened species, populations or ecological communities would be affected), establishing site compounds (in locations meeting the criteria of the conditions), or other activities determined by the Minister to have minimal environmental impact.

The Department

The Australian Government Department responsible for the *Environment Protection and Biodiversity Conservation Act 1999*.

The Minister

The Minister responsible for the *Environment Protection and Biodiversity Conservation Act 1999*.

Occupied Habitat

Habitat that is occupied or used periodically by individuals of the subject species.

Potential Habitat

Habitat that is not currently occupied or used by the subject species but has the potential to become occupied or used if rehabilitated or managed appropriately.

Substantial commencement

When any construction (as defined above) has started, not including the clearing (as defined above) of any EPBC listed species or ecological communities.

Ingram & Agnew (2010)

Appendix B of the Multi-Modal Transport Corridor – Supplementary Response to Information Request, February 2010. *Wallum Sedgefrog Litoria Olongburensis Surveys and Habitat Assessments Report* prepared on behalf of the Queensland Department of Main Roads (the proponent).



Member of the Surbana Jurong Group

DESIGN JOINT VENTURE